

**SCIENCE AND THE FARMER:  
THE DEVELOPMENT OF AGRICULTURE IN WEST WALES, 1900-1950**

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**Submitted in partial fulfilment for the award of the degree of Doctor of Philosophy  
University of Wales Trinity Saint David**

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## **ABSTRACT**

This study contends that agricultural science significantly contributed to the development of agriculture in West Wales and argues that farming during the decades under study was progressive and not, as portrayed by some historians, that farmers in general were suspicious of change, resentful of science and irresponsible to the opportunities available.

The research has shown that farmers were receptive to new ideas but the process of adoption and adaption was often challenged by conservative farmers and the scientific information and its practical use had to be rigorously tested and confirmed before becoming an established process. The application of agricultural science is shown in this study to be a complex process and local knowledge combined with the new science was at the heart of any changes in procedures by farmers in West Wales. The slow rate of adoption of agricultural science that has been attributed to the traditional conservatism of farmers may be justified in part but the complexity of the processes necessitated trials and validation and this shows an acceptance and an understanding by farmers of the difficulties inherent in the techniques and applying them to individual farms.

Agricultural improvement is not just confined to increases in production and profitability but also encompasses quality and importance and this study acknowledges the value of both county advisory support and the leadership of progressive farmers. This research shows how their roles became the means of channelling the scientific information from the laboratory scientists to the farmer in order to contribute to the adoption of new technology and the production of new foodstuffs.

Agrarian policy and strategies are seen to support the challenges of the farmers and the scientific principles of the plough-up campaigns in the First and Second World Wars and the formation of the Development Commission and the Agricultural Research Council

are considered within a scientific context that contributed to changing attitudes in the farming community.

The considerable historiography of twentieth century Welsh agriculture has paid little attention to the value of agricultural science and the farmers' acceptance and implementation of this science within agricultural development. The vast literature tends to focus more on economic progress and the social history of estates, tenants and tenancies, and the farm labourers. Agricultural progress and development encompasses many components such as inputs and outputs, market forces, labour, agricultural policy and pricing policies and these subjects are well documented and referenced. This study addresses the disparity within historical agricultural literature on the application of agricultural science and its role in contributing to agricultural progress.

This thesis demonstrates that scientific methods applied to farming provided the essential foundation to progress in West Wales in the decades 1900-1950.

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# TABLE OF CONTENTS

	Page
Declaration	ii
Abstract	iii
Acknowledgements	v
Table of Contents	vi
Abbreviations	ix
List of Tables	x
List of Figures	xi
List of Appendices	xiii
Chapter One: Science and the Farmer - Introduction	1
1.1 Introduction	
1.2 Methodology	
1.3 Historiography Review	
1.4 Thesis Structure	
Chapter Two: The History of Agricultural Science	28
2.1 Introduction	
2.2 Agricultural Science: a definition	
2.3 The Emergence of Agricultural Science	
2.4 Agricultural Science in the Nineteenth Century: From the Laboratory to the Farm	
Chapter Three: Science and the Livestock Farmer	55
3.1 Introduction	
3.2 Science and Stock Breeding	
3.3 Science and Sheep Farming	
3.4 Science in the Dairy	
Chapter Four: Science and Crop Husbandry	90
4.1 Introduction	
4.2 Crop Rotation	
4.3 The Development of Root Crops	
4.4 The Development of Cereal Crops	
4.5 Disease and Pest Control	

Chapter Five: Science and Grassland Management	119
5.1 Introduction	
5.2 Science and Grassland Management and Improvement	
5.3 Improvement of Hill Land	
5.4 Eradication of Bracken	
5.5 Improvement of Grass Nutrition	
5.6 Science and the Production and Utilisation of Grass Seeds and Strains	
Chapter Six: Science and Soil Management	144
6.1 Introduction	
6.2 Soil Fertility Improvement	
6.3 Organic Farming	
Chapter Seven: The Dissemination of Information	160
7.1 Introduction – The Diffusion and Adoption of New Methods	
7.2 Agricultural Education	
7.3 Societies, Clubs and Shows	
7.4 County Council Organised Education in Pembrokeshire	
Chapter Eight: Agricultural Advisory Service and County Organised Support	191
8.1 The Development Commission	
8.2 The County Advisory Service in Pembrokeshire	
8.3 Commercial Advisory Services	
Chapter Nine: Agricultural Co-operation	218
9.1 Introduction	
9.2 The Formation of the Agricultural Organisation Society	
9.3 The Early Co-operative Movement in Wales	
9.4 The Formation of the Welsh Agricultural Organisation Society	
9.5 The West Wales Farmers' Dairy Society	
Chapter Ten: Scientific Support in the First and Second World Wars	236
10.1 Agriculture and National Defence	
10.2 Scientific Support in the First World War	
10.3 Scientific Support in the Second World War	
10.4 The Control of Rabbits	
10.5 Scientific Farming and Post War Strategy	
Chapter Eleven: Conclusion	281

Bibliography

292

Primary Sources:

- a) Manuscript Collections
- b) Printed Sources
- c) Private Collections
- d) Oral Testimony
- e) Miscellaneous Testimony

Secondary Material:

- a) Published Articles
- b) Published Books
- c) Theses and Dissertations
- d) Miscellaneous Reports and Publications

Appendices

327



## ABBREVIATIONS

<i>AH</i>	<i>Agricultural History</i>
<i>AHR</i>	<i>Agricultural History Review</i>
AI	Artificial Insemination
<i>AP</i>	<i>Agricultural Progress</i>
CAEC	County Agricultural Executive Committee
<i>EHR</i>	<i>Economic History Review</i>
<i>JMA</i>	<i>Journal of the Ministry of Agriculture</i>
<i>JRASE</i>	<i>Journal of the Royal Agricultural Society of England</i>
<i>JRWAS</i>	<i>Journal of the Royal Welsh Agricultural Society</i>
MAF	Ministry of Agriculture and Fisheries
MERL	Museum of English Rural Life
NAAS	National Agricultural Advisory Service
NFU	National Farmers Union
NFYFC	National Federation of Young Farmers' Club
NLW	National Library of Wales
<i>NLWJ</i>	<i>National Library of Wales Journal</i>
PP	Parliamentary Papers
PA	Pembrokeshire Archives
PACR	Pembrokeshire Agricultural Committee Report
PWAEC	Pembrokeshire War Agricultural Executive Committee
RC	Royal Commission
TNA	The National Archives
WAEC	War Agricultural Executive Committee
WAOS	Welsh Agricultural Organisation Society
<i>WHR</i>	<i>Welsh History Review</i>
WPBS	Welsh Plant Breeding Station
YFC	Young Farmers' Club

## LIST OF TABLES

		Page No.
Table 1	Live Stock Improvement Grants 1914-1915	60
Table 2	Grants Paid in Respect of Premium Bulls	63
Table 3	Number of Cattle in Pembrokeshire 1902-1947	64
Table 4	Trials of Potato Varieties in Pembrokeshire 1920	94
Table 5	Results of Potato Experiments at Lower Treginnis	97
Table 6	Potato Variety Trials at Angle in Pembrokeshire 1936	98
Table 7	Oat Varieties Trials at Cilwendeg in 1920	107
Table 8	Oat Trials at Somerton Farm 1926	108
Table 9	Experiments comparing Imported Oat Seeds	109
Table 10	Scholarships granted by West Wales Counties 1938	170
Table 11	Dairy Classes in Pembrokeshire in 1919	183
Table 12	Development Commission Grants 1912-1939	195
Table 13	Grants from the Development Fund to Advisory Centres in Wales	202
Table 14	Requests for Advice on Agriculture in Pembrokeshire 1930	206
Table 15	Advisory Work undertaken in 1935-36	208
Table 16	Requests for advice on Agriculture in Pembrokeshire, 1939	209
Table 17	Number of Samples investigated by the Advisory Chemist at the University of North Wales for the year ended 30 September 1946	211
Table 18	Agricultural Marketing Societies and Trading 1923-24	222
Table 19	Geographical Distribution of Requisite Societies in Wales, 1939	228

## LIST OF FIGURES

		Page No.
Figure 1	Welsh Black Cattle in St Davids, 1902	62
Figure 2	Sheep washing and dipping near Trawsfynydd 1 January 1944	72
Figure 3	Glasfryn Dairy advertisement	82
Figure 4	The Unfair Godfather, 1931	111
Figure 5	Finger and Toe experiments at Tregadwgan, Solva, 1928	116
Figure 6	The Harvest at Penysgwarne, 1905	136
Figure 7	Haymaking at Trefin, Swyn y Don, c.1910	137
Figure 8	Grass-drying plant at Penrhos Aerodrome, Pwllheli, 1948	139
Figure 9	Silage demonstration by Captain W F N Leighton at Maesmawr Hall Caersws Jan 6 <sup>th</sup> 1940	142
Figure 10	Liming from a sledge at Llawr-y-glyn 1940	152
Figure 11	Judging Welsh Black at Royal Welsh Show July 29, 1939, Caernarfon	176
Figure 12	Butter making competition Royal Welsh Show, Caernarfon, 29 July 1939	178
Figure 13	Conditions of Pembrokeshire County Council Dairy School	180
Figure 14	Butter making and poultry dressing competition held at Trenewydd Farm, Pencaer, 1930	185
Figure 15	Winners of the milking competition at the Royal Welsh Show, Swansea. Champions for Wales and Monmouthshire	186
Figure 16	Pembrokeshire Dairy School on a visit to Harper Adams, 1937	189
Figure 17	The Agricultural Advisors' Exhibits at Local Agricultural Shows 1926	205
Figure 18	ICI Grassland and Silage demonstrations at Tai Hen Farm, Rhoscoch.	216

Figure 19	ICI Grassland and Silage demonstrations at Tai Hen Farm, Rhoscoch (2)	216
Figure 20	The Seed growing areas of South Wales	230
Figure 21	S.23 Ryegrass in swath at the Home Farm Stackpole. Mr J. E. Bennion discusses the sample with the Seed Production Office of Pembrokeshire W.A.E.C	231
Figure 22	Crop of S.37 Cocksfoot standing in stook on Trefelyn Farm, Mathry, Pembrokeshire	232
Figure 23	Farm workers and soldiers c.1917-18	242
Figure 24	Pembrokeshire War Agricultural Executive Committee watching a display of ploughing during the First World War	243
Figure 25	Ploughing the field above Scotchwells to make allotments for the Dig for Victory Campaign during the First World War	245
Figure 26	The Bridge Builder	249
Figure 27	Camrose South School children after potato picking at Summerhill Farm, Roch, 1941	252
Figure 28	Technical drawing for drainage by the Pembrokeshire War Agricultural Executive Committee in the Second World War	264
Figure 29	Programme of presentation of the Victory Churn	266
Figure 30	Norman Thelwell Cartoon	278

## LIST OF APPENDICES

	Page
Appendix 1 University Degree Courses September 1939	325
Appendix 2 University Diploma Courses September 1939	326
Appendix 3 Number of Students in Farm Institutes in England and Wales in 1938/39	327
Appendix 4 Number of Students attending Classes, Correspondence Courses, Lectures and Demonstrations in 1938/9	328

# CHAPTER ONE: SCIENCE AND THE FARMER - INTRODUCTION

## 1.1 Introduction

The supposed state of British agriculture during the last two decades of the nineteenth century has often been cited as being one of the long term agricultural problems inhibiting progress within the industry during the early stages of the twentieth century. It was a period described by Lord Ernle and often quoted:

Since 1862 the tide of agricultural prosperity had ceased to flow; after 1874 it turned and rapidly ebbed. A period of depression began which, with some fluctuations in severity, continued throughout the rest of the reign of Queen Victoria.<sup>1</sup>

Historians have challenged the portrayed severity of the agricultural depression and their studies have shown that regional and sectoral variations occurred throughout Britain; most vulnerable were the arable areas of the south and south-east, livestock producers being affected later in the period and most areas affected by the 1890s.<sup>2</sup> Although Britain's response to this period was seen as laissez-faire, elsewhere in Western Europe the reactions differed; France, Germany and Italy adopted a defensive response with protection

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<sup>1</sup> The Right Honourable Lord Ernle, *English Farming Past and Present*, (London: Longmans, 1936, Fifth Edition), p.377.

<sup>2</sup> T. W. Fletcher, 'The Great Depression of English Agriculture, 1873-1896', *Economic History Review*, Vol. XIII, 1961, pp.417-32; P. J. Perry, 'Where was the "Great Agricultural Depression"? A Geography of Agricultural Bankruptcy in Late Victorian England and Wales', *Agricultural History Review*, 20(1), 1972, pp.30-45; Richard Perrin, *Agriculture in Depression, 1870-1940*, (Cambridge: CUP, 1995), pp.10-11; Alun Howkins, *Reshaping Rural England, A Social History 1850-1925*, (London: Routledge, 1992), p.140; F. M. L. Thompson, 'An Anatomy of English Agriculture, 1870-1914', in B. A. Holderness and Michael Turner, eds, *Land, Labour and Agriculture, 1700-1920, Essays for Gordon Mingay*, (London: Hambledon Press, 1991), p.211.

tariffs, whereas Denmark and the Netherlands adopted a positive response and adapted and improved agricultural production and marketing.<sup>3</sup>

Farmers in Wales felt the depression later than the English arable farmers but by the last decade of the nineteenth century Welsh farmers were facing similar challenges. The agricultural depression in Wales at this time was attributed to many factors such as foreign competition, disease, defective cultivation, labour costs, high rents and lack of capital. The period was often seen as bad farming with inferior and unskilful methods in farming practices placing Welsh farmers at a disadvantage in the industry resulting, as many believed, in the production of lower quality food. Welsh farmers were accused of not making the most of their holdings, using antiquated methods and not utilising cooperative measures in both production and distribution to improve potential profits. Although there is some evidence of progress, for most of the nineteenth century farmers in Wales applied traditional methods and scarcely varied their techniques and choice of produce.<sup>4</sup> Farmers were often suspicious of innovation and many only regarded the land as a means of livelihood. They kept only the number of livestock needed and did not have the money to invest in improvements or have the knowledgeable attitude to make changes.<sup>5</sup>

Landlords and tenant farmers in this century were often divided by social class, language, religion, and political affiliation.<sup>6</sup> When the political and social prestige of landownership was diminishing in the last quarter of the century many Welsh landowners began to sell parts of their properties reaping the rewards of a favourable land market. This

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<sup>3</sup> Michael Tracy, *Agriculture in Western Europe, Challenge and Response 1880-1980*, (London: Granada, 1982), Part I, pp.1-121

<sup>4</sup> D. Lleufer Thomas, *Welsh Land Commission*, (London: Whittaker & Co., 1896), pp.348-68.

<sup>5</sup> David W. Howell, *Land and People in Nineteenth-Century Wales*, (London: Routledge, 1977), p.151.

<sup>6</sup> *Ibid.*, p.25; Matthew Cragoe, "'A Contemptible Mimic of the Irish': The Land Question in Victorian Wales", in Matthew Cragoe and Paul Readman, eds., *The Land Question in Britain, 1750-1950*, (Basingstoke: Palgrave Macmillan, 2010), p.96.

period also saw a decrease in the hereditary freeholders and an increase in the tenant farmers purchasing their holdings. The freeholders of the late nineteenth century were described as a 'race of new men' at a time when landlords were eager to sell and tenant farmers were anxious to remain on the family holding.<sup>7</sup> The 1880s were seen to be the start of the 'economic dethronement' of landowners and their power at a local level, further diminished by the passing of the County Council Act of 1888 and subsequent creation of the new County Councils. Landowners and the gentry were no longer self-elected governors of the countryside and were replaced by many nonconformist middle class candidates.<sup>8</sup> The Councils were seen to establish educational initiatives and the windfall of the 'whisky money' provided vital educational progress at a local level.<sup>9</sup>

The Royal Commission on Land in Wales and Monmouthshire in the 1890s saw an abundance of evidence of disagreement or conflicts between landowners and tenant farmers; there was reported a 'great lack of human brotherhood between landlord and tenant in Wales'.<sup>10</sup> Testimonies from tenant farmers showed a clear demand for tenural security, compensation for land improvements and compulsory fixing of rents. They wanted to 'get as a right what they now obtain as a favour'.<sup>11</sup> However the evidence from landowners and agents, aided by legal counsel, showed a different picture; long tenancies and good relationships.<sup>12</sup> At the time of this Royal Commission, agriculture in Wales was already changing from landlord dominance to a freehold system of farming and, as the

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<sup>7</sup> David W. Howell, *Land and People in Nineteenth-Century Wales*, op.cit., pp.24-42.

<sup>8</sup> R. C. K. Ensor, *England 1870-1914*, (Oxford: Clarendon Press, 1936), p.119; Andrew Adonis, 'Aristocracy, Agriculture and Liberalism: The Politics, Finances and Estates of the Third Lord Carrington', *The Historical Journal*, 31(4), 1988, p.871; David W. Howell, *Land and People in Nineteenth-Century Wales*, op.cit., p.3; Kenneth O. Morgan, *Wales in British Politics 1868-1922*, (Cardiff: UWP, 1991), p.107; Kenneth O. Morgan, *Rebirth of a Nation*, (Oxford: OUP, 2002), p.52.

<sup>9</sup> R. C. K. Ensor, op.cit., pp.203-204. The amount of 'whisky money' varied each year and was dependant on the consumption of beer and spirits, £740,376 was paid to English and Welsh authorities in 1891 and £1,028,001 in 1900.

<sup>10</sup> Matthew Cragoe, "'A Contemptible Mimic of the Irish": The Land Question in Victorian Wales', op.cit., p.96.

<sup>11</sup> PP 1985 (C.7661) Royal Commission on Land in Wales and Monmouthshire, Vol. III, 1985, p.113, q.38,764.

<sup>12</sup> Kenneth O. Morgan, *Wales in British Politics 1868-1922*, op.cit., p.128.



landed estates were beginning to fragment, landlords were no longer regarded as leaders in the agricultural industry; this leadership was passed on to the farmers and the agricultural scientists. The new freehold farmers at the end of the nineteenth century had a different attitude towards farm improvement and education. By the turn of the century agricultural science and agricultural education was acknowledged as beginning to play a part in alleviating the agricultural depression by improving the quality of Welsh produce especially butter and cheese, progress with selective stock breeding, disease control and improvement of soil quality for crops and grass.<sup>13</sup>

This study examines how farmers in West Wales used agricultural science to help develop their business in the first half of the twentieth century. It seeks to analyse a neglected theme; the relationship between agricultural science and farmers and how science was used on farms in West Wales. This geographical location was studied because Pembrokeshire, Carmarthenshire and Cardiganshire were considered by agricultural economists as the most important agricultural region of Wales therefore allowing a wider scope to analyse the trends of development.<sup>14</sup> Although there is a greater focus on Pembrokeshire farms and farmers within this study, national and international agricultural aspects are referenced.

Agricultural improvement is a complex process that combines productivity expansion with increases in efficiency and profit and this thesis seeks to provide a detailed investigation into three distinct themes: the dissemination of scientific information to the farmer; the diffusion and adoption of the new science; and the science used on the farm. This research analyses this knowledge against a background of two world wars, the

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<sup>13</sup> John Davies, 'The End of the Great Estates and the Rise of Freehold Farming in Wales', *Welsh History Review*, Vol.7, 1974, p.188; Christabel S. Orwin and Edith H. Whetham, *History of British Agriculture 1846-1914*, (Newton Abbot: David & Charles, 1971), p.314.

<sup>14</sup> A. W. Ashby and I. L. Evans, *The Agriculture of Wales and Monmouthshire*, (Cardiff: UWP, 1944), pp.163-66.

interwar agricultural depression and the rise of freehold farming for tenure security. It endeavours to provide a fresh insight to the development of agriculture in West Wales and challenges the views of some historians that farmers were ignoring the advances in agricultural science and that the discoveries from pioneering agricultural research was advisory only.<sup>15</sup> In questioning this conventional orthodoxy this thesis provides evidence that Welsh farmers did not ignore agricultural science but embraced it within their own agenda according to their personal social and economic needs. The function and purpose of science mattered to farmers and this study stands alongside the social, economic and geographical investigations within the overall study of Welsh agriculture.

## 1.2 Methodology

The selection of source material was particularly chosen to generate information about the interactions between farmers, scientists and policy makers and these written primary sources give an insight into the specific farmers' responses to the agricultural science available to them. This thesis draws together extensive primary sources and a substantial amount of information originating from the collections of the County Archives, the National Library of Wales and The National Archives. These unpublished sources reveal initiatives and activities that are often missing from published sources. The minute books of the Ministry of Agriculture, the County Agricultural Executive Committees, the County Agricultural Education Committees, the National Farmers Union and the Young Farmers' Club not only convey details of the agricultural science available to the farmer but also show how the information was communicated and monitored for the benefit of the farming

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<sup>15</sup> For example see Geraint H. Jenkins, *A Concise History of Wales*, (Cambridge: CUP, 2007), p.235; Angus Calder, *The People's War, Britain 1939-1945*, (London: Pimlico, 1969), p.419; Kenneth O. Morgan, *Rebirth of a Nation, A History of Modern Wales*, op.cit., p.221; Clare Griffiths, 'Red Tape Farm'? Visions of a Socialist Agriculture in 1920s and 1930s Britain' in J.R. Wordie, ed., *Agriculture and Politics in England, 1815-1939*, (Basingstoke: Macmillan Press, 2000), p.225; John Davies, *A History of Wales*, (London: Penguin, 2007), p.554; Robert Waller, *Prophet of the New Age*, (London: Faber and Faber, 1962), p.165; C. J Holmes, 'Science and the Farmer: the Development of the Agricultural Advisory Service in England and Wales', *Agricultural History Review*, Vol. 36, 1988, p.83.

community. The correspondence files of the County Organiser are a particularly rich source of information as they contain informative letters to and from the farmers in the county as well as to and from the scientific agricultural advisors in the university. These letters provide an insight to the trials and experimentation that were taking place on farms and of the way progressive farmers were putting agricultural science into practice and sharing the results.

Other sources such as farming diaries from private archived collections highlight the day to day activities on the farm and are used to add a vivid illustrative element to the thesis. The diaries indicate many facts not obtainable elsewhere and tell us about cultural practices, conditions, use of farm labour, farm management and the crop trends and fluctuations. Although the use of diaries has limitations in that entries are usually short and sometimes confined to the weather and the labour exerted on the day, they are useful in that they convey the character and environment of the farm and contain details about farm cooperation. Personal correspondences between farmers also demonstrate opinions and sentiments about farming conditions in the community. Similarly the local newspapers of the time period emphasised farming initiatives, opinions, descriptive anecdotes, narratives and yarns.

The *Welsh Journal of Agriculture* has been extensively referenced in the writing of this thesis and provided the essential elements of the application of agricultural science in local conditions giving evidence of the cooperation between the scientist and the farmer. The authors of the papers discussed the experimental results within a framework of agricultural improvement and the journal articles provided valuable information on how farmers could improve their crops, their grassland and the feeding stuffs they used. Many of the scientists also published their findings in newspapers and the *Farmers Weekly* often contained lengthy articles on scientific improvements. Newspapers and periodicals gave critical insight to the information available and educational articles provided an

understanding of the way farmers were using the science and disseminating the results of experiments and trials. They were also a valuable source of government information particularly at times of subsidy use, fertiliser applications, plough up campaigns and advisory schemes.

During the research for this study, a number of retired farmers were interviewed. These oral testimonies have been used within this thesis as an additional primary resource to strengthen written primary and secondary documents. Abrams identifies three models of oral history usage; community interviews for historical records, evidential models for gathering information and theoretical models for analysis.<sup>16</sup> The evidential model is used within this study as the oral testaments provide information to either support an argument or used as an illustration to add a social dimension within the relevant chapters.

The use of oral history or oral testaments is criticised by some historians because of memory distortions, nostalgia in old age, personal bias, forgetfulness or reticence, and that the testimonies are not valid as they lack verification or objectivity.<sup>17</sup> However, the fact that it is not a written document enables the researcher to obtain frank and open remarks from the conversation and record the memories from a setting and environment of the era in history being researched.<sup>18</sup> The process of remembering images, stories and experiences are used to reflect the social narrative of history focussing less about events and more about what the experience meant to farmers.<sup>19</sup> As Hoffman comments, the use of oral history preserves the life experience of people and ‘facilitates a new kind of history – a

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<sup>16</sup> Lynn Abrams, *Oral History Theory*, (London: Routledge, 2010), p.15.

<sup>17</sup> Alistair Thomson, ‘Four Paradigm Transformations in Oral History’, *The Oral History Review*, Vol.34, No.1, 2007, p.53; Kip Joseph Kay, ‘Saving Legacies Pitfalls and Public History’, *Utah Historical Review*, 2011, epubs.utah.edu, p.18; William W. Cutler, ‘Accuracy in Oral History Interviewing’, *Historical Methods Newsletter: Quantitative Analysis of Social, Economic, and Political Development*, University of Pittsburgh, Vol.III, No.3, 1970, p.1; Donald A. Ritchie, *Doing Oral History*, (Oxford: OUP, 2015), p.15-17.

<sup>18</sup> William W. Cutler, op.cit., p.5.

<sup>19</sup> Lynn Abrams, op.cit., pp.78-79; Donald A. Ritchie, op.cit., p.18; Kip Joseph Kay, op.cit., p.19.

history not of the captains, kings and presidents but of farmers, workers, immigrants, and the like'.<sup>20</sup> Similarly Portelli comments:

...the unique and precious element which oral sources force upon the historian and which no other sources possess in equal measure is the speaker's subjectivity... They tell us not just what people did, but what they wanted to do, what they believed they were doing, what they now think they did.<sup>21</sup>

Reliable oral history concerned with agriculture is essential to study patterns of behaviour and use of technology on farms. Although farm account books, wages books and farmers' diaries are available in records offices and archives for the larger and more progressive farms, these do not give information on the social and personal opinions and sentiments of the time.<sup>22</sup> David Jenkins was able to use many oral testaments for his publication *The Agricultural Community in South West Wales at the turn of the Twentieth Century*, and this book is considered a major contribution to the historical anthropology of Wales. He acknowledged the validity of the evidence from farmers, farmers' wives, labourers, servants and craftsmen within the community in his field work which allowed him to study the structure and changes of the society.<sup>23</sup> As Trefor Owen observed:

His informants were not 'tradition-bearers' in the sense in which that term is used in folklife studies, the knowledge which they imparted was based on direct participation: they were delayed eyewitnesses rather than passive transmitters of an old tradition.<sup>24</sup>

A number of unpublished theses and dissertations relating to agriculture were reviewed during this study and they generally emphasise the complexity and diversity of

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<sup>20</sup> Alice M. Hoffman, 'Reliability and validity in oral history', *Today's Speech*, 22:1, 1974, pp.26-27.

<sup>21</sup> Alessandro Portelli, 'The Peculiarities of Oral History', *History Workshop Journal*, 12(1), 1981, pp.99-100.

<sup>22</sup> Paul Thompson, *The Voice of the Past*, (Oxford: OUP, 2000), pp.85-86.

<sup>23</sup> David Jenkins, *The Agricultural Community in South-West Wales at the turn of the Twentieth Century*, (Cardiff: UWP, 1971), p.1.

<sup>24</sup> Trefor M. Owen, 'Community Studies in Wales: An Overview' in Ian Hume and W. T. R. Pryce, eds., *The Welsh and their Country*, (Llandysul: Gomer Press, 1986), p.129.

all aspects of farming, food production and agrarian policy. The in-depth studies are important and valuable and provide a useful background to more detailed investigations. Agricultural development can be analysed in various ways: economists look at agricultural input and output statistics to evaluate economic growth; sociologists study the welfare of the farmer and rural population to monitor employment and migration; the government defines agrarian policies within the political national and international economy to supervise and oversee food availability; and the scientist explores how new science and technology improves the harvest and productivity.

This research shows the many disciplines under the ambit of agricultural development: productivity improvement by changes of crops, the diversity of breeds and selection, the introduction of mechanisation and the use of modern equipment all contributed to the overall expansion and progress of agriculture. With this diversity in mind there is clearly a need for this study to analyse the role that agricultural science and the farmer played in the overall agricultural development in the first half of the twentieth century, especially in West Wales. This thesis highlights the important realistic and experimental plans that are not published within general historical accounts and provides a new qualitative and quantitative description of farmers' experiences and farming circumstances for historical records. Using all available sources this thesis endeavours to provide a new insight into the scientific aspect of agricultural development to support the economic, cultural and social viewpoint.

### **1.3 Historiography review**

In order to study how agricultural science was implemented on farms, with a key focus on Welsh farms, it was necessary to research the diverse body of writing dealing with the history and development of agriculture. The review of literature provided a foundation and framework for this study to support.

Any history that deals with aspects of agricultural science needs to begin by paying tribute to Sir E. John Russell and *A History of Agricultural Science in Great Britain* which surveyed the history of agricultural science from the seventeenth century until the end of the Second World War.<sup>25</sup> It is considered one of the most valuable studies of agricultural science and is still considered the standard work in its field. However, it primarily concentrates on the work of scientists, with an emphasis on Lawes and Gilbert, and pays little attention to the practical use of agricultural science by farmers. Similarly, Margaret W. Rossiter's work *The Emergence of Agricultural Science* focusses on the research of agricultural scientists in America and the formation of experiment stations. Although practical use of agricultural chemistry is reviewed the focus of this publication is not on the farmer.<sup>26</sup> Kenneth Blaxter and Noel Robertson, both authoritative agricultural scientists, focussed primarily on scientific research in *From Dearth to Plenty, the Modern Revolution in Food Production*.<sup>27</sup> It outlines the linking of science to agriculture and subsequent integration into farming practices but focusses on the scientific problems confronted by scientists. Although Welsh agriculture is not referred to in the book it does however offer a wealth of references to other published works.

Within historical literature there is a canon of work, whilst not centred on agricultural science, forms a critical framework for studying agricultural development from a local, national and international perspective demonstrating the economic and social history of farming. Each body of literature contributes in its own way towards an understanding of the subject and this historiographic review outlines the more comprehensive accounts. *The Agrarian History of England and Wales, Volumes VII and*

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<sup>25</sup> Sir E. John Russell, *A History of Agricultural Science in Great Britain*, (London: George Allen & Unwin, 1966).

<sup>26</sup> Margaret W. Rossiter, *The Emergence of Agricultural Science, Justus Liebig and the Americans, 1840-1880*, (New Haven: YUP, 1975).

<sup>27</sup> Kenneth Blaxter and Noel Robertson, *From Dearth to Plenty, The Modern Revolution in Food Production*, (Cambridge: CUP, 2007).

VIII provide a comprehensive reference for the timeframe of this thesis and the footnotes have proved to be an excellent guide for research.<sup>28</sup> The contributors to these volumes have provided an invaluable and comprehensive resource and illustrate the range and diversity of the agricultural industry. Paul Brassley's chapter on agricultural science and education in Volume VII has been a valuable and helpful influence acknowledged within this thesis and this study of the Welsh experience brings a new additional direction. Volume VIII contains just a few pages on changes in farming practices in Wales between 1914 and 1939 and a short chapter relating practice with science but does not critique the relationship between science and the farmer which this study addresses and expands.

On a national level the *History of British Agriculture 1846 – 1914* by Christabel S. Orwin and Edith H. Whetham summarises the changing conditions affecting British farmers and gives a general picture of country life for this thesis to contrast and evaluate.<sup>29</sup> The authors acknowledge that agricultural science at the beginning of the twentieth century was seen to be an exciting possibility in soil studies and animal and plant physiology but that progress was slow because of the lack of education facilities. This study demonstrates how the Development Commission, Research Institutes and universities and colleges were able to address this problem and how science and education progressed in the decades after the First World War.

Moving to the inter-war years, *The English Country-side Between the Wars* edited by Paul Brassley, Jeremy Burchardt and Lynne Thompson looks at society, culture, politics and economics and although mechanisation was acknowledged as progress both

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<sup>28</sup> Joan Thirsk, Gen. Ed., *The Agrarian History of England and Wales, Vol. VII, 1850-1914*, (Cambridge: CUP, 2000); Joan Thirsk, Gen. Ed., *The Agrarian History of England and Wales, Vol. VIII, 1914-1939*, (Cambridge: CUP, 1978).

<sup>29</sup> Christabel S. Orwin and Edith H. Whetham, *History of British Agriculture 1846-1914*, (Newton Abbot: David & Charles, 1971).



agricultural science and Welsh farming do not feature highly.<sup>30</sup> The publication is restricted to England and the editors acknowledge that it does not form a complete history but saw it as a challenge to produce further research. This thesis looks at the inter-war years and the impact on West-Walian farmers and discusses the ways that farmers used science to improve conditions during the agricultural depression and how they used the information and advice available.

John Martin's *The Development of Modern Agriculture: British Farming since 1931* argues that the situation for many farmers was not as bleak as often portrayed and that increases in agricultural production were not so much a result of technical efficiency but because more land was under production.<sup>31</sup> This publication chronicles in detail the major trends in British agriculture from the 1930s to the end of the twentieth century and provides an informative critique of the causes and consequences of the modern agricultural revolution. However, the author focusses mainly on the role of government intervention and protectionism and pays little attention to the role that individual farmers and farm workers made towards making improvements and applying new scientific methods. The author claims that folklore and inherited wisdom and not scientific knowledge were fundamental to successful farming prior to the Second World War and this study argues that scientific methods were used at this time and farmers were combining new and traditional methods to maximise output. John Martin does however acknowledge that the greater use of machinery and new scientific and technological methods were the catalyst for post war improvements and his publication examines this in detail for the second half of the twentieth century. Although the time period for this research only includes the one decade following the Second World War, the findings are in agreement with the author and

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<sup>30</sup> Paul Brassley, Jeremy Burchardt and Lynne Thompson, Eds., *The English Countryside Between the Wars, Regeneration or Decline?*, (Woodbridge: Boydell Press, 2006).

<sup>31</sup> John Martin, *The Development of Modern Agriculture*, (Basingstoke: MacMillan Press, 2000).

acknowledge that agricultural science was embraced within agricultural expansion and as John Martin's focus is primarily English farming this research illustrates and contrasts the Welsh experience.

The importance of agriculture and land use throughout the world has been described and interpreted by many historians in a variety of ways including animal breeding plant cultivation, export statistics, migratory studies and scientific progress. For this international perspective the review of the application of agricultural science included Harro Maat's study in the Netherlands; *Science Cultivating Practice* focusses on the way scientists and policy makers organised the links between agricultural science and practice, with education featuring prominently in the publication.<sup>32</sup> Jonathan Harwood's *Style of Scientific Thought* details historical and sociological comparisons of German and American scientific traditions and contributes to the history of genetics.<sup>33</sup> The publication *Agricultural Science and the Quest for Legitimacy* written by Alan I. Marcus describes nineteenth century agriculture in America and the challenges of farmers, the colleges and experiment stations. Its contents broaden the view of the development of agricultural science to help the farmer.<sup>34</sup> Deborah Fitzgerald's *Every Farm a Factory* traces the diffusion of industrial agriculture and the technological and economic changes that led to the transformation of traditional farms in America and gives an insight into how the agricultural leadership developed the country's agriculture.<sup>35</sup> International practices of agricultural development differ in many ways; these publications show how the scientific focus in the USA was led by mechanical innovations for labour saving technical progress whereas the European focus leaned more towards technical progress on the land and the

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<sup>32</sup> Harro Maat, *Science Cultivating Practice*, (Dordrecht: Kluwer, 2001).

<sup>33</sup> Jonathan Harwood, *Styles of Scientific Thought, The German Genetics Community 1900-1933*, (Chicago: University of Chicago Press, 1993).

<sup>34</sup> Alan I. Marcus, *Agricultural Science and the Quest for Legitimacy, Farmers, Agricultural Colleges, and Experiment Stations, 1870 – 1890*, (Ames: Iowa State University Press, 1985).

<sup>35</sup> Deborah Fitzgerald, *Every Farm a Factory, The Industrial Ideal in American Agriculture*, (New Haven: Yale, 2003).

development of fertilisers, chemical products and better cultivation processes. Innovations and progress on the small farms in West Wales were more in line with the European initiatives than the much larger farms of the USA and there is a valid argument that the small family farms, divided into too many fields, was a major shortcoming of Welsh farming as it prevented the use of mechanisation for progress.

There is a significant body of literature which concerns food production and government policies. Reviews of government election manifestos show that although agriculture and its importance to the nation was a key element for economic progress, very little was described as being scientific and technology driven. Iain Dale's three volumes of elections manifestos and F. W. S. Craig's *British General Election Manifestos 1918-1966* provides precise details of the government's agrarian strategies but do not cover any subject in depth.<sup>36</sup> Therefore in order to study the circumstances and environment in which the farmers worked, this research was directed towards Commission Reports, Bills and Government Acts which provided more detail concerning agricultural policy, agreements and subsidies. The Royal Commission Reports on Land in Wales and Monmouthshire at the end of the nineteenth century in particular present an abundance of evidence of the farming scene and the interactions of farmers and landowners. Works by historians and economists have given the development of agriculture very little attention within the general study of the economy in the inter-war years and tended to be critical of the government's agricultural strategies. Sidney Pollard's *The Development of the British Economy* criticises agricultural policies and apart from fertiliser subsidies makes little reference to the agricultural science used on the farm.<sup>37</sup> Other economic histories

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<sup>36</sup> Iain Dale, ed., *Conservative Party General Election Manifestos 1900-1997*, (London: Routledge, 2000); Iain Dale, ed., *Labour Party General Election Manifestos 1900-1997*, (London: Routledge, 2000); Iain Dale, ed., *Liberal Party General Election Manifestos 1900-1997*, (London: Routledge, 2000); F. W. S. Craig, *British General Election Manifestos 1918-1966*, (Chichester: Political Reference Publications, 1970).

<sup>37</sup> Sidney Pollard, *The Development of the British Economy, 1914-1967*, (London: Edward Arnold Ltd, 1969).

reviewed also credit the development of agriculture as an outcome of government aid; Derek H. Aldcroft's *The Inter-War Economy: Britain, 1919-1939* and William Ashworth's *An Economic History of England 1870-1939* both outline protection policies and subsidies but pay little attention to the research and scientific support to agriculture.<sup>38</sup>

Many publications report on food production and agricultural policies in the First and Second World Wars. Peter Dewey's *British Agriculture in the First World War* contends that food production remained steady and shortages not as bad as feared and suggests that the supply of food would have increased without the plough-up campaign.<sup>39</sup> Alan F. Wilt examines the relationship between food, agriculture and the nations' preparation for the Second World War in *Food for War, Agricultural and Rearmament in Britain before the Second World War* while Keith Murray's *Agriculture* describes the technical and economic position and the initiatives for increased production. Particular reference is made to the policies from the government to the regions and the work of the County War Agricultural Committees.<sup>40</sup> Alongside these publications, *The Front Line of Freedom, British Farming in the Second World War* edited by Brian Short, Charles Watkins and John Martin shows the complexity of agriculture during the war and how significant change was made by policymakers to implement ideas by agricultural economists and how the relationship between the farmers and advisors improved.<sup>41</sup> The responsibility that the County War Agricultural Committees had in Wales has been researched by Richard Moore-Colyer who found that the role that they played facilitated

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<sup>38</sup> Derek H. Aldcroft, *The Inter-War Economy: Britain, 1919-1939*, (London: Batsford, 1970); William Ashworth, *An Economic History of England 1870-1939*, (London: Methuen, 1960).

<sup>39</sup> P. E. Dewey, *British Agriculture in the First World War*, (London: Routledge, 1989).

<sup>40</sup> Alan F. Wilt, *Food for War, Agriculture and Rearmament in Britain before the Second World War*, (Oxford: OUP, 2001); Keith A. H. Murray, *Agriculture, History of the Second World War*, (London: HMSO and Longmans, Green and Co., 1955).

<sup>41</sup> Brian Short, Charles Watkins and John Martin, *The Front Line of Freedom, British Farming in the Second World War*, (British Agricultural History Society, 2006).

essential food production.<sup>42</sup> This study has found similar evidence of cooperation and agrees that farmers, with few exceptions, responded efficiently to comply with cultivation orders and took advantage of the advice, fertilisers and machinery made available to them by their local district committee members. This thesis seeks to develop and expand the historical information within all these publications and explore the value of agricultural science in relation to food production at a time of national need.

A number of institutional, centenary and official publications have been consulted, two of which relate to the Royal Agricultural Society. Nicholas Goddard's *Harvest of Change, The Royal Agricultural Society of England, 1838-1988* highlights the importance of its journal and agricultural shows and concentrates on production techniques and the membership while J. A. Scott Watson's *The History of the Royal Agricultural Society of England 1839-1939* describes the first one hundred years of achievements. Both publications emphasise the role of the Society in disseminating scientific knowledge to farmers and guided this thesis to research how new scientific information reached the farmers in West Wales leading to adoption and adaption of new techniques.<sup>43</sup> David W. Howell's *Taking Stock, The Centenary History of the Royal Welsh Show* traces the evolution of the society from its foundation demonstrating how the show supported and endorsed Welsh agriculture.<sup>44</sup> Evidence in this study has shown how early agricultural societies governed by wealthy landowners fostering technical improvements evolved into agricultural shows that provided essential educational elements and promoted new techniques and products of practical use on the farm. The publication *The University College of Wales Aberystwyth 1872-1972* was written by E. L. Ellis to celebrate the

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<sup>42</sup> R. J. Moore-Colyer, 'The County War Agricultural Executive Committees: The Welsh Experience, 1939-1945', *WHR*, 22(3), 2005, pp.559-87.

<sup>43</sup> Nicholas Goddard, *Harvests of Change, The Royal Agricultural Society of England 1838-1988*, (London: Quiller Press, 1988); J. A. Scott Watson, *The History of the Royal Agricultural Society of England 1839-1939*, (London: The Royal Agricultural Society, 1939).

<sup>44</sup> David W. Howell, *Taking Stock, The Centenary History of the Royal Welsh Agricultural Society*, (Cardiff: UWP, 2003).

college's centenary. Although the publication focusses on commemoration it highlights the introduction of agricultural education, the role of Sir George Stapledon and the foundation of the Welsh Plant Breeding Station, all of which has relevance to this study and are investigated further for the impact on farming within the timeframe and geographical district.<sup>45</sup>

Studies of the agricultural industry and community are an important part of British history and the reports of Welsh agriculture have been presented by many prolific writers. Many historians include elements of agricultural science within their publications but they do not look specifically at the application of science by farmers. The focus of this thesis is to address the farmers' perspective, and whilst it is focussed on science and the farmer, agricultural policy and economics are not ignored. The body of work reviewed for agriculture in Wales included David W. Howell's *Land and People in Nineteenth-Century Wales* in which the principal chapters outline landownership, occupancy and the labouring class. The author summarises politics and economics of the time and amalgamates the social and agrarian history of Wales. The author also devotes a chapter to evaluating farming practices in the nineteenth century which has formed a base for this thesis to extend in order to expand the agricultural scientific information to the twentieth century.<sup>46</sup> Matthew Cragoe's study of the Welsh aristocracy in rural society in Carmarthenshire pays attention to the agricultural conditions of the county in *An Anglican Aristocracy, The Moral Economy of the Landed Estate in Carmarthenshire 1832-1895*.<sup>47</sup> Although the author suggests that the county's agriculture was backward, the assumption was based on social and economic elements of farming and that profit was of little concern. Farmers were seen to lack ambition to make changes as they were content on just working to pay

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<sup>45</sup> E. L. Ellis, *The University College of Wales Aberystwyth 1872-1972*, (Cardiff: UWP, 1972).

<sup>46</sup> David W. Howell, *Land and People in Nineteenth-Century Wales*, (London: Routledge, 1977).

<sup>47</sup> Matthew Cragoe, *An Anglican Aristocracy, The Moral Economy of the Landed Estate in Carmarthenshire 1832-1895*, (Oxford: Clarendon Press, 1996).

the rent and the landlord and tenant relationship was good. The promotion of agricultural societies, machinery demonstrations and quality prize winning breeding stock were all contributing to bringing science to the farmers however it was suggested that it was only the landowners who took a keen interest. Both David Howell and Matthew Cragoe describe the main characteristic of Welsh agriculture in the nineteenth century as being backwards due in part to lack of investment and peasant conservatism. However there is evidence that new methods of farming made steady progress and despite the exodus of rural labour, large areas of land were brought into cultivation for the first time and new markets for agricultural products were available because of new transport facilities. In the later decades of the nineteenth century Wales was also witnessing the beginning of the break-up of the large estates and the rise of freehold farming brought a new attitude by farmers who took a greater interest in technical innovations.

David Jenkins' *The Agricultural Community in South-West Wales* also looks at farm practice and the social structure of farming.<sup>48</sup> Although the author describes some new agricultural methods and machinery the emphasis is only what affected the relationships of farmers and workers on the land. For example farmers selling milk to the Milk Marketing Board was not seen as progress and financial security but more as changing relationships in the community. Similarly self-binders that cut the corn and bound it with wire were not seen as labour saving and productivity progress but as a machine that brought an end to the farmer-cottager relationship. Mechanisation was not seen as technological progress by the author and this study interprets his observations differently; one that sees significant progress consistent with other geographic regions.

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<sup>48</sup> David Jenkins, *The Agricultural Community in South- Wales at the turn of the Twentieth Century*, (Cardiff: UWP, 1971).

One of the most valuable studies of Welsh agriculture is Ashby and Evans' *The Agriculture of Wales and Monmouthshire*.<sup>49</sup> The study draws heavily on the work of the Department of Agricultural Economics at Aberystwyth and the authors present details of crops, livestock and labour as well as county and national statistical data covering seventy years to the outbreak of the Second World War. The authors describe economic conditions and the social environment and their analytical and comparative approach constitutes a valuable survey of Welsh agriculture. This publication provides a foundation to build on and this study extends the timeframe by a decade to include the Second World War and post war initiatives, introduces a topic that was not widely covered, and brings the farmers' personal perspectives and experiences to complement the statistical data.

Professor Richard Moore-Colyer has extensively written about many aspects of agrarian history with particular reference to Wales and the publications deal with a wide range of the social, cultural and technical aspects of agrarian development. His journal articles and books cover a wide range of subjects such as the lime trade in the eighteenth and nineteenth centuries, agricultural science education, inter-war agricultural depression, the early agricultural societies, and farming in the Second World War.<sup>50</sup> He has also contributed to published works such as *The Agrarian History of England and Wales, Volume VII*, and *Transforming the Countryside* to give the Welsh region perspective within the national context.<sup>51</sup> Although his publication *Man's Proper Study, A History of Agricultural Science Education in Aberystwyth 1878-1978* describes the developments at the university agricultural department and illustrates the contribution of individual

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<sup>49</sup> A. W. Ashby and I. L. Evans, *The Agriculture of Wales and Monmouthshire*, (Cardiff: UWP, 1944).

<sup>50</sup> For example, R. J. Moore-Colyer, 'Of Lime and Men: Aspects of the Coastal Trade in Lime in South-West Wales in the Eighteenth and Nineteenth Centuries', *Welsh History Review*, Vol.14, No.1, (1988), pp.54-77; R. J. Moore-Colyer, 'Farming in Depression: Wales between the Wars, 1919-1939', *Agricultural History Review*, 46(2), (1998), pp.177-196; Richard Moore-Colyer, *Farming in Wales, 1936-2011*, (Y Lolfa, 2011).

<sup>51</sup> Joan Thirsk, gen. ed., *The Agrarian History of England and Wales, Vol. VII, 1850-1914*, op.cit.; Paul Brassley, Jeremy Burchardt and Karen Sayer, *Transforming the Countryside*, (London: Routledge, 2017).



scientists it does not describe the interactions of these scientists with farmers.<sup>52</sup> This thesis enhances and complements Professor Moore-Colyer's published research in areas relevant to 'science and the farmer' and as a number of his studies concentrated on historical aspects of the county of Cardiganshire, the focus on Pembrokeshire and the use of unpublished primary sources within this thesis adds a new dimension to extend the understanding of Welsh agricultural history. This study seeks to further Moore-Colyer's approach with a more detailed contextual comparison within the counties and farms of West Wales.

This historiographical review has explored in depth the facets of agricultural development and identifies key works and recognises and acknowledges the complexity of agriculture and the role of agriculturalists. This study emphasises an additional approach to agricultural development; the use of science on the farm and shows that 'science and the farmer' deals with a new approach of farming improvement and is one that stands alongside the many publications reviewed here.

## **1.4 Thesis Structure**

A number of research questions were identified within the framework of this thesis and are addressed throughout the chapters. Four key questions to be addressed are:

- 1) What were the motivations and influences that enabled the West Walian farmers to make the decision to adopt new methods provided by agricultural science?
- 2) How did Welsh farmers learn about agricultural science?
- 3) Did the science change farms or farmers?
- 4) Did science matter to the farmer?

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<sup>52</sup> Richard J. Colyer, *Man's Proper Study, A History of Agricultural Science Education in Aberystwyth 1878-1978*, (Llandysul: Gomer, 1982).

The chronological and thematic structure of this thesis is intended to reflect the work of the farmer; it is focussed on the category of farming, for example livestock, arable, or mixed and considers the use of science and technology from the perspective of the farmer. Chapter two discusses the emergence of agricultural science and introduces the pioneers who believed that the foundation of agricultural research was to increase the output of farms and to help farmers in their work. The chapter opens with a discussion of terminology and the ambitions and objectives of the research scientists. It analyses the agricultural science that was emerging in the nineteenth century which was available for the farmers to utilise by the early twentieth century. Alongside this the Welsh landscape, culture and traditions are considered and compared with the national and international representation. It acknowledges the challenges of the characters of Welsh farms; the acreage, the Welsh language and terrain and how farmers responded and reacted.

Chapter three investigates the use of agricultural science in livestock farming and includes a study of selective breeding and genetics, the value of nutrition and also the components of dairy management. Scientific studies in the dairy were directed mainly towards milk composition and the improvement of its quality. Tuberculin testing and the Accredited Herds Schemes reflect the positive impact of science in dairy farming and milk production. The Milk Marketing Board and the initiation of the artificial insemination programmes are examined in order to evaluate breeding programmes and the impact on milk yields and consequent economics. The scientific principle of the mechanisation of milk production is explored and the objectives of efficiency and economy are examined. The chapter studies how farmers responded to the requirements of the laboratory testing and managing herds to comply with the quality expectations of consumers. Hill farms vary greatly in terms of size, soil and climate and the role of the agricultural scientist was to investigate every facet of production from the ability to thrive in adverse conditions to improved pasture for sufficient feed. This is explored in order to study if changes in

technology and herbage production gave hill farmers an economic advantage and whether science helped them increase their flock sizes or meat value and wool weight yields.

First class arable land was described as land that was capable of intensive cultivation, retained moisture and fertiliser, was rich in humus and mineral salts and was well drained. At the time of the Land Utilisation Survey, Pembrokeshire was regarded as one of the most cultivated of the Welsh counties but the distribution of the arable land was not uniform and concentrated in the coastal areas and in the north-eastern district. It was suggested that although there were strong links between genetic research and plant breeding there were weaker links between the breeders and the farmers. Some agricultural scientists were criticised because they assumed they could do their work without involving the farmer. However there were those who advocated that the farmers played an important role and were the agents of scientific improvement. The introduction and cultivation of new crops required Welsh farmers to collaborate with scientists and county agricultural organisers. Chapter four examines how farmers responded to the new knowledge of genetics and plant breeding and how this research was applied on the farm. It also looks at how Welsh farmers responded to genetic improvements compared with the national and international response and how the end product compared at the market. Plant research was considered to have an economic outlook to increase production by both improving the plant itself and its environmental conditions. Improved varieties of cereals, potatoes and root crops were continually introduced by specialist breeders and farmers were expected to choose and then change either the types or grade of crops they produced in response to consumer demand. It was acknowledged that trialling and testing new varieties or breeds was costly to the farmer and was more of a challenge to the poorer West-Walian farmers than the wealthier farmers of southern English counties. Therefore this chapter looks at the ways that scientists and farmers worked together to use the scientific information available in order to eliminate the guess work and speculation.

The soils of Pembrokeshire contain a high proportion of fine sand and silt and when sufficiently fertilised produced quality grassland. This grassland was considered the most important crop in Wales providing summer and winter fodder for sheep and a high proportion of winter fodder for cattle and horses. Although studies of grassland can be traced back to the eighteenth century, it was the early decades of the twentieth century that scientific studies were considered to have contributed to improvements of grassland production and management. Scientific studies of seeds, feeding values of grass and conservation methods contributed to more cost-effective and higher productivity farming. This thesis was able to use the research findings of these scientific laboratory and field studies to discover how the science was applied on the farm and evaluate how this was correlated into improved grassland management. Chapter five discusses the contribution of science to the grassland farmer and how Welsh farmers used this new knowledge given by the Welsh Plant Breeding Station and the County Agricultural Organisers to their advantage. Until the twentieth century grassland was accepted as natural herbage and very little was done to facilitate improvement. It was the research work at Aberystwyth and Cambridge that led to improved grassland conditions using improved strains with better feeding values. This chapter demonstrates how the farmer used this science to maximise production on the farm by using the best varieties of grasses for the breeds of his stock.

Successful farming depended on many factors; prices, wages, and economic factors all played a part but it was considered that this success ultimately depended on the kind of soil the farmer had to deal with and the use that he made of it. Chapter six investigates how soil research was considered a fundamental application of science and how experiments and investigations intensified at the beginning of the twentieth century. Most farmers were able to make a basic soil map of their holdings to provide a practical classification such as high, medium or low lime status and use this knowledge for subsequent treatment. However, a scientific soil map was more difficult as it took into

account many different properties assessed in the field and in the laboratory. For example, texture and mechanical composition, moisture holding capacity in relation to clay soil, organic-matter content, and the content of minerals and colloidal matter. Physical, chemical and biological processes all contributed to the classification of the soil and the scientific study allowed the farmer to know the soil's constitution and its nutritional value to the plant, enabling correction of any inferior qualities on his land.

Farmers would be more likely to adopt an innovation if it offered them a better way to do something, could be tried out before adoption, had observable benefits preferably under conditions similar to their own and was well communicated. Cultural and social factors were known to inhibit adoption decisions; the Welsh nonconformist tenant farmer had little in common with their often English speaking Church of England landlords and on some estates tenants believed that any increase in their incomes due to improvements in their farming methods would be swallowed up in increased annual rentals especially at a time of increased land sale and the break-up of some large estates. Terminologies for model systems of the diffusion and the adoption of innovation vary amongst historians and sociologists but the essential elements are common. The two terms 'diffusion' and 'adoption' are inter-related but have different concepts. Diffusion is the spread of new practices in a social and geographical sense; social diffusion referring to the spread of an innovation from its original source, for example the agricultural scientist to a group of potential users and geographical diffusion where an innovation spreads from an area where its use is more general at an earlier time than surrounding areas. The progressive farmers within Pembrokeshire were central to both the social and geographical diffusion; for example the sharing of the Welsh Plant Breeding Station seed trials and the expansion of the new potato crops south of the county. The adoption process refers to the acceptance of an innovation that then becomes part of the normal farming activity. Chapter seven explores how scientific information was disseminated to farmers and acknowledges that

agricultural education was not limited to formal institutions such as universities, colleges and farm institutes but recognises the value of societies, clubs and associations, and local and national agricultural shows.

In the time period of this study there were national, local and commercial advisory services available to help the farmer with scientific advice. Chapter eight explores the relationships between the advisers and the farmers and also investigates the advice given in respect of farm development. The roles of the County Agricultural Organiser within agricultural committees are studied in the context of influencing changes in methods or attitudes and this chapter investigates whether relationships and leadership influenced changes of practice which contributed to progress and improvement. One of the key research questions addressed in this chapter is whether the advisors tried to change farms or change farmers. The role of the Pembrokeshire Agricultural Organiser is explored in respect of his relationship with Pembrokeshire farmers and with the advisory scientists at Aberystwyth. These links manifested into a two way flow of information; for example the scientists recommended percentages of fertiliser application to the farmer and the farmer shared crop results.

Agricultural science within the agricultural industry was by definition not related to the economic side of the farmers' business. It was not linked to rent, rates and taxes, foreign competition, nor labour and pay. Science determined the methods the farmers used and the maximum commodities produced. Although agricultural cooperation was seen as an economic programme it is included in this study because of how it changed the way Welsh farmers worked. Chapter nine studies how farmers' adopted and applied the

principles of Horace Plunkett's doctrine *Better Farming, Better Business, Better Living*<sup>53</sup> and how the science of better farming formed the basis for improvements in efficiency for crop production, soil fertility, livestock breeding and quality in the dairy. Cooperation in purchasing and selling is shown to become a routine part of the farmers' schedules and is proven within the study to have an economic benefit. It also demonstrated, however, that there was a negative experience of cooperation in the form of cooperation in the dairy, which had a financial and emotional impact for West Wales.

Much has been written about the role of the War Agricultural Committees in both the First and Second World Wars and there has been a focus on the relationships between the members of the committees and the farming community. War-time increases in the production of wheat and potatoes and the feeding of the population has led contemporaries to write positively about the food campaigns. Chapter ten evaluates the role that science and technology played and the ways the committees were able to bring agricultural science to the farmer in terms of aiding food production and helping farmers improve their farmland. During the First World War the Lloyd George government implemented a food production policy to produce more food by ploughing up grassland in order for the country to be self-sustained. The scientific rationale behind this policy was considered sound as more food was to be produced for human consumption than for livestock and effective local control was provided by the county based War Agricultural Executive Committees. The policy was regarded as a success and provided the model for the policy of the Second World War. This study showed that the WAEC were both accepted and spurned by West-Walian farmers and examples of the relationships between the farmers and committee men are shown to have both helped and hindered the farmers' livelihoods. This chapter

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<sup>53</sup> Dafydd Jenkins, *Clear the Harvest-Dawn*, (James Publications, 1987), p.60, *Better Farming, Better Business, Better Living* was the doctrine of Horace Plunkett who was the leading activist for the UK co-operative movement and who had established the Irish AOS in 1894.

concludes with a study of the post war decade and how the government initiatives contributed to agricultural improvements and stability. The formation and actions of the National Agricultural Advisory Service is also examined to evaluate whether their role, in association with the county agricultural committees, improved agricultural output by influencing a widespread application of new ideas and were successful in changing 'C' farmers to 'B' and 'B's to 'A's.

Chapter eleven, the conclusion, draws the key research findings together in order to form an overview of the importance of science to the farmer. It summarises the evidence found in each chapter of how agricultural science was utilised and resulted in positive changes in improvement of the product or method of production. It also recognises the personal interactions between advisors and farmers and challenges the perception of Welsh farmers not willing to change. The relationship between agricultural science, agricultural policy and the farmer is discussed in order to evaluate how government decisions impacted on the day to day role of the farmer during the First World War, the inter-war years and the Second World War. Finally the overall conclusions relate back to the initial research questions and motivation for this study.



## CHAPTER TWO: THE HISTORY OF AGRICULTURAL SCIENCE

### 2.1 Introduction

This chapter studies the emergence of agricultural science and introduces the pioneers who believed that the foundation of agricultural research was to increase the output of farms and to help farmers to do their work more efficiently. It opens with a discussion of terminology, the ambitions and objectives of the research scientists and analyses the agricultural science that was emerging in the nineteenth century which was available for the farmers to utilise by the early twentieth century. This section also considers the landscape, culture and traditions in Wales in the same period in order to form a structure and introduction for the remaining chapters.

### 2.2 Agricultural Science: a definition

Lord Blyth considered that the general public did not interpret 'science' as another word for 'knowledge' and that agriculture had suffered because of the lack of application of scientific skills practiced in other industries.<sup>54</sup> The metaphor 'science and technology' was formed in the nineteenth century and was described as a spectrum with pure science at one end and traditional craft at the other, with applied science and engineering sciences in between. To complement this the term 'agricultural technology' was applied to the process of systematically cultivating plant and animals and the economic, mechanical, human, and scientific forces that supported it.<sup>55</sup> Definitions of what agricultural research represents are variable and the following constitutions offered their opinions. The Board of

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<sup>54</sup> Memorandum by Lord Blyth on the Application of Science to Agriculture, British Science Guild Annual Report of the Executive Committee, Fourth Annual Report presented at the General Meeting held at the Mansion House 18 March 1910. Lord Blyth (1841-1925) was a British businessman and had a deep interest in agriculture and farming.

<sup>55</sup> Otto Mayr. 'The Science-Technology Relationship as a Historiographical Problem', *Technology and Culture*, Vol.17, No. 4, 1976, p.666; Deborah Fitzgerald. 'Beyond Tractors: The History of Technology in American Agriculture', *Technology and Culture*, Vol.32, No.1, 1991, p.115.

Agriculture and Fisheries considered that in order that work was classified as research it must result in the collection of fresh facts and constitute an addition to knowledge. The British Science Guild considered true research as work that was important enough to be published by the learned societies or in the *Journal of Agricultural Science* and that work published in annual reports of institutions were educational rather than research oriented.<sup>56</sup>

Another definition offered by Ashton and Lord is that research includes the basic and applied research on the production of crops and livestock up to the point of sale and the utilisation of agricultural inputs like feed, fertilisers and machinery.<sup>57</sup> The Committee on the Co-ordination of Scientific Research drew a distinction between pure research, applied research and experiment; pure research being investigations without practical application, applied research being of more practical use in the industry and experiment being an investigation with existing machinery and implements.<sup>58</sup> Sir William Slater, the former Secretary of the Agricultural Research Council, offered a more poignant definition describing the foundation of agricultural research as a move to offer ‘hope, however remote, of increasing the output of the land and easing the burden of those who work on it’.<sup>59</sup>

### **2.3 The Emergence of Agricultural Science and the Landscape of Wales**

...it must be admitted that farmers had good reason to distrust the pseudo-scientific advice of book farmers. Before the end of the eighteenth century it was often indistinguishable from quackery, often false in its conclusions, often so mixed with

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<sup>56</sup> PP 1910 (Cd.5388) Board of Agriculture and Fisheries. Report on the distribution of grants for agricultural education and research 1908-09 and 1909-10, p. xii; *Nature* 3 November 1910.

<sup>57</sup> J. Ashton and R. F. Lord. *Research, Education and Extension in Agriculture*, (Edinburgh: Oliver & Boyd, 1969), p.4.

<sup>58</sup> TNA, CAB/24/122, Cabinet, Committee on Co-ordination of Scientific Research in Government Departments, 13 December 1920, Memorandum on the Report of the Departmental Committee on Agricultural Machinery, submitted by Sir Frank Heath, pp.21-22.

<sup>59</sup> Sir William Slater, ‘The Organization of Agricultural Research in Great Britain’, *Journal of the Science of Food*, Vol. 2, Issue 8, 1951, p.337.

folly as to be ridiculous...<sup>60</sup>

The history of agricultural science can be traced back to the Roman statesman Cato the Elder (234-149BC) who advocated that ‘the master’s forehead is of more use than his back’ and was said to have favoured the use of science by farmers.<sup>61</sup> Farmers followed his advice and devoted their time to the conservation of soil and to the improvement of agriculture by drainage, when to plough, and what to sow.<sup>62</sup>

From the late sixteenth to the end of the eighteenth centuries, scientific research was pioneered by amateurs, who called themselves philosophers and improvers, and the progress of the science emerging was limited, and almost entirely related, to soil and plant growth. Books of this period did not relate to the practical problems of farming nor appeal to farmers because there was little proof for them to put the discoveries into practice. Discoveries of agricultural chemistry had not been directed to help progress in farming and if it had then it was accidental.<sup>63</sup>

The credit for the Georgian accomplishment in agriculture was given to a small band of pioneers or improvers: Jethro Tull, whose chief legacy was economic seeding and drilling; Viscount Townsend and Coke of Norfolk who cultivated large acreage, introduced new crops and bred quality cattle and sheep; Robert Bakewell renowned for breeding the New Leicester sheep; and Arthur Young described as the greatest essayist of the new

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<sup>60</sup> Lord Ernle. *The Land and Its People; Chapters in Rural Life and History*, (London: Hutchinson, 1925), p. 33.

<sup>61</sup> F. D. Farrell, ‘Science and the Farmer’, *The Annals of the American Academy of Political and Social Science*, Vol. 142, 1929, p.202

<sup>62</sup> Lois Olson, ‘Cato’s Views on the Farmer’s Obligation to the Land’, *Agricultural History*, Vol.19, No.3, 1945, pp.129-32.

<sup>63</sup> Sir E. John Russell. *A History of Agricultural Science in Great Britain 1620-1954*, (London: Allen & Unwin, 1966), p. 471; Lord Ernle, op. cit., pp. 31-33; Report of the eighty-second meeting of the British Association for the Advancement of Science, 1912, Section M – Agriculture, chaired by T H Middleton who gave the presidential address ‘Early Associations for Promoting Agriculture and Improving the Improver’ and outlines the history of the early pioneers of agricultural science; G. E. Fussell, *Crop Nutrition: Science and Practice before Liebig*, (Kansas: Coronado Press, 1971), p.183.

agricultural methods.<sup>64</sup> These improvements were linked with prosperity; Coke of Norfolk was reported as increasing his rent-roll from £2,200 in 1776 to £20,000 in 1816 as the result of improvements based on experiments.<sup>65</sup> However, as Fussell commented ‘...marked as all this progress was it did not cover the whole country or even most of it. The great majority of farmers remained steadfast in their adherence to the systems they had inherited from their fathers’.<sup>66</sup>

Agricultural improvement was mentioned in Volume III of *The Myvyrian Archaiology of Wales*. This volume contained a collection of the wise sayings of Catwg Ddoeth (Wise Catwg) and others who captured the spirit of the Welsh people.<sup>67</sup> There are over ninety pages of aphorisms attributed to Catwg Ddoeth and it is notable that some of these sayings are of the importance of the improvement and cultivation of the land. The lines within *Casbethau Catwg* (the things he disliked) included: “*Tir heb ddiwylllydd, Meusydd heb ydau*” (Land with no one to cultivate it, Fields without corn), “*Gorau gweinyddiaeth, llafurio tir, Goreu llafur, gwenith*” (The best type of service, working the land, The best corn, wheat), “*Goreu llawnder, buwch, Goreu golud, gwartheg*” (The most desirable fullness, a cow, The most desirable, wealth) and “*Goreu gallu, tir*” (The best power, owning land).<sup>68</sup>

At the end of the eighteenth century farming in Wales was described as poverty stricken, crop rotations were almost unheard of, farms were too small to be economically

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<sup>64</sup> Sir A. D. Hall, *English Farming Past and Present*, (London: Longmans, 5<sup>th</sup> Edition, 1936), p.139, p.149, p.169; Sir E. John Russell. *A History of Agricultural Science in Great Britain*, op. cit., pp.195-206; G. E. Fussell, *Farming Technique from Prehistoric to Modern Times*, (Oxford: Pergamon Press, 1966), pp.133-37.

<sup>65</sup> J. C. Gower. ‘Statistics and Agriculture’, *Journal of the Royal Statistical Society, Series A*, Vol. 151, No.1, 1988, p.181.

<sup>66</sup> G. E. Fussell, *Farming Technique from Prehistoric to Modern Times*, op.cit., p.138.

<sup>67</sup> Mary-Ann Constantine, ‘Welsh Literary History and the Making of ‘The Myvyrian Archaiology of Wales’, in Dirk Van Hulle and Joep Leerssen, eds, *Editing the Nation’s Memory: Textual Scholarship and Nation-Building in Nineteenth-Century Europe*, (Amsterdam: Rodopi, 2008), p.120.

<sup>68</sup> Quoted in Edward T. John, ‘Wales: Its Politics and Economics’, *The Welsh Outlook*, Vol. 5, No.6, June 1918, p186. I am very grateful for the translation and explanation of these sayings by Revd Richard Davies, St Peters Church, Little Newcastle.

viable and the farming implements had been unchanged for centuries.<sup>69</sup> Improvements were patchy and sparse and technical knowledge was slow to permeate through the agricultural community and could be argued as not acknowledging or supporting the agricultural revolution taking place.<sup>70</sup> Rural Cardiganshire in the late eighteenth century was described as having ‘a flavour of mild decay and dilapidation’ and the poverty of the farmers was the main reason of aversion towards progressive practices.<sup>71</sup> Tenant farmers were said to have been distrustful of innovation and ‘shrouded in a miasma of inertia’ and consequently farming practices remained unchanged with few improvers pioneering progress.<sup>72</sup>

In order to research the state of agriculture at this time, historians have relied on travellers and tourists who recorded their observations. Travel writers in the eighteenth century portrayed Wales as a country with its own culture and history in its landscape and that its geography gave it a character of difference with mountains behaving as barriers which ‘harboured old memories, old beliefs, old habits and unaltered ways’ and the uplands as harbouring ‘old ways and old types’.<sup>73</sup> Writers and artists thought Wales fulfilled the Romantic criteria for beauty and was the epitome of sublimity and solitude. Sutherland found Pembrokeshire peasant life to be ‘almost biblical in its sober dignity’.<sup>74</sup> During the last quarter of the eighteenth century there was a flood of English travellers arriving in Wales which resulted in over fifty publications of ‘Tours through Wales’.

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<sup>69</sup> David W. Howell, *The Rural Poor in Eighteenth-Century Wales*, (Cardiff: UWP, 2000), pp.4-6; David Ceri Jones, ‘Iolo Morganwg and the Welsh Rural Landscape’, in Geraint H. Jenkins, ed., *A Rattleskull Genius The Many Faces of Iolo Morganwg*, (Cardiff: UWP, 2009), p.240.

<sup>70</sup> M. Alan Griffiths, ‘Agricultural Development in South Wales, 1830-1875’, *Morganwg*, Vol.17, 1973, p.27.

<sup>71</sup> R. J. Moore-Colyer, ed., *A Land of Pure Delight: Selections from the letters of Thomas Johnes of Hafod, Cardiganshire 1714-1816*, (Llandysul: Gomer, 1992), p.26; David Howell, ‘The Agricultural Community of Cardiganshire in the Eighteenth Century’, *Ceredigion*, Vol.12, No.1, 1993, p.67.

<sup>72</sup> R. J. Moore-Colyer, Ed., *A Land of Pure Delight*, op.cit., p.26; David Thomas, *Agriculture in Wales during the Napoleonic Wars*, (Cardiff: UWP, 1963), p.181; David Ceri Jones, ‘The Board of Agriculture, Walter Davies (Gwallter Mechain) and Cardiganshire, c.1794-1815’, *Ceredigion*, Vol.14, No.1, 2001, p.79.

<sup>73</sup> Prys Gruffudd, David T. Herbert and Angela Piccini, ‘In Search of Wales: travel writing and narratives of difference, 1918-50’, *Journal of Historical Geography*, 26(4), 2000, p.589-595; H. V. Morton, *In Search of Wales*, (London: Methuen, 2008), p.303; David Ceri Jones, op.cit., p.88.

<sup>74</sup> Graham Sutherland, *Sutherland in Wales*, (London: McAlpine, 1976), p.14.

However it was a Welshman, Thomas Pennant, who was regarded as the most important influential writer and his two-volume work *A Tour in Wales*, which was published in three parts between 1778 and 1783, was recognised as having an important impact on English attitudes towards travel in Wales.<sup>75</sup> Within his publication the peasantry was transformed from ‘uncouth’ to ‘unspoiled’ and the landscape from ‘horrid’ to ‘romantic and picturesque’. He was recognised as changing the public perception of Wales and promoting Wales as a desirable destination to the English traveller. Pennant depicted Wales as a country of immense natural beauty and not the unreachable wild landscape described by earlier accounts.<sup>76</sup> It was said that Pennant recreated ‘a Wales genuine enough to stand scrutiny, but Romantic enough to be vulnerable to legend’; images confirmed by the landscapes of J. M. W. Turner on his tours in the 1790s.<sup>77</sup> Professional artists began to settle in various towns late in the century and the new British school of landscape painters focussed their attention to Wales. Richard Wilson (1718-1782), a founder of the Royal Academy said that ‘everything the landscape painter could want was to be found in Wales’.<sup>78</sup>

This Romantic period attracted many artists and poets all keen to be inspired by the Welsh landscape and to observe the ‘exoticism’ found in the Welsh culture, Welsh language, geography and the austere mountainous terrain.<sup>79</sup> The British poet William

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<sup>75</sup> R. Paul Evans, ‘Thomas Pennant (1726-1798): ‘The Father of Cambrian Tourists’’, *Welsh History Review*, Vol.13, No.4, 1987, p.395; Shawna Lichtenwalner, *Claiming Cambria, Invoking the Welsh in the Romantic Era*, (Newark: University of Delaware Press, 2008), p.98.

<sup>76</sup> Shawna Lichtenwalner, op.cit., pp.98-105.

<sup>77</sup> Gwyn A. Williams, ‘Romanticism in Wales’, in Roy Porter and Mikuláš Teich, eds., *Romanticism in National Context*, (Cambridge: CUP, 1988), p.20; Peter Lord, *The Visual Culture of Wales, Imagining the Nation*, (Cardiff:UWP, 2000), p.155-157, the author notes that J. M. W. Turner visited Wales for the first time in 1792 at the age of seventeen and his five tours in Wales laid the foundations for his art. In 1795 Turner toured Pembrokeshire and Glamorgan and his most comprehensive tour was in the summer of 1798 and extended from St Donat’s in the south to Beaumaris in the north.

<sup>78</sup> Paul Joyner, *Artists in Wales c.1740 – c.1851*, (The National Library of Wales, 1997); Jane Zaring, ‘The Romantic Face of Wales’, *Annals of the Association of American Geographers*, Vol.67, No.3, 1977 p.404.

<sup>79</sup> Mary-Ann Constantine, ‘Beauty Spot, Blind Spot: Romantic Wales’, *Literature Compass*, 5(3), 2008, p.577; Kathryn N. Jones, Carol Tully and Heather Williams, ‘Travel writing and Wales’, *Studies in Travel Writing*, 18:2, 2014, p.102.

Wordsworth, who was credited with leading the English Romantic Movement, made two visits to North Wales in the 1790s. He was attracted by the historical, cultural and poetic associations that were of interest to the romantic traveller.<sup>80</sup> Wordsworth's 'sweet shire of Cardigan' was the setting for 'Simon Lee: The Old Huntsman' and was said that Cardiganshire as a setting stood for rusticity and poverty.<sup>81</sup> Wales at this time was described as being 'situated equidistant between the unnaturalness of Ireland and the artificiality of London Society' and during this Romantic period was seen to reflect the best of both worlds.<sup>82</sup> However the perception of Constantine was that:

Wales, it seems, has suffered from a chronic in-betweenness, being either too exotic (an unfamiliar language and a literature which rarely appears on any English syllabus) or not exotic enough (politically subsumed, and – language apart – not as challengingly 'other' as the Scottish Highlands or Ireland).<sup>83</sup>

Although by the end of the eighteenth century tourists considered Wales to have a beautiful landscape, the Welsh themselves showed little interest in this and generally did not appreciate their own land until the mid-nineteenth century.<sup>84</sup>

Edward Pugh was a patriotic miniature and landscape painter who had a righteous indignation at the misrepresentation of Welsh people:

I have but too often seen it observed by tourists, that the Welsh are an 'unpolished and ignorant people'; if at all ignorant, it must be ignorance of those fashionable dissipations, the never-failing promoters of diseases, incident only to the *great* and fashionable *wise*, who take so much pains to secure them; so far as the Welsh are ignorant of such *finished*, such *elegant* refinement of manners, may they ever

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<sup>80</sup> J. R. Watson, 'Wordsworth, North Wales and the Celtic landscape', in Gerard Carruthers and Alan Rawes, eds., *English Romanticism and the Celtic World*, (Cambridge: CUP, 2010), pp.85-87.

<sup>81</sup> Mike Benbough-Jackson, *Cardiganshire and the Cardi c.1760-c.2000*, (Cardiff: UWP, 2011), p.37.

<sup>82</sup> Jim Shanahan, "'The Fostering Aid of a Sister Country': Wales in Irish Novels", in Damian Walford Davies and Lynda Pratt, eds., *Wales and the Romantic Imagination*, (Cardiff: UWP, 2007), p.138.

<sup>83</sup> Mary-Ann Constantine, 'Beauty Spot, Blind Spot: Romantic Wales', op.cit., pp.585-86.

<sup>84</sup> Gwyn A. Williams, 'Romanticism in Wales', op.cit., p.20; Prys Morgan, 'From a Death to a View: The Hunt for the Welsh Past in the Romantic Period', in Eric Hobsbawm and Terence Ranger, eds., *The Invention of Tradition*, (Cambridge: CUP, 2012), p.87.

remain so!<sup>85</sup>

The publication of *The Cambrian Register* in 1796 represented the Welsh point of view of its country and in the second volume included a satirical attack which voiced the irritation of patriotic Welsh intellectuals at the misrepresentations made by the English:

I fear that, in most of those who have honoured Wales with a visit, will be found a lamentable deficiency. Whether it be from the want of knowledge of the language, or from too transient an acquaintance with the inhabitants, it is remarkable, that, among all the tours into this country, which have met the public eye, (Mr. Pennants's only excepted (sic)... ) we have nothing like a resemblance of the men and manners of Wales.<sup>86</sup>

When the negative views of Wales as an inaccessible terrain was replaced by an appreciation of the landscape there was a shift in the stereotyping of wild Wales. Prys Morgan commented that there was a shift away from the hostile image of incivility to one of admiration.<sup>87</sup> This 'uncivil' image perceived by the English tourists was replaced by an appreciation of a more developed and modernised country and agrarian improvements were acknowledged alongside the industrial manufacturing of copper, coal and iron.<sup>88</sup> As the Welsh community became more and more industrialized the English tourists came to appreciate the image of the Welshman as a sturdy tough hillman, 'free as mountain air'.<sup>89</sup> Edward Williams, better known by his bardic pseudonym Iolo Morganwg, was considered,

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<sup>85</sup> Peter Lord, op.cit., p.164, the author references this to Pugh, *Cambria Depicta*, p.53; see also Paul Joyner, op.cit., pp.97-98.

<sup>86</sup> Peter Lord, op.cit., p.162, the author references this to Cymro, 'Cursory Remarks on Welsh Tours or Travels, *The Cambrian Register for the year 1796* (1799), 422. 'Cymro' was not identified but assumed to be a Welsh speaker from South Wales and probably resident in Wales. The first attempt at producing a Welsh periodical was *The Cambrian Magazine* in 1796 but was short lived.

<sup>87</sup> Prys Morgan, 'Wild Wales: Civilizing the Welsh from the Sixteenth to the Nineteenth Centuries', in Peter Burke, Brian Harrison and Paul Slack, eds., *Civil Histories: Essays Presented to Sir Keith Thomas*, (Oxford: OUP, 2000), p.274.

<sup>88</sup> Ibid., p.277, the author comments that a good indicator of the 'new civility' of the Welsh was the rapid spread of choirs and the Methodist revival that resulted in a chapel opening somewhere in Wales at the rate of one per fortnight.

<sup>89</sup> Prys Morgan, 'From a Death to a View: The Hunt for the Welsh Past in the Romantic Period', in Eric Hobsbawm and Terence Ranger, eds., *The Invention of Tradition*, (Cambridge: CUP, 2012), p.89.



amongst many of his achievements, a scientific agricultural observer and his opinion of rural life in South Wales was believed to have been well informed. He wrote about farming, geology, rural life and agricultural improvements in the hope of being appointed a surveyor by the Board of Agriculture.<sup>90</sup> In his poetry he eulogised ploughmen, shepherds and reapers and contrasted the lives of those ‘who abide in the filth of a town’ with the lot of the happy farmer.<sup>91</sup> He also recognised that the Board of Agriculture was not helping Welsh tenant farmers and recommended agricultural literature be written and distributed in the Welsh language.’<sup>92</sup>

The images portrayed by tourists were exaggerated and the *General Views* reports commissioned by the Board of Agriculture at the end of the eighteenth and beginning of the nineteenth century were counteractive to this Romantic vision. The Romantic tourists saw Wales as a wild and uncultivated country but the agricultural reporters saw evidence of steady improvements in agricultural progress; immense tracts of uncultivated land brought into cultivation, an improvement of farming stock, neat ploughing and cleaning of the soil, the enclosing of waste commons, increased draining and irrigation, and improved cheese-making. Soil improvement was also observed by farmers carrying out manuring from the putrefaction of dung, rotten straw and vegetables, and also using fossil

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<sup>90</sup> David Ceri Jones, ‘Iolo Morganwg and the Welsh Rural Landscape’, in Geraint H. Jenkins, ed., *A Rattleskull Genius The Many Faces of Iolo Morganwg*, (Cardiff: UWP, 2009), p.227 and p.249; also p.1 where Iolo Morganwg summarised his achievements as ‘...author of a book of English poetry priced one pound, Welsh psalms priced a shilling, a stonemason, builder, wall-shutter of Flemingston cemetery, Bard of the Society of Welsh Unitarians, Leader of the fools of the island of Britain’. It was Iolo Morganwg’s political opinions that cost him a commission from the Board of Agriculture, see David Ceri Jones, ‘The Board of Agriculture, Walter Davies (Gwallter Mechain) and Cardiganshire, c.1794-1815’, *Journal of the Cardiganshire Antiquarian Society*, Vol.14, No.1, 2001, p.81.

<sup>91</sup> David Ceri Jones, ‘Iolo Morganwg and the Welsh Rural Landscape’, op.cit., p.232.

<sup>92</sup> Ibid., p.248; For a review of books and periodicals available see Nicholas Goddard, ‘Agricultural Literature and Societies’ in G. E. Mingay, ed., *The Agrarian History of England and Wales*, Vol.VI, 1750-1850, Cambridge: CUP, 1989, pp.361-70.

manures (sand, marl, clay) and manures of combustion (ashes of fuel, charred sods, lime).<sup>93</sup>

The use of lime was regarded an indicator of agricultural progress and in the later years of the eighteenth century, lime either used on its own or mixed with seasand, seaweed, farmyard manure or organic material, became a predominant agricultural fertiliser resulting in the expansion of the lime trade.<sup>94</sup> There was also evidence of improvements in Carmarthenshire where several farmers were experimenting with new techniques: for example, William Davies of Glynogwyr was using lime and farmyard manure as fertilisers and introduced potatoes as a break crop between successive crops of wheat and as winter fodder; and George Rice of Newton brought in a Berkshire man to act as his farm-bailiff to instruct his tenants in turnip and cabbage cultivation.<sup>95</sup>

Despite evidence of these improvements Walter Davies observed that even though there was a willingness to learn, the new agricultural techniques were slow to percolate down to the tenant farmer. He recorded that it was landowners and more substantial freehold farmers who had the time and resources to experiment. It was acknowledged that many of the gentry that took a keen interest in agricultural improvement used their home farms and influence in agricultural societies to achieve the limited success in spreading improvements among their tenants.<sup>96</sup> Some landowners inserted progressive husbandry clauses in their tenant's leases and encouraged them to adopt new practices by sponsoring

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<sup>93</sup> Walter Davies, *General View of the Agriculture and Domestic Economy of South Wales*, 1815, passim

<sup>94</sup> R. J. Moore-Colyer, 'Of Lime and Men: Aspects of the Coastal Trade in Lime in South-West Wales in the Eighteenth and Nineteenth Centuries', *Welsh History Review*, Vol.14, No.1, 1988, p.55 and p.69.

<sup>95</sup> David Ceri Jones, 'Iolo Morganwg and the Welsh Rural Landscape', op.cit., p.245; David W. Howell, *Patriarchs and Parasites*, (Cardiff: UWP, 1986), p.78, the author notes that his son George Talbot Rice (later Lord Dynevor) carried on his father's aim of promoting good farming and were members of the Carmarthenshire Agricultural Society.

<sup>96</sup> David Ceri Jones, 'The Board of Agriculture', op.cit., p.88,; see also David W. Howell, *Patriarchs and Parasites*, op.cit., p.80, the author notes that William Knox of Slebech, John Campbell of Stackpole Court, John Mirehouse of Brownslade, Captain Ackland of Amroth and Boulston, Thomas Lloyd of Cwmgloyne, George Bowen of Llwyngwair, and Thomas and Charles Hassall were the leading agricultural improvers in Pembrokeshire in the last quarter of the century.

agricultural societies.<sup>97</sup> The formation of these societies was regarded as exerting an influence on farming practice as farmers could invest and use new varieties of seeds, have access to improved strains of livestock and see the latest agricultural implements.<sup>98</sup>

The earliest society, the Brecon Society, was established in 1755 by Charles Powell of Castell Madoc and was described as more appropriately a ‘hunting club meeting monthly for bucolic evenings around (or under) the dining table’.<sup>99</sup> However, decades later Walter Davies witnessed a more appropriate and supportive society;

The view of this Society is to encourage agriculture in all its branches; to introduce the linen, and extend the woollen manufacture; and in a word, to support industry of every kind. View this in one light, it is a most extensive charity; in another, it is a most profitable academy; where, by a communication of separate lights, the whole body gradually acquires a treasure of solid and practical science: look upon it in what way you will, it is still prudent, useful, amiable!<sup>100</sup>

Within a few decades after the formation of the Brecon Society, most of the South Wales counties had their own agricultural societies; Carmarthenshire Agricultural Society founded at the instigation of Watkin Lewis of Abernantbychan in 1772<sup>101</sup>, the Pembrokeshire Agricultural Society founded in 1784 by William Knox of Slebech and Llanstinan,<sup>102</sup> and the Cardiganshire Agricultural Society also founded in 1784 by Thomas Johnes of Hafod and others.<sup>103</sup> Johnes was keen on promoting agricultural improvements

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<sup>97</sup> David W. Howell, *Patriarchs and Parasites*, op.cit., p.76.

<sup>98</sup> David Ceri Jones, ‘Iolo Morganwg and the Welsh Rural Landscape’, op.cit., p.243.

<sup>99</sup> R. J. Colyer, ‘Early Agricultural Societies in South Wales’, *WHR*, Vol. 12, No.4, 1985, p.568.

<sup>100</sup> Walter Davies, *General Views*, op.cit., pp.488-489, the author is quoting from Campbell’s *Political Survey* of 1774 p.417.

<sup>101</sup> R. J. Colyer, ‘Early Agricultural Societies in South Wales’, op.cit., p.569.

<sup>102</sup> Derek Rees, *Rings & Rosettes, the History of the Pembrokeshire Agricultural Society 1784-1977*, (Llandysul: Gomer, 1977), the earliest society was The Society for the Encouragement of Agriculture, Manufactures and Industry followed in 1805 by the Society for the Encouragement of Agriculture and Internal Improvement in the County of Pembroke which was established by members of the local gentry, and became the Pembrokeshire Agricultural Society in 1844. The author suggests that the Pembrokeshire Society was the brainchild of Charles Hassall and not Knox because of Hassall’s expertise and keenness on agricultural improvement and who was engaged by Knox as his Steward.

<sup>103</sup> Mike Benbough-Jackson, *Cardiganshire and the Cardi*, op.cit., c.1760-2000, p.50; see also David W. Howell, *Patriarchs and Parasites*, op.cit., p.79, the author notes that Thomas Johnes was a generous patron and the first President of the Cardiganshire Agricultural Society.

and was aware that there was a lack of informative literature in the Welsh language and therefore had his *A Cardiganshire Landlord's Advice to his Tenants* translated into Welsh for his tenant farmers.<sup>104</sup> Johnes farmed nearly 5,000 acres himself on the Hafod estate and undertook ambitious draining and reclamation schemes. He promoted intelligent cropping to include a fallow period and break crops to improve soil conditions, however, costs and technical difficulties effected the application in practice.<sup>105</sup> He was also keen to improve livestock and introduced a cross between the Cheviot and Ryeland breeds of sheep into the county and also experimented with crossbreds of the Shorthorn, Hereford, Devon and Scots breeds on the native cattle.<sup>106</sup>

Walter Davies found that the rules of the Carmarthenshire Agricultural Society were focussed on success and that the society promoted improved husbandry and planting and that premiums were offered for encouragement and good behaviours of farm labourers.<sup>107</sup> Similarly in the Pembrokeshire Society premiums were offered for best livestock, cleanest crops of wheat on clover leys, best turnip crops and to the best turnip hoers and ploughmen. It was questioned, however, if the society was fair:

This county, from its varieties of soils and situations, requires at least, two distinct Societies; one for the division below, and the other for the division above the mountains; otherwise it seems unfair to start the hundred of Castle Martin against the hundred of Kemaes.<sup>108</sup>

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<sup>104</sup> Richard J. Moore-Colyer, *A Land of Pure Delight*, op.cit., p.28, the author comments that because of eccentric spelling and the 'forlorn attempts to give the translation a dialect' the work might have been incomprehensible to the majority of farmers. See also Mike Benbough-Jackson, 'Landlord Careless'? Landowners, Tenants and Agriculture on Four Estates in Wales, 1850-75', *Rural History*, Vol.14, No.1, 2003, p.90 who comments that printed agreements produced by landlords to influence good agricultural practices were also written in English and were seen to be a distinct disadvantage to the monoglot Welsh farmers.

<sup>105</sup> Mike Benbough-Jackson, *Cardiganshire and the Cardi*, op.cit., p.51; Richard J. Moore-Colyer, *A Land of Pure Delight*, op.cit., p.29, the author suggests that Johnes's well-meaning work had any significance beyond emphasising his admirable intentions; David Thomas, *Agriculture in Wales during the Napoleonic Wars*. Cardiff: UWP, 1963, p.175.

<sup>106</sup> David Thomas, *Agriculture in Wales during the Napoleonic Wars*, op.cit., p.175, the author notes that his particular concern with the land was afforestation and in 1797 planted almost 700,000 trees.

<sup>107</sup> Walter Davies, *General Views*, op.cit., p.493.

<sup>108</sup> *Ibid.*, p.497.

These early agricultural societies in Wales parallel a similar progress in America; the American Philosophical Society was formed in 1743, just twelve years prior to the Brecon Society and was said to have been the earliest association that related a scientific view to agriculture. This was followed by the formation of the Philadelphia Society for the Promotion of Agriculture in 1785, the South Carolina Society for Promoting and Improving Agriculture the same year and the Society for the Promotion of Agricultural Arts and Manufacture in New York in 1791. Similarly as was also seen in Wales, many county agricultural societies across the United States soon followed which included livestock shows and equipment demonstrations.<sup>109</sup>

Although the gentry's home farms were seen to have influenced some better husbandry practices, the adoption of new methods was considered slow for three reasons: firstly the tenants did not have the money to farm in the same way as their landlords; secondly they were worried that land improvements would result in rent increases; and thirdly the tenants were following the ways of their forefathers and farming in the familiar way.<sup>110</sup> Although these hereditary prejudices were seen throughout the eighteenth and nineteenth centuries and were considered an inhibitory factor in agricultural development, it is acknowledged that adherence to their time-honoured methods amongst West-Walian farmers could have been due, as Colyer states, to 'a sense of impending cultural annihilation or merely to innate conservatism garnished with a liberal dressing of pigheadedness'.<sup>111</sup> Agricultural improvement may have been considered slow at the end of the eighteenth century but there was evidence of scientific methods being adopted; white clover, cocksfoot grass, purple clover and mail grass were being introduced and the

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<sup>109</sup> M. L. Wilson, 'Survey of Scientific Agriculture', *Proceedings of the American Philosophical Society*, Vol.86, No.1, 1942, pp.52-53.

<sup>110</sup> David W. Howell, *Patriarchs and Parasites*, op.cit., pp.80-81; Charles Hassall, *General view of the agriculture of the county of Pembroke*, (ECCO print edition, first published in London, 1794), pp.37-39.

<sup>111</sup> R. J. Colyer, 'Limitations to Agrarian Development in Nineteenth-century Wales', *Bulletin of the Board of Celtic Studies*, Vol.XXVII, part IV, 1978, p.609.

new Norfolk ideas of crop rotation were evident.<sup>112</sup> The behaviour of the cautious Welsh farmer in adopting new methods was considered by geographer H. J. Fleure:

Lest anyone should say that the west is the land of the out-of-date, let us at once realise that the west has, a little slowly, assimilated new ideas without letting them utterly destroy the old pattern of life and work.<sup>113</sup>

Fleure criticised landlords for not caring about old traditions and not appreciating that a countryman was a ‘craftsman of multilateral skill’ and may:

thatch a corn stack in the morning and go to cut the corn for the next one in the afternoon, and he would need to know how to drain the fields, to make a hedge, to fell a tree and make the most of its wood.<sup>114</sup>

He felt that it was a feature of the Celtic West that the old life of the peasantry survived and commented that ‘a wit has said that as one travels from England to rural Wales the talk in a railway compartment changes from betting to chapels, or from horse racing to the eisteddfod’ a sign of simple peasant heritage.<sup>115</sup> Charles Hassall also suggested that the farmers in Pembrokeshire had an ‘unconquerable dislike to anything introduced by strangers’ and that ‘whatever new practice is attempted, will be most likely to succeed through the medium of the natives of the country’.<sup>116</sup>

The scientific principles of enclosure related primarily to improvement. At the end of the eighteenth century dividing and enclosing rendered the open common fields to double its value. Charles Hassall commented ‘the fences alone benefit the land by giving shelter to it. The husbandman manures with a certainty of reaping the fruits of his labour,

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<sup>112</sup> Margaret F. Davies, *The Land of Britain, Pembrokeshire Part 32*, (London: Geographical Publications, 1939), pp.117-19.

<sup>113</sup> H. J. Fleure, ‘The Celtic’, *Journal of the Royal Society of Arts*, Oct 4, 1940, p.882. In 1905 Fleure began an anthropological study of the Welsh people and visited villages in all parts of Wales.

<sup>114</sup> H. J. Fleure, *op.cit.*, p.883

<sup>115</sup> *Ibid.*

<sup>116</sup> Charles Hassall, *General View*, *op.cit.*, p.63.

and the produce and stock are consequently improved in at least a two-fold degree'.<sup>117</sup> The history of the enclosure of open fields, common lands, meadows and wastes is well documented and the motives of enclosure such as improvements and profit as well as the social and economic consequences are acknowledged as the most remarkable development and the most controversial in the eighteenth and nineteenth centuries. Farms were reorganised, spending on drainage increased, crops and rotation were controlled and there was a better balance between arable and pasture. Although the extinction of common rights or enclosure could not be used as a criterion of agricultural progress, it is well documented that enclosed farms were more efficient and productive and the advantages translated into higher rents. In Wales, landowners such as Sir Watkyn Williams Wynn, Sir Stephen Glynn and Lord Penrhyn invested in improved drainage, better breeding and new crops. Fenced land resulted in a higher standard of upland farming because sheep were contained and undisturbed which ultimately led to improvements of the breeds. Although new methods of farming in Wales were progressing in the first half of the nineteenth century it was still centred around the family farm and within a self-contained economic unit. This lack of capital therefore meant that by the end of the nineteenth century the cultivated land in Wales was only 59.8 per cent as opposed to the 76.4 per cent in England of the total potential cultivatable land.<sup>118</sup>

In addition to enclosure, another precursor to agricultural improvement was land drainage. This included field drainage, for improving the growth conditions for the crops

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<sup>117</sup> Ibid., pp.20-21.

<sup>118</sup> J D Chambers and G. E. Mingay, *The Agricultural Revolution 1750-1880*, (London: Batsford, 1966), pp.77-105; Michael Turner, *English Parliamentary Enclosure*, (Folkestone: Dawson, 1980); David W. Howell, *Land and People in Nineteenth Century Wales*, (London: Routledge, 1977), pp.37-41; Ivor Bowen, *The Great Enclosures of Common Lands in Wales*, (London: Chiswick Press, 1914); J. R. Wordie, 'The Chronology of English Enclosure, 1500-1914', *The Economic History Review*, Vol.XXXVI, No.4, 1983, pp.502-503; Michael Williams, 'The enclosure and reclamation of waste land in England and Wales in the eighteenth and nineteenth centuries', *Transactions of the Institute of British Geographers*, No.51, 1970, p.55; David Cannadine, *Aspects of Aristocracy*, (New Haven: YUP, 1994), p.14; ; Eric Kerridge, *The Agricultural Revolution*, (London: Allen & Unwin, 1967), p.19; A. W. Ashby and I. L. Evans, *The Agriculture of Wales and Monmouthshire*, (Cardiff: UWP, 1944), p.9.

and arterial drainage to improve the capacity of the rivers to shift water from the land which was significant progress in the Victorian era. Most of the upland grassland improvement schemes were made possible by field drainage, the invention of clay drainage pipes and subsequent exemption from tax. This initiated intensive drainage in England and Wales which was greatest in the north and west where there was high rainfall and poorer soils. Although there was a charge that landlords were not pioneering agriculturalists, West Wales account books show many purchases thought to have been encouraged by the Drainage and Improvement of Land Acts of 1846. Drainage came with considerable cost and was not affordable by many farmers. Therefore on some Welsh estates the landlord supplied the pipes and the tenant the haulage and labour. In the 1860s it was estimated that the under-drainage of 900,000 acres of land in England and Wales cost £7.92 million.<sup>119</sup>

The truisms that Welsh farming was primitive and at subsistence level, that communications were poor and the Welsh language was an insulating factor and a barrier to advancement and innovation, needs to be questioned. The wealth of knowledge from estate books, account books and farmers' diaries show patterns of progress and development. Mechanisation and the introduction of threshing machines, advanced drainage systems, improvement and investment in buildings, attendance of agricultural society shows, supportive squires and the arrival of the railways all factored towards

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<sup>119</sup> John Bowers, 'Inter-War Land Drainage and Policy in England and Wales', *AHR*, Vol.46, No. 1, p.65; Joan Thirsk, Gen. Ed., *The Agrarian History of England and Wales*, Volume VII, Part I, 1850-1914, Cambridge: CUP, 2000, pp.888-893; M. Robinson, 'The Extent of Farm Underdrainage in England and Wales, prior to 1939', *AHR*, Vol.34, 1986, pp.79-85; David W. Howell, *Land and People in Nineteenth Century Wales*, op.cit., p.53; Matthew Cragoe, *An Anglican Aristocracy, The Moral Economy of the Landed Estate in Carmarthenshire 1832-1895*, (Oxford: Clarendon Press, 1996), pp.60-61; Mike Benbough-Jackson, 'Landlord Careless'? Landowners, Tenants and Agriculture on Four Estates in West Wales, 1850-75', op.cit., p.89; PP 1846 (536) Drainage. A bill (as amended by committee) to authorize the advance of public money to promote the improvement of land in Great Britain and Ireland, by works of drainage.



agricultural development. Agricultural science is shown in this study to be another such influence on agricultural development.<sup>120</sup>

## 2.4 Agricultural Science in the Nineteenth Century: From the Laboratory to the Farm

Modern chemistry emerged at the end of the eighteenth century thanks to the work of scientists such as Antoine-Laurent Lavoisier<sup>121</sup> and Jöns Jakob Berzelius<sup>122</sup> and even though Lavoisier published some reports on cultivation their experiments and results were not linked directly with agriculture. Agricultural science progressed in Britain by the work of the botanist Erasmus Darwin<sup>123</sup> and that of the British chemist Humphry Davy.<sup>124</sup> Davy's work was thought to have been the first to promote science in farming practice with his knowledge of the chemical and physical aspects of soil.<sup>125</sup> The 'old' Board of Agriculture, established in 1793, arranged for Davy to help bring science to farmers by delivering courses of lectures on agriculture and by 1813 Davy published *The Elements of Agricultural Chemistry*.<sup>126</sup> This publication linked the agricultural experimental farming

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<sup>120</sup> Gwyn A Williams, *The Welsh in their History*, (London: Croom Helm, 1985), p.70; D. Parry-Jones, *My Own Folk*, (Llandysul: Gomer, 1972), p.69; D. Parry-Jones, *Welsh Country Upbringing*, (London: Batsford, 1948), p.93; David W. Howell, *Land and People in Nineteenth-Century Wales*, op.cit., pp.45-6 and p.137; Mike Benbough-Jackson, 'Landlord Careless'? Landowners, Tenants and Agriculture on Four Estates in West Wales, 1850-75', op.cit., p.95.

<sup>121</sup> Antoine-Laurent Lavoisier (1743-1794), among his contributions to chemistry was the understanding of combustion and respiration in chemical reactions and producing better gunpowder by using purer compounds of potassium nitrate and sulphur.

<sup>122</sup> Jöns Jakob Berzelius (1779-1848) was known for experiments in electrochemistry as well as mineral classification by chemical composition.

<sup>123</sup> Erasmus Darwin (1731-1802) was an English physician and botanist and was said to have formed the early ideas relating to the theory of evolution that was further developed by his grandson Charles Darwin.

<sup>124</sup> Humphry Davy (1778-1829) was a leader in the chemistry movement initiated by Lavoisier and also a pioneer in the field of electrochemistry.

<sup>125</sup> Sir E. John Russell, *A History of Agricultural Science in Great Britain*, op. cit. pp.73-74; 'We Tell the Story of Chemistry', Chemical Heritage Foundation, <http://www.chemheritage.org>, for profiles of Lavoisier, Berzelius and Davy; Friedrich Engels, *The Condition of the Working Class in England*, (London: Penguin, 2005), p.60; G. E. Fussell, *Farming Technique from Prehistoric to Modern Times*, op.cit., p.149.

<sup>126</sup> Sir E John Russell. *A History of Agricultural Science in Great Britain*, op. cit., pp. 67-68 and p. 75; J. D. Sykes. 'Agriculture and Science' in G. E. Mingay, ed., *The Victorian Countryside*, (London: Routledge, 1981), pp.260-261; For the role Davy played in the Royal Society see Jack Morrell and Arnold Thackray, *Gentlemen of Science, Early Years of the British Association for the Advancement of Science*, (Oxford: Clarendon, 1981), p.37; A. W. Ashby and I. L. Evans, op.cit., p.127, the main duty of the old Board of Agriculture was the collection and dissemination of information. The work of Walter Davies, his *General*

reports and the findings of scientists such as Humboldt and Gay-Lussac, deSaussure, Thaer and other scientists who had researched soil and plant growth.<sup>127</sup>

The experimental farming movement of the early nineteenth century encouraged farmers to write reports of their own experiments in farming newspapers. These experimental reports written by practising farmers and landowners, as opposed to scientists, described the agricultural experiment with the associated costs and profits. If any experiment deemed successful did not demonstrate increased profit and productivity, the farmer's claims of improvement and success were open to question.<sup>128</sup> As Robinson commented 'to risk capital in a more or less untried idea may be praised as pioneer work, but it is not the farmer's conception of sound business'.<sup>129</sup>

Agricultural science was not a subject that featured highly in the British Society for the Advancement of Science (BAAS) when it was founded in 1831, but was reluctantly admitted to the association via Section B, Chemistry and Mineralogy, by 1843.<sup>130</sup> This reluctance was seen in correspondence from Sir Francis Alexander Mackenzie who wrote to Roderick Impey Murchison the General Secretary of BAAS, on 20 July 1837:

...Let me I pray into the secret of your dislike to a subject which was so interesting to Davy and which would interest hundreds of our country squires amongst whom I

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*View of the Agriculture and Domestic Economy of North Wales* (1810) and his two volumes *Survey of South Wales* (1814) were both published under the auspices of the Board and provide the first consecutive account of Welsh Agriculture. The 'old' word is used to differentiate it from its late Victorian successor, for a review of the old board see Rosalind Mitchison. 'The Old Board of Agriculture (1793-1822)', *English Historical Review*, Vol.74, No.290, 1959, pp.41-69.

<sup>127</sup> Mary S. Morgan. 'Experimental Farming and Ricardo's Political Arithmetic of Distribution', Working Papers on the Nature of Evidence: How Well Do Facts Travel? No. 03/05 London School of Economics, May 2005, p.4, <http://www.lse.ac.uk/collection/economichistory>; Paul Brassley. 'Agricultural Science and Education', in Joan Thirsk, Gen.Ed., *The Agrarian History of England and Wales, Part I*, op.cit., p.598; Alan I. Marcus, *Agricultural Science and the Quest for Legitimacy*, op.cit., p.29, the author comments that agricultural science was a European creation.

<sup>128</sup> Mary S. Morgan, op. cit., p.4.

<sup>129</sup> D. H. Robinson, *The New Farming*, (London: Thomas Nelson & Sons, 1946), p.15.

<sup>130</sup> Jack Morrell and Arnold Thackray, *Gentlemen of Science, Early Years of the British Association for the Advancement of Science*, op. cit., p.454 and p.456. Agriculture did not have its own Section until 1912.

have always understood it to be one of our great objects to encourage a thirst for science instead of the more common thirst for claret etc.<sup>131</sup>

The publication of *Organic Chemistry in Its Application to Agriculture and Physiology* in 1840 by Justus von Liebig<sup>132</sup>, a German chemist, was considered significantly important for the development of agricultural science because it was said to give an optimistic message that the application of science could increase food yields. The book was influential but it was thought to be written for scientists as opposed to farmers.<sup>133</sup> As previously mentioned, the limited printed information appropriate for Welsh tenant farmers was challenging and more so for monoglot Welsh tenant farmers.

By the beginning of the 1840s agronomy, the science of soils and plants was studied in laboratories of agricultural research stations. These stations were operating in Europe, first in France followed by Germany and were funded by government and private organisations for the promotion of agricultural improvement.<sup>134</sup> German stations became the model for the American agricultural stations in the 1870s and 1880s, the purpose of which was to bridge laboratory science to farm practice with the involvement of farmers in

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<sup>131</sup> Jack Morrell and Arnold Thackray, Eds. *Gentlemen of Science, Early Correspondence of the British Association for the Advancement of Science*, (London: Royal Historical Society, University of London, 1984), pp.247-48, Sir Francis Alexander Mackenzie was a Scottish improving landowner.

<sup>132</sup> Justus von Liebig (1803-1873) was born in Darmstadt and was regarded as the one of the greatest chemistry teachers of the time and also developed a manufacturing process for beef extracts and trademarked the Oxo brand.

<sup>133</sup> William H. Brock, *Justus von Liebig, The Chemical Gatekeeper*, (Cambridge: CUP, 2002), p.145; J. D. Sykes, op.cit., p.262; , Margaret W. Rossiter, *The Emergence of Agricultural Science, Justus Liebig and the Americans, 1840-1880*, (New Haven: YUP, 1975), pp. 29-30; Jack Morrell and Arnold Thackray, *Gentlemen of Science, Early Years of the British Association for the Advancement of Science*, op. cit., pp.490-91; Sir E John Russell, *A History of Agricultural Science in Great Britain*, op. cit., pp.114-15. The book was translated by Lyon Playfair (1818-1898) who became the first consulting chemist to the Royal Institute.

<sup>134</sup> Lyvia Diser, 'Laboratory versus Farm: The Triumph of Laboratory Science in Belgian Agriculture at the End of the Nineteenth Century', *AH*, Vol.86, p.33-34.

the research.<sup>135</sup> As Marcus commented ‘...in America, the scientists did not win an easy victory over the farmers for control of the experiment stations’.<sup>136</sup>

Another influential figure in agricultural science at this time was John Bennet Lawes who established the first British experimental station at Rothamsted, Hertfordshire, his ancestral home. Lawes started field trials and experiments in pots in order to evaluate the value of ground bones as a fertiliser and went on to develop and produce superphosphate fertilisers which he patented in 1842.<sup>137</sup> Dr Joseph Henry Gilbert, a former student of Liebig, joined him at Rothamsted in 1843, forming a partnership which lasted fifty-seven years. Their work was characteristic of the nineteenth century being privately financed and concerned mainly with fertilisers.<sup>138</sup>

The scientific controversies between Liebig, Lawes and Gilbert are well documented and were initially caused in part by inaccurate analytical information from Liebig who believed a crop could obtain nitrogen from the atmosphere while the Rothamsted experiments concluded that plants required a supply of nitrogen from fertilised

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<sup>135</sup> Mark R. Finlay, ‘The German Agricultural Experiment Stations and the Beginnings of American Agricultural Research’, *AH*, Vol.62, No.2, 1988, p.42-43. Liebig’s agricultural chemistry was thought to have been the influence behind creating the German agricultural stations.

<sup>136</sup> Alan I. Marcus, *Agricultural Science and the Quest for Legitimacy*, op.cit., pp.3-6. The Hatch Act was passed by Congress in 1887 and provided each state with \$15,000 a year to fund an agricultural experiment station. It created a network of federally supported research stations devoted to agricultural investigation and experimentation.

<sup>137</sup> Kenneth Blaxter and Noel Robertson, *From Dearth to Plenty, The Modern Revolution in Food Production*, (Cambridge: CUP, 2007), p.11; James A. Scott Watson and May Elliot Hobbs, *Great Farmers*, (London: Faber, 1951), p.74-75; E. John Russell. *A History of Agricultural Science*, op. cit., pp. 143-45, other manufacturers tried to produce the same product, but Lawes successfully defended his patent, and forced them to pay a royalty of 10s.0d on every ton of their output. These royalties and the profits of his own factory, provided the money for Lawes to pay for the scientific work at Rothamsted.

<sup>138</sup> H. E. Dale. *Daniel Hall, Pioneer in Scientific Agriculture*, (London: John Murray, 1956), p.53; Sir Daniel Hall, *The Book of the Rothamsted Experiments*, (London: John Murray, 1905), pp. xxxiv-v; Margaret Harcourt Williams, ‘Rothamsted and the correspondence of Sir John Lawes and Sir Henry Gilbert’, *Local Historian*, Vol.23, No.2, 1993, p.87, the best known of the Rothamsted experiments was that of continuous wheat growing on Broadbalk field. This was begun in 1843 with the aim of testing the manure requirements of wheat by growing it continuously with various combinations of fertilizers repeated year after on the same plots.

soil, a subject of controversy for over thirty years.<sup>139</sup> Lawes criticised Liebig's mineral theory not only for being wrong but for wasting farmers' hard earned money. This failure also proved that pure science needed practical verification, therefore science could only be of use to farmers when there were successful practical results to share.<sup>140</sup>

To verify any agricultural theory during this period was very difficult and the problems in the 1840s were complex because farmers and scientists alike would not have had a working knowledge of statistics and controls that were to become routine in the early twentieth century. As Rossiter suggested, farmers were trying to both implement and verify theories at the same time to prove success or failure. Crop failures could have been the result of technique or products as well as other factors such as rainfall or inadequate drainage. Crop successes could have been due to the new charcoal applied or the lime treatments that had been used in previous years. A trial plot of potatoes may have resulted in a useful crop but this did not indicate to the farmer what would happen in subsequent years. It was well into the nineteenth century that the gulf between scientific experiment and the trial plot was said to have been bridged by the work of Thaer, Lawes, Gilbert and Liebig when checks and cross-checks were introduced and it was acknowledged that results of experiments had to be made against a background of hypothesis.<sup>141</sup>

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<sup>139</sup> Sir E. John Russell. *A History of Agricultural Science in Great Britain*, op. cit., pp. 91-122 gives a detailed discussion of the debate between Lawes and Liebig; Margaret Harcourt William. op. cit., p.88; Paul Brassley, 'Agricultural Science and Education', op. cit., p. 599; James A. Scott Watson and May Elliot Hobbs, *Great Farmers*, op. cit., p.74; William H. Brock, op. cit., p.165, the 'mineral theory' may be summarised as claiming that the principal nutrients of plants are, besides carbon, hydrogen, and nitrogen, a clutch of essential minerals, including sulphur, phosphorous, iron, calcium, magnesium, and silicon, and in some plants, sodium and potassium, but ignored the role of nitrogen.

<sup>140</sup> J. W. Malden. 'Recent Changes in Farm Practices', *JRASE*, Vol. 7, 1896, quoted in Vance Hall, *A History of the Yorkshire Agricultural Society, 1837-1987*, (London: Batsford, 1987), p.211, Appendix B; John Richard Fisher, *Public Opinion and Agriculture 1875-1900*, (unpublished PhD thesis, University of Hull, 1972), p.83; Mark R. Finlay, op.cit., pp.42-43.

<sup>141</sup> Margaret W. Rossiter, op. cit., p. 30; G. E. Fussell, 'Agricultural Science and Experiment in the Eighteenth Century: an Attempt at a Definition', *AHR*, Vol.24, 1976, pp.46-47; Hugh Kearney, *Science and Change*, (New York: McGraw-Hill, 1988), p.49.

Lawes was aware of the feelings of farmers he was trying to help and criticised scientists who did not show the same respect expressing the following to the Royal Agricultural Society:

The contempt which the practical farmer feels for the science of agricultural chemistry arises from the errors which have been committed by its professors. They have endeavoured to account for, and sometimes to pronounce as erroneous, the knowledge which ages of experience have established; and they have attempted to generalise without the practical data necessary to accomplish their end with success. Agriculture will eventually derive the most important assistance from chemistry, but before it can propose any changes in the established routine of the farmer, it must, by a series of laborious and costly experiments, explain this routine in a satisfactory manner.<sup>142</sup>

Although the scientific work of Liebig was acknowledged, the experiments and work of Lawes and Gilbert were described as a competent authority of agricultural chemistry and that Rothamsted was regarded as the greatest agricultural research station of the Victorian age.<sup>143</sup> However, Sir Daniel Hall, British agricultural educationist and researcher, considered that research work at Rothamsted was more useful for educating those who instructed farmers rather than for the farmers themselves.<sup>144</sup> He also suggested that the economic application of research was a secondary consideration and research results were of no use to the farmer. Hall explained this by quoting the work of Hellriegel and Wilfarth who made a discovery of immense importance to agricultural science but with little view of its importance for the application on the farm.<sup>145</sup>

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<sup>142</sup> Lynnette J Peel. 'Practice with Science: The First Twenty Years', *JRASE*, 1976, p. 14; J. D. Sykes, op. cit., p. 263.

<sup>143</sup> Sir Daniel Hall, *The Book of the Rothamsted Experiments*, op.cit., p.xxxv; William H. Brock, op. cit., p. 173; Sir E. John Russell, *A History of Agricultural Science in Great Britain*, op. cit., p106; G. V. Dyke, *John Lawes of Rothamsted, Pioneer of Science, Farming and Industry*, (Harpenden: Hoos Press, 1993), p.218; Sir E. John Russell, *A History of Agricultural Science*, op. cit., pp. 143-159, for a discussion of the work of Lawes and Gilbert at Rothamsted; Rowland E. Prothero, 'English Agriculture in the Reign of Queen Victoria', *JRASE*, Vol. LXII, 1901, p.24.

<sup>144</sup> A. D. Hall, 'Agricultural Research in England', *Contemporary Review*, November 1904, p.19.

<sup>145</sup> *The Dissemination of Research Results among Agricultural Producers*, Answers to a Questionnaire issued by the Empire Marketing Board, (London: HMSO, 1930), p.5; Sir E. John Russell, *A History of Agricultural*

The perception was that agricultural research in Britain was only performed by amateurs or enlightened entrepreneurs and that the research was mainly about fertilisers.<sup>146</sup> However this does not take into consideration other British research initiatives; the experimentation in cross-fertilisation, the field and stock experiments by the Royal Agricultural Society, horse breeding, poultry breeding and scientific management, and the work of Eleanor Ormerod in agricultural entomology.<sup>147</sup> It took a considerable time for the Rothamsted findings to be incorporated into farming practice but by the end of the nineteenth century the work of Lawes and Gilbert was influencing cultivation practices and the treatment of livestock. However Lawes told the Royal Commissioners that although farmers knew how to use manure to improve their soils they had much to learn about agricultural science.<sup>148</sup> By the beginning of the twentieth century it was considered that agriculture was still not adequately understood by scientists or farmers and Daniel Hall's appointment to Rothamsted was thought to have brought a new vision; one of development based on scientific research with the results carried to farmers through advisory and educational agencies.<sup>149</sup> He acknowledged that agricultural science had been regarded as a branch of chemistry but believed that both plant and soil were too complex to be studied from one point only. Therefore to gain different perspectives to the issues of plant growth, he employed the services of a botanist, a bacteriologist and a soil and organic chemist, together with the assistance of postgraduate students.<sup>150</sup>

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*Science in Great Britain*, op. cit., p.106. The scientists demonstrated that leguminous plants obtained nitrogen from the atmosphere because of bacteria residing in the nodules of the roots.

<sup>146</sup> Avner Offer, *The First World War: An Agrarian Interpretation*, (Oxford: Clarendon, 1991), p. 101; Barbara T Gates 'Ordering Nature: Revisioning Victorian Science Culture' in Bernard Lightman, ed., *Victorian Science in Context*, (Chicago: University of Chicago Press, 1997), p.181, the author suggests that the boundaries dividing amateurs from professional scientists were fluid and amateur observation was at the forefront of scientific discovery.

<sup>147</sup> Rowland E Prothero, 'English Agriculture in the Reign of Queen Victoria', op.cit., pp. 36-37.

<sup>148</sup> PP 1881 (C.3096), Minutes of evidence taken before Her Majesty's Commissioners on Agriculture, Vol. II, p.950, q. 57,644-47.

<sup>149</sup> J. D. Sykes, op. cit., pp. 271-72; Sir E. John Russell, 'Rothamsted and Its Experiment Station', *AH*, Vol.16, No.4, 1942, p.183.

<sup>150</sup> Sir E. John Russell, 'Rothamsted and Its Experiment Station', op. cit., p.182.

The adoption of farm machinery and mechanical innovation in the nineteenth century was thought to have been of less importance than the chemical advances of soil improvement. Although the development of machinery and implements were demonstrated and tested at agricultural shows, the various improvements on traditional machinery made only a marginal contribution to agricultural output.<sup>151</sup> As Moore-Colyer commented ‘for all the triumphalist articles in the contemporary agricultural and engineering press applauding the achievements of steam and mechanisation, the horse remained the fundamental unit of power in Victorian Britain ...’<sup>152</sup> Collins suggests that agricultural progress was dependent on closing the technical gap between farm and factory and that it was the introduction of the reaping machine in the 1850s that gave the greatest benefit to the farm. However, the greater part of the British corn harvest was still cut by hand as late as 1870.<sup>153</sup> This lack of technical progress was said to be due to a belief that the social costs of mechanisation, wages, employment and labour relations, outweighed the economic benefits and in many parts of Britain this was an issue long after the Swing Riots.<sup>154</sup>

Agricultural economics was a branch of research that received the least encouragement in Britain. As commented by Astor and Murray:

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<sup>151</sup> John R Walton ‘Mechanization in agriculture: a study of the adoption process’, in *Change in the Countryside: Essays on Rural England 1500-1900*, (London: Institute of British Geographers, 1979), p. 23; J D Chambers and G E Mingay, *The Agricultural Revolution 1750-1880*, op.cit., pp.2-3; Christabel S Orwin and Edith H Whetham. *History of British Agriculture 1846-1914*, (Newton Abbot: David & Charles, 1971), pp.102-3; G. E. Fussell, *The Farmer’s Tools, The History of British Farm Implements, Tools and Machinery 1500-1900*, (London: Orbis, 1981), p.115-39, for detailed history of reapers, the author considers the nineteenth century most important for the advancement of agricultural mechanism.

<sup>152</sup> Richard Moore-Colyer. ‘Aspects of Horse Breeding and the Supply of Horses in Victorian Britain’, *AHR*, 43(1), 1995, p.47.

<sup>153</sup> E. J. T. Collins, ‘Harvest Technology and Labour Supply in Britain, 1790-1870’, *EHR*, 22(3), 1969, pp.454-55.

<sup>154</sup> E. J. T. Collins, ‘The Rationality of “Surplus” Agricultural Labour: Mechanization in English Agriculture in the Nineteenth Century’, *AHR*, 35(1), 1987, p.36. The author comments that the ‘machinery question’ was one of the principal theoretical concerns of classical economics in the early nineteenth century; Maxine Berg, *The Machinery Question and the Making of Political Economy, 1815-1848*, (Cambridge: CUP, 1982), pp.16-17



Making two blades of grass grow in the place of one is not necessarily an end in itself. There must also be an increase in profit.<sup>155</sup>

While the results of research in other countries on soil fertility, soil physics, plant breeding and animal nutrition were all available to this country, the application of the results were dependent on their economic suitability to the particular conditions in Britain.<sup>156</sup> Agricultural research, by its very nature, was considered to be regional and research findings could not be adopted without studying the results in the ecological and economical situations that farmers faced in their local farming communities.<sup>157</sup> Farmers were serving their community by assuring a good, regular and affordable supply of agricultural products as well as trying to guarantee a better living for themselves and farm workers.<sup>158</sup> The technical efficiency of the farmer meant that he could manage the stock and growing of crops within the region and climate in which he was familiar with but would need the scientist and economist to help with change to maximise productivity.<sup>159</sup>

Rural sociologists and economists emphasised the importance of the role of the farmer in the technology transfer process as farmers knew more about their farms and specific local conditions than the agricultural scientists and that this local knowledge was complementary to the scientific knowledge.<sup>160</sup> As explained by Molnar et.al:

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<sup>155</sup> Viscount Astor and Keith A. H. Murray, *Land and Life, The Economic National Policy for Agriculture*, (London: Victor Gollancz, 1932), p.150. Although Sir George Stapledon refers to this quote in *Gulliver's Travels*, Stapledon Archives, MERL, D/77/29/C3; Jonathan Swift, *Gulliver's Travels*, Ware: Wordsworth Editions, 1992 reprint (original publication 1726), p.101, '...that whoever could make two ears of corn, or two blades of grass to grow upon a spot of ground where only one grew before; would deserve better of mankind, and do more essential service to his country, than the whole race of politicians put together.'

<sup>156</sup> Viscount Astor and Keith A. H. Murray, *Land and Life*, op.cit., p.150.

<sup>157</sup> I. Arnon, *Agricultural Research and Technology Transfer*. London: Elsevier, 1989, p. ix.

<sup>158</sup> Walton H. Hamilton, 'Agricultural Research in a Changing Order', *Journal of Farm Economics*, Vol.8, No.1, 1926, p.56-57.

<sup>159</sup> Ronald Ede, *The Principles of Agriculture*, (London: Pitman, 1946), p.233; Dr D. G. Melvyn Howe, op.cit., p.55.

<sup>160</sup> Jack Kloppenburg Jr. 'Social Theory and the De/Reconstruction of Agricultural Science: Local Knowledge for an Alternative Agriculture', *Rural Sociology*, Vol.56, No.4, 1991, p.539; Jonathan Murdoch et.al. 'Sustainable Agriculture and Endogenous Development: A Socio-Political Perspective', in Jan Douwe van der Ploeg and Ann Long, eds, *Born from Within*, (Assen: Van Gorcum, 1994), p.273; Fergus Lyon, 'How

Farmers and scientists operate in fundamentally different worlds. Scientists have instruments to extend their senses through microscopic landscapes and across diverse locations. Farmers have continuity of experience and personal involvement in one environment; ...The perspectives of farmers and scientists are complementary and supplemental to one another and not in conflict. Farmers cannot substitute for researchers nor would researchers be well advised to neglect their laboratories in favour of too much time on the farm.<sup>161</sup>

One of the farmer's main objectives was the guaranteed production of crops and therefore he needed to know whether the chosen crop and field were compatible, whilst the scientist's objective was generating knowledge and analysing how and why the crop grew. Both farmer and scientist faced risks; the farmer in applying new ideas that had been extrapolated from another part of the country with different conditions and the scientist if the farmer did not comply with the technology or practice they were promoting.<sup>162</sup>

It was suggested that the farmer considered agriculture as an art and the teachings of the professor as pure science but the ideal was a combination of profession with practice that justified the expression 'scientific agriculture'.<sup>163</sup> Cheese-making was regarded as one of the finest examples of how an art successfully combined with complicated biological processes to form a product with differing qualities and varieties.<sup>164</sup>

The history of the development of agricultural science has been shown here to have evolved from the fields of the landed gentry to the laboratories of pioneer scientists and into the hands of progressive farmers. This review leads us to the appropriate time frame for analysing the relationship between science and the farmer in the first half of the

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Farmers Research and Learn: The Case of Arable Farmers of East Anglia, UK', *Agriculture and Human Values*, Vol.13, No.4, 1996, p.39.

<sup>161</sup> Joseph J. Molnar et.al. 'Agricultural Science and Agricultural Counterculture: Paradigms in Search of a Future', *Rural Sociology*, Vol.57, No.1, 1992, p.86.

<sup>162</sup> Fergus Lyon, op.cit., p.44.

<sup>163</sup> Frances Evelyn, 'Scientific Agriculture', *The North American Review*, Vol. 182, No. 592, 1906, p.411.

<sup>164</sup> L. A. Rogers, 'Science and the Art of Cheesemaking', *The Scientific Monthly*, Vol. 42, No. 5, 1936, p.437.

twentieth century. This chapter closes with an appropriate comment by Lord Blyth describing the value of agricultural science:

Science can teach us how best to occupy each separate acre of the soil; by corn here, pasture there, fruit, vegetables, or timber elsewhere, for it is a truism to say that every acre has a capacity of its own for the production of some special article. I am convinced that there is nothing in connection with agriculture which science will not be the means of showing us can be produced either 1) much more abundantly on the same space; 2) to a much greater degree of perfection; 3) at a much lower cost.<sup>165</sup>

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<sup>165</sup> Memorandum by Lord Blyth on the Application of Science to Agriculture, op.cit.

## CHAPTER THREE: SCIENCE AND THE LIVESTOCK FARMER

### 3.1 Introduction

The majority of livestock farmers were known as breeders because they chose the kind of stock to keep and breed, unlike arable farmers who were largely constrained by what plant breeders bred and supplied. It was suggested that the craft of breeding had been developed centuries before the scientific principles of genetics were formulated. While early improvers of livestock breeds did not have the scientific knowledge of the principles of breeding, they were acknowledged to have been successful in setting high standards of performance in their stock and it was also recognised that important classes of domestic animals throughout the temperate zones of the world were of British origin. Marshall and Hammond's explanation of this was twofold: the selection of suitable animals was an art and not a science and depended on the attributes of 'hand and eye'; and secondly, that many of the methods adopted by the breeder were essentially, though unconsciously, scientific.<sup>166</sup> It was said that there were many interesting comparisons between the two great R. B.s of agriculture – Robert Boutflour and Robert Bakewell; 'what Boutflour was doing with scientific knowledge to improve the utility of stock, Bakewell was doing two hundred years previously by instinct and keen observation'.<sup>167</sup>

Robert Bakewell made several national tours to observe the latest techniques and developments in agriculture. He inherited a family tradition of practical improvement of farming dating from his grandfather and when he was bequeathed the farm from his father,

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<sup>166</sup> Raymond Pearl, 'Genetics and Breeding', *Science*, Vol. 37, No.954, 1913, p.541; F. H. A. Marshall and John Hammond, *The Science of Animal Breeding in Britain*, (London: Longmans, 1948), pp.1-2. Among the most successful of the early pioneers was Robert Bakewell whose work led to the development of the famous Longhorn cattle and the Leicester sheep.

<sup>167</sup> Mary Boutflour, *Bobby Boutflour*, (London: Crosby Lockwood, 1965), p.169.

the Dishley estate was considered a model farm for the period.<sup>168</sup> Bakewell founded his reputation on the principle of in-breeding to strengthen the good properties he wished to develop.<sup>169</sup> This inbreeding was the only practical tool the breeder had at the time to develop genetic uniformity. He adapted inbreeding methods of racehorse owners to his farm livestock and without any comprehension of the scientific base of the technique, gained the reputation of having transformed the quality of Britain's cattle, sheep and horses.<sup>170</sup> In contrast, Robert Boutflour became known as being a pioneering agriculturalist, using scientific technology to manage animal nutrition and advocating the balanced ration.<sup>171</sup> Whereas Robert Bakewell's agricultural development was based on observation and inbreeding for desirable traits, Robert Boutflour's was from laboratory research, application and formal education.<sup>172</sup>

It was considered that the gentlemen farmers of Wales did not share the enthusiasm of English livestock breeders meaning Welsh stock remained unimproved until late nineteenth century.<sup>173</sup> When farmers were encouraged to apply scientific principles of breeding on their herds the plans were considered 'too far-fetched'.<sup>174</sup> Similarly Jackson commented that 'our attention to breeding has been literally worse than nothing; the best stock being invariably sold out of the country, added to which a great deal of prejudice has existed among people of capital and influence against anything Welsh'.<sup>175</sup>

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<sup>168</sup> David L. Wykes, 'Robert Bakewell (1725-1795) of Dishley: farmer and livestock improver', *AHR*, Vol. 52(1), 2004, p. 39.

<sup>169</sup> *Ibid.*, p.44.

<sup>170</sup> Robert Trow-Smith, *A History of British Livestock Husbandry 1700-1900*, (London: Routledge, 1959), pp.53-55.

<sup>171</sup> Mary Boutflour, *op.cit.*, p.95.

<sup>172</sup> Professor Boutflour became principal of the Royal Agricultural College in 1931, see Mary Boutflour, *op.cit.*, Chapter Nine, pp.107-114.

<sup>173</sup> R. J. Colyer, 'Some Welsh Breeds of Cattle in the Nineteenth Century', *AHR*, Vol.22(1), 1974, p.1

<sup>174</sup> Jenny Buckton, *The Best of Breeds, A History of Welsh Black Cattle*, (Llandysul: Gomer, 2004), p.69.

<sup>175</sup> R. J. Colyer, 'Some Welsh Breeds of Cattle in the Nineteenth Century', *op.cit.*, p.1, the author quotes from the National Library of Wales Glansevern MS.2374 letter from R. H. Jackson to Edward Jones of Glansevern complaining about the attitude of Welsh landlords towards stock improvement.

The most striking difference between the agriculture of Wales and that of England is the relative importance of grassland and of livestock production. Wales is a country of high rainfall, high altitude, low insolation and poor soil. The mountainous topography, cool moist climate and abundant rainfall meant plenty of grass resulting in livestock breeding being the mainstay of Welsh agriculture. The dual-purpose and beef breeds, Shorthorn, Welsh Black and Hereford, and the Welsh mountain sheep formed an integral part of the Welsh rural scene.<sup>176</sup>

### **3.2 Science and Stock Breeding**

In cattle the terms ‘dairy’, ‘dual purpose’ and ‘beef’ types broadly described the animals according to shape and size, proportions of bone, muscle and fat and general metabolism. In pigs the pork, bacon and lard types described the differences in function and performance and in sheep the fat lamb and mutton types contrasted with the wool-producing types.<sup>177</sup> The results of breeding depended, to a large extent, on the possibility of assessing the breeding value of animals and how those potentials were utilised. When selecting animals for breeding the farmer’s aim was partly to prevent the spread of undesirable genes in the population, for example, genes for anatomical or physiological defects, and partly to increase the frequency of genes responsible for desirable production traits, namely more wool and heavier lambs.<sup>178</sup> The business of the productive breeder was described as one who improved the herd rather than just increased the herd. The productive breeder also produced ‘a good type of animal that will breed true to its qualities’ and with an ideal economic consideration of producing meat, milk or wool with

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<sup>176</sup> Anne Martin, ‘Agriculture’, in Brinley Thomas, ed., *The Welsh Economy*, (Cardiff: UWP, 1962), p.74; D. Ifor Jenkins, ‘The Milk Industry in Wales’, *Transactions of the Royal Welsh Agricultural Society*, 1904-1954, p.72.

<sup>177</sup> J. E. Nichols, ‘Livestock Improvement’ in J. A. Hanley, ed., *Progressive Farming Vol.III*, (London: Caxton, 1949), pp.42-72.

<sup>178</sup> Ivar Johansson and Jan Rendel, *Genetics and Animal Breeding*, (Edinburgh: Oliver & Boyd, 1968), p.387; Helen Newton Turner, ‘What Can Science do for Sheep-breeding?’, *Wool Technology*, Vol.3, Issue 1, 1956, p.45.

maximum efficiency.<sup>179</sup> Livestock improvements were also questioned as to how much was due to breeding practice and how much to better nutrition or improved environment. The science of nutrition in the inter-war years was thought to have enabled farmers to evaluate the optimum production of their stock and it was suggested that this increase in production resulted more from knowledge of nutrition than from the knowledge of stock-breeding.<sup>180</sup> Farmers who paid attention to starch and protein in balanced rations saw immediate increases in milk production and herds of 2000 gallon cows emerged.<sup>181</sup>

The lack of the application of genetic research in animal breeding in the first decades of the twentieth century was not due to lack of interest from breeders but rather to the fact that animal geneticists had not been able to develop methods suitable for breeders to apply in practice. The agricultural colleges and farm institutes attempted to give scientific precision to qualities sought by the farmers but the combination of breeding, feeding and economics proved difficult. This changed when research was intensified and important results of practical value were obtained in several fields, for example population genetics combined with inbreeding, crossbreeding and selection experiments, in addition to research on monozygotic twins, blood grouping and disease resistance.<sup>182</sup> Farmers interested in animal breeding and genetics were looking for improvements in characteristics such as milk yields, growth rates or fleece weights and it was only in the 1930s that quantitative genetics was influential.<sup>183</sup> By this time animal disease was also considered a priority in scientific research for the economic well-being of the British farmer and Special Committees were formed within the Agricultural Research Council to

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<sup>179</sup> James A. S. Watson and James A. More, *Agriculture, The Science and Practice of British Farming*, (Edinburgh: Oliver and Boyd, 1941), p.416.

<sup>180</sup> W. M. R. Evans, 'Modern Research into Agricultural Problems', *Transactions of the Royal Welsh Agricultural Society, Jubilee Edition 1904-1954*, pp.81-82.

<sup>181</sup> Mary Bouffour, *op.cit.*, pp.56-59.

<sup>182</sup> Ivar Johansson and Jan Rendel, *op.cit.*, p.9; Edith H. Whetham, *Beef Cattle and Sheep 1910-1940*, University of Cambridge Occasional Paper No. 5, 1976), p.33.

<sup>183</sup> G. W. Cooke, Ed., *Agricultural Research 1931-1981*, (London: Agricultural Research Council, 1981), p.277.

coordinate further research on braxy-like diseases in sheep, contagious abortion, tuberculosis, fowl paralysis, helminths, Johne's disease in cattle and sheep, and swine fever in pigs.<sup>184</sup>

Before the First World War farmers in Wales received advice on breeding and management of stock from the university agricultural departments and had assistance with grants from the Board of Agriculture and the Development Commission for the Livestock Improvement Scheme. This enabled local societies and clubs to purchase well-bred sires for the improvement and upgrading of farm livestock. When the Livestock Scheme commenced in 1914 grants in the first year were made to 140 societies in respect of 168 bulls and to a private owner of one bull.<sup>185</sup> Table 1 shows the details of the stock improvement grants allocated to the Bull Societies in each county in Wales in 1914-15. Although initially the state aid was relatively small, it was regarded as the start of a progressive farming movement. The use of well-bred sires, even on a limited extent under this scheme, started an improvement in the quality of stock and was said to have an influence on Welsh farmers, giving an indication of future stock development.<sup>186</sup>

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<sup>184</sup> Ibid., p.26.

<sup>185</sup> PP 1916 (Cd.8222) Board of Agriculture and Fisheries, Report on Agricultural Education and the Improvement of Live Stock, p.33. The Development Commission is further discussed in chapter eight.

<sup>186</sup> Ibid., pp.33-37.



**Table 1. Live Stock Improvement Grants 1914-1915**

<b>Province</b>	<b>County</b>	<b>No. of Bull Grants allocated</b>
South Wales....	Brecon	13
	Cardigan	14
	Carmarthen	24
	Glamorgan	15
	Monmouth	12
	Pembroke	17
	Radnor	10
	<b>Total</b>	<b>105</b>
North Wales....	Anglesey	10
	Carnarvon	12
	Denbigh	15
	Flint	11
	Merioneth	13
	Montgomery	14
	<b>Total</b>	<b>75</b>
	<b>Total for Wales</b>	<b>180</b>

*Source: PP 1916 (Cd.8222) Board of Agriculture and Fisheries, Report on Agricultural Education and the Improvement of Live Stock in Wales, p.31*

By 1928 there were 336 Bull Societies which increased to 476 in 1938. Initially there was some delay in adopting the scheme to improve sheep and the first Ram Improvement Society was formed in 1921 at Trawsfynydd and by 1931 there were 29 societies in Wales. This progress and development was considered to have given Welsh farmers an insight into the main principles of breeding, feeding and management of livestock and in a community of small farms this was helped by the financial assistance of

the government.<sup>187</sup> Not all breeding schemes were encouraged; it was commented that the Welsh pig farmer favoured the Welsh pig with ‘its long snout and long ears covering the eyes’ and until the farmers found another suitable breed ‘the money would remain idle’.<sup>188</sup> Welsh farmers favoured the Welsh Pig Breed as when it was crossed with a Large White boar it was a valuable baconer.<sup>189</sup> Within a few years there was a noticeable change in breeding policy. In 1923-4 of the 113 payments made there were 70 in respect of the Large White, 14 of the Large Black, 18 of Gloucester Old Spot, and 11 of other breeds. By 1938-9 the number of breeds had fallen to two, the Large White and the Welsh Pig.<sup>190</sup>

The Welsh Black cattle were a hardy, dual-purpose breed suited to the harsh and varying climate of Wales and were either suited to ‘the pail or the butcher block’.<sup>191</sup> These traits were the reason that Welsh Black Cattle were stocked at Morfa Mawr, the University of Wales college farm, where the land was very exposed and got the full force of westerly and north-westerly gales.<sup>192</sup> Scientific breeding of the Black Castlemartin breed had been known in West Wales for centuries and the breed was found to be comparatively disease free which was important when attested herds were being built up. This breed was also crossed with Shorthorns and Herefords to improve milk quality.<sup>193</sup>

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<sup>187</sup> Tom Gee, ‘Livestock Improvement in Wales’, *The Transactions of the Royal Welsh Agricultural Society*, 1954, pp.58-61. In 1913 Mr C Bryner Jones was appointed as the Agricultural Commissioner for Wales and was responsible for the administration and supervision of the Livestock Improvement Scheme.

<sup>188</sup> *Haverfordwest and Milford Haven Telegraph* 31 March 1915.

<sup>189</sup> A. W. Ashby and I. L. Evans, *op.cit.*, p.42.

<sup>190</sup> *Ibid.*, p.132.

<sup>191</sup> Jenny Buckton, *op.cit.*, p.85.

<sup>192</sup> NLW Dr T J Jenkin diaries 110.

<sup>193</sup> Margaret F. Davies, *op.cit.*, pp.120-21 and p.144.



**Figure 1. Welsh Black Cattle in St Davids, 1902**

*Source: Private photograph collection – Courtesy of Edward Perkins*

When scientific advice was not available to help farmers breed for higher milk yields or to upgrade stock, they would use any type of bull to service their cows but the Hereford Bull breed was popular in Pembrokeshire and the Livestock Officer was asked to place one or more in the county to improve the existing stock.<sup>194</sup> The statistics show that there were no grants paid in respect of premium bulls of the Hereford bull breed in Pembrokeshire in 1927-8 but by 1937-38 seven were paid. The number was still low compared to the Shorthorn breed but higher than those for the Welsh Black as shown in Table 2.

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<sup>194</sup> PA, PCC/SE/2/7, Meeting of the County Agricultural Committee, 18 January 1936.

**Table 2. Grants Paid in Respect of Premium Bulls**

Premium Bulls						
County	1927-28			1937-38		
	Shorthorn	Hereford	Welsh Black	Shorthorn	Hereford	Welsh Black
Cardigan	30	-	4	48	1	4
Carmarthen	30	5	2	43	9	2
Pembroke	30	-	3	38	7	3

*Source; A. W. Ashby and I. L. Evans, The Agriculture of Wales, Cardiff: UWP, 1944, p.145.*

In 1935 the Pembrokeshire Livestock Committee expressed concern that farmers were breeding increasingly from dairy bulls and passed a resolution that this was not in the interest of stock raising in the county. The percentage of farmers that had moved to milk production had increased beyond the expectations of the committee and there was a concern there could be a shortage of good quality store cattle in the county.<sup>195</sup> The agricultural statistics reflect such concern; although the total number of cattle in Wales in the inter-war years remained nearly the same there was a major shift towards dairy. The same pattern is seen in Pembrokeshire as is shown in Table 3.

By 1946 the Livestock Improvement Scheme in Pembrokeshire reported that farmers were showing an increased interest in the improvement of livestock and paying greater attention to quality breeding by using a higher standard of pedigree sire. This improvement was reflected by the number of Premium Bull Societies increasing from 53 in 1944 to 74 in 1946.<sup>196</sup>

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<sup>195</sup> *County Echo*, 13 June 1935.

<sup>196</sup> PA, PCC/SE/2/7, Meeting of the Agricultural Executive Committee, 1 June 1946.

**Table 3. Number of Cattle in Pembrokeshire 1902-1947**

	<b>Cows and Heifers in milk and in calf</b>	<b>Other Cattle</b>
1902	32,037	58,176
1907	33,352	60,849
1912	33,191	62,466
1917	34,636	67,045
1922	36,153	59,987
1927	37,722	63,916
1932	37,219	67,489
1937	38,533	57,991
1942	41,341	47,570
1947	47,694	47,432

*Source: John Williams, Digest of Welsh Historical Statistics, Volume I, Department of Economic and Social History, University College of Wales, Aberystwyth, 1985, p.231.*

Store-cattle breeders' aims were to build up the finest pedigree herds therefore when there was a move for the government to remove the embargo of Canadian store cattle an estimated ninety-five per cent of farmers in England and Wales resolved to fight this policy change. The farmers' views, especially in Wales, were supported by leading agriculturalists and from a scientific view it was seen as a retrograde step for improvement of livestock by breed societies and livestock schemes.<sup>197</sup> Although the Royal Commission recommended lifting the embargo, the government delayed the vote in the House of Commons and it was not until July 1922 that the debate was heard and the embargo lifted.<sup>198</sup> Farmers' concern over the pleuro-pneumonia present in Canadian cattle, the original reason for the introduction of the embargo, was dispelled as the disease had not existed in Canada for thirty years. The chief scientific expert of the Board of Agriculture,

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<sup>197</sup> TNA CAB/24/131/70 Memorandum by the Minister of Agriculture and Fisheries, Cabinet paper 'The Embargo on Canadian Store Cattle', 19 December 1921.

<sup>198</sup> PP 1921 (Cmd.1139) Royal Commission on the Importation of Store Cattle, pp.14-15; For a detailed discussion of the embargo of Canadian cattle see Max Foran, 'The Politics of Animal Health: The British Embargo on Canadian Cattle, 1892-1932', *Prairie Forum*, Vol.23, No.1, 1998, pp.1-17 and Simon Moore, 'The Real "Great Betrayal"? Britain and the Canadian Cattle Crisis of 1992', *AHR*, 41(2), 1993, pp.155-68.

Sir Daniel Hall, and the chief veterinary expert, Sir Stewart Stockman, gave evidence to this effect.<sup>199</sup>

In the inter-war years the Welsh farmers were experiencing the impact of national and international affairs affecting their business. Welsh store-cattle breeders ear-marked the progeny of premium bulls with the sign of the Welsh Dragon as a mark of their breeding and encouraged others to breed branded females with tuberculin-tested premium bulls to eliminate scrub stock and build up dependable herds.<sup>200</sup> This brand recognition was not welcomed by all farmers; a south Pembrokeshire farmer considered the Welsh brand a weakness giving Welsh farmers a disadvantage marketing their produce. He commented:

We should be looking outward and not inward. What's the point of advertising Welsh beef? We are advertising against the Irish, English and Scots and nationalism is holding us back. We should be selling British beef.<sup>201</sup>

Faced with competitive markets, farmers were demanding the limitation of imports and were themselves forced to change production policies and to manage the marketing of their products. These factors culminated around 1933 in the Ottawa agreements, the marketing acts and what proved of immense importance to Wales, the establishment of the Milk Marketing Board.<sup>202</sup>

Protective measures were introduced by the government in the early 1930s to allay the anxiety of farmers of their live-stock product prices and their concern with world trade

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<sup>199</sup> Hansard HC Deb 24 July 1922, vol 157 cc63-68.

<sup>200</sup> Viscount Astor and Keith A. H. Murray, *The Planning of Agriculture*, (London: OUP, 1933), p.81; PP 1935-36 (148) Development Commission twenty-sixth report for the year ended 31 March 1936, p.120, the Welsh Dragon Mark Association had direct contact with 1500 beef producers in the principal fattening districts at this time.

<sup>201</sup> Oral testimony of George Mathias MBE, Somerton Farm, Carew.

<sup>202</sup> J. Morgan Jones, 'Welsh Agriculture in Transition', *JMA*, Vol.60, 1954, pp.286-87.

competition.<sup>203</sup> In March 1932 the Import Duties Act<sup>204</sup> came into force imposing a ten per cent *ad valorem* duty of foreign imports, however, there was a 'free list' which included important food imports including beef, mutton, lamb, pig products and wool. As the main concern for the farmer was the future of live-stock prices, there was a high expectation of help from the Imperial Economic Conference at Ottawa that was being held in July and August 1932.<sup>205</sup> The Ottawa Conference and the subsequent Ottawa Agreements Act<sup>206</sup> did not help the farmer with economists and historians agreeing that the British farmers were not helped to compete successfully against world trade and beef producers experienced financial hardship.<sup>207</sup>

The severe fall in beef prices at the end of 1932 called for emergency action by the government to restrict imports as well as introducing a subsidy policy to avoid the collapse of the industry. The Cattle Industry (Emergency Provisions) Act 1934<sup>208</sup> was planned to offset the low prices seen in the previous year and a subsidy of five shillings per cwt. for live animals and 9s.4d. per cwt. for carcasses was given to farmers for their bullocks and heifers.<sup>209</sup> However this subsidy was not seen to help West-Walian farmers as one farmer commented:

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<sup>203</sup> R. S. Sayers, *A History of Economic Change in England, 1880-1939*, (London: OUP, 1967), p.119.

<sup>204</sup> PP 1932 (91) Import Duties Act, Finance Bill.

<sup>205</sup> Viscount Astor and Keith A. H. Murray, *The Planning of Agriculture*, op.cit., pp129-130; PP 1932 (Cmd. 4174) Imperial Conference at Ottawa, 1932; TNA, CAB/24/232 Cabinet Ottawa Agreements Bill. An authoritative account of the Ottawa Conference can be found in Ian M. Drummond, *Imperial Economic Policy 1917-1939*, (London: George Allen & Unwin, 1974), chapters 5 and 6.

<sup>206</sup> PP 1932 (127) Ottawa Agreements Bill, under this act import quotas were allocated and the quotas for imports of beef, mutton and lamb, and bacon and ham from Empire countries were the first to be established, see also Keith A. H. Murray, *Agriculture*, (London: HMSO, 1955), p.29.

<sup>207</sup> Michael Tracy, *Agriculture in Western Europe*, (London: Granada, 1982), pp.163-64; Viscount Astor and Keith A. H. Murray, *The Planning of Agriculture*, op.cit., p.135; T. Rooth, 'Trade Agreements and the Evolution of British Agricultural Policy in the 1930s', *AHR*, 1985, p.174.

<sup>208</sup> PP 1934 (175) Cattle Industry (Emergency Provisions) Bill.

<sup>209</sup> Viscount Astor and B. Seebohm Rowntree, *British Agriculture, the Principles of Future Policy*, (London: Longmans, 1938), p.193-194; Joan Thirsk, Gen. Ed., *The Agrarian History of England and Wales, VIII, 1914-1939*, op.cit., p.245, the author also notes that from the beginning of 1934 imports of fat cattle from Ireland were limited to half that of 1933 in order to protect prices in the British market.

...since the subsidy came into force the price of beef on the hoof has fallen 5/- per cwt, so the only person benefiting by the subsidy is the butcher as the public have to pay the same price for their beef. It is to be hoped that when the Ottawa and other agreements expire the Minister of Agriculture will put a tariff on meat...<sup>210</sup>

Reproductive physiology was another branch of science which developed rapidly in the period of this study. Before the adoption of Artificial Insemination (AI) cows from small holdings without a bull were transported to bigger farms. When farmers took their cows to the bull in the summer and found that the bull 'was in' and no-one but the maid was home the custom was to give her a penny to let the bull free.<sup>211</sup> W. R. Morgan recalled that the service fee for the bull was normally a half crown 'but father never paid this sum ... because he helped him with his ploughing which was an arrangement of mutual advantage'.<sup>212</sup>

In the early 1930s investigations with AI were begun by Walton and Hammond at Cambridge University and in 1942 the first cattle AI centre in Great Britain was founded as a farmer co-operative at Cambridge, with Dr Joseph Edwards as chairman.<sup>213</sup> AI was the first conceptive technology widely used in agriculture and although there were few supporters of AI in the 1920s and 1930s it became an indispensable method for reproducing cattle in the 1940s. By the end of the 1950s sixty per cent of cows in England and Wales were conceived through AI.<sup>214</sup> One of the major reasons for initiating AI was to make the males that transmit superior genetics for milk production available to more

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<sup>210</sup> Correspondence of Mr M Harries of Llanreithen Farm, courtesy of Mrs Merrill Mabey.

<sup>211</sup> Dafydd Jenkins, 'Arfer Ffarm a Ffurf Cymdeithas', *JRWAS*, Vol. XXVII, 1959, p.47. Translated title is Farm Practice and the Community Ways.

<sup>212</sup> W.R. Morgan, *A Pembrokeshire Countryman Looks Back*, (self-published, 1988), p.61.

<sup>213</sup> Ivar Johansson and Jan Rendel, *op.cit.*, p.11, the first successful artificial insemination on record was made by the Italian biologist Lazzaro Spallanzani with dogs in 1780. The pioneer in the practical application of AI to farm animals is the Russian veterinary physiologist Elia Ivanov, who started his work in the field in 1899.

<sup>214</sup> Sarah Wilmot, 'From "public service" to artificial insemination: animal breeding science and reproductive research in early twentieth-century Britain', *Studies in History and Philosophy of Biological and Biomedical Sciences*, Vol.38, 2007, pp.411-413; NLW T J Jenkin diaries 108, AI was first used on the Budloy herd in Maenclochog in January 1950.



producers in the animal industry. As Foote commented, ‘this was democracy in action and the elite bulls would not be limited to the wealthy’.<sup>215</sup> Field trials and research of AI soon proved to the agricultural community that technology applied appropriately could identify superior production bulls free from lethal genes, would control venereal diseases and produce healthy calves.<sup>216</sup> By the end of the Second World War progressive farmers in West and South Wales acknowledged the advantage of AI and its importance to livestock. Although the General Purposes Committee of the NFU did not have regional representation, John Bennion of Pembrokeshire, supported by farmers in Carmarthen and Glamorgan, called for Wales to have direct representation on the Committee in view of the importance of livestock to the country.<sup>217</sup> Government support to farmers was eventually offered by way of the Agriculture (Artificial Insemination) Bill.<sup>218</sup> This Bill facilitated the development of the practice of artificial insemination for better breeding and more efficient production and allowed for grants to be paid to centres either owned by the milk marketing scheme or by any farmers’ co-operative society, cattle breeders’ societies or cattle owners.<sup>219</sup>

### **3.3 Science and Sheep Farming**

Hill farms varied greatly in terms of size, soil and climate and the task of the scientist was to investigate each aspect of production in order to provide information to improve the understanding of the potential and limitations to output. Centuries ago a system of transhumance involved the occupation of two holdings; the upland *Hafod* where cattle were tended between May Day and All Saints Day and the lowland *Hendre* where the

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<sup>215</sup> R. H. Foote, ‘The History of Artificial Insemination: Selected Notes and Notables’, *Journal of Animal Science*, Vol.80, E-suppl 2, 2002, pp.4-5.

<sup>216</sup> *Ibid.*, p.8.

<sup>217</sup> NFU Record, The Official Journal of the National Farmers’ Union, Vol. XXIII, No.269, February 1945, p.85.

<sup>218</sup> PP 1945 (7) Agriculture (Artificial Insemination) Bill.

<sup>219</sup> *Ibid.*, pp.1-5.

fertile soil and arable crops were undisturbed after the cattle had been moved in the summer months. The seasonal movement of people and animals was a way of life for the farmers of cattle and dairy produce. By the eighteenth century, it was suggested that the decline of the *Hafod* system was because of the wide-spread increase of sheep-farming and subsequently the *Hafodydd* evolved into upland farms. Sheep did not require daily attendance, except in lambing season, and therefore could be sent to more distant and rougher countryside resulting in seasonal movements disappearing in Wales by early nineteenth century.<sup>220</sup>

The ability to thrive in adverse hill environments was a prerequisite to hill sheep production and unless the environment was changed by adopting winter housing and improved summer grazing the potential productivity of hill sheep was restricted.<sup>221</sup> Moreover, it was recognised that increased animal production from the hills needed improved pasture to provide sufficient feed and farmers looked to scientists to help them improve their herbage production.<sup>222</sup> As Lucas commented ‘the correct solutions to the problems of hill farming are an amalgam of technology with economics’.<sup>223</sup> On the higher hill farms the provision of winter keep was considered a serious problem for the Welsh farmer and in many cases the amount the farmer paid for the wintering of his younger stock in the lowlands exceeded his rent.<sup>224</sup>

Many farmers tried to increase output per acre by stocking more ewes and lambs but this was seen to intensify problems of disease, especially those caused by internal

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<sup>220</sup> Robert Trow-Smith, op.cit., p.120; R. U. Sayce, ‘The Old Summer Pastures’, *Montgomeryshire Collections*, Vol.54, 1955-56. P.117; Elwyn Davies, ‘Hafod and LLuest: The Summering of Cattle and Upland Settlement in Wales’, *Folk Life*, 1984, 12:1, pp.86-88, the author notes that the latest recorded instance of people moving to live in a *Hafod* occurred in 1862.

<sup>221</sup> I. A. M. Lucas, ‘The Contribution of Science to the Improvement of Hill Sheep Production’, *Proceedings of the British Society of Animal Production*, Vol. 4, 1975, p.45.

<sup>222</sup> M. B. Alcock, ‘The Contribution of Science to the Improvement of Hill Pasture Production’, *Proceedings of the British Society of Animal Production*, Vol. 4, 1975, p.25.

<sup>223</sup> I. A. M. Lucas, op.cit., p.61

<sup>224</sup> Moses Griffith and P. M. G. Hutton, ‘The Wintering of Sheep on Temporary Grasses’, *WJA*, Vol.XI, 1935, p.121.

parasites which spread more easily due to the density of stock on unploughed pastures. Scientific research of these diseases began in the 1920s but had little impact on farms. Minor copper and cobalt deficiencies were suspected in lambs on the Preseli Hills, but as many of the sheep spent the winter in the lowlands elsewhere it was difficult to investigate.<sup>225</sup> Mineral deficiency research was successful in other areas; copper licks helped farmers who had sheep with 'swayback' and the preventative effect of these licks was demonstrated in a combined operation by farmers who provided the sheep, landowners who provided the finance, the agricultural institute and analyst who studied the physiology and the chemists who provided the mineral licks.<sup>226</sup> Anaemia, or Pine disease, in sheep was widespread in the hills in winter and spring when there was a shortage of food with affected sheep becoming very weak and losing weight rather than gaining it in the summer. Agricultural scientists found that affected sheep responded to iron compounds and that the disease was caused primarily by the lack of cobalt in certain soils and herbage and this was prevented by licks of cobalt sulphate.<sup>227</sup>

Sheep scab, or psoroptic mange<sup>228</sup>, is one of the most contagious diseases of sheep in the UK and effects body condition, increases ewe and lamb mortality, reduces fleece value and contributes to secondary infection. The first effective sheep dips contained arsenic and sulphur and by 1905 the compulsory dipping of sheep leaving a parish or county was supervised by the local authority and enforced by the local constable.<sup>229</sup> By 1938 the responsibility for sheep mange control passed from the local authority to the Ministry of Agriculture. Better husbandry, smaller flock size and double-dipping

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<sup>225</sup> R. I. Bradley, C. C. Rudeforth, and C. Wilkins, 'Distribution of Some Chemical Elements in the Soils of North Pembrokeshire', *Journal of Soil Science*, Vol.29, 1978, p.268.

<sup>226</sup> Edith H. Whetham, *Beef Cattle and Sheep*, op.cit., pp.33-34.

<sup>227</sup> H.H. Corner, 'Pine Disease in Sheep', *AP*, Vol. XVI, 1939, pp.181-85; Edith H. Whetham, *Beef Cattle and Sheep 1910-1940*, op.cit., pp.33-34.

<sup>228</sup> Psoroptic mange is an acute or chronic allergic skin dermatitis caused by the burrowing mite *P. ovis* and transmission occurs from sheep to sheep contact.

<sup>229</sup> C. J. Lewis, 'Sheep psoroptic mange: An update on history, control and present situation in the United Kingdom', *Small Ruminant Research*, Vol.110, 2013, p.72.

procedures resulted in a modest success in the control of infection.<sup>230</sup> Farmers were aware of the importance of sheep dipping and acknowledged the technological advances of organochlorines<sup>231</sup> as pesticides. At Caerbellan, sheep infected by wool lice from the reeds during warm months were successfully cured by the use of dipping solutions.<sup>232</sup>

In Pembrokeshire the flock at Trefelyn Farm, Mathry, was used by the University College of Wales for experimental dipping and was encouraged by the County Agricultural Committee as the results would be of national interest.<sup>233</sup> Two farmers, one from south Pembrokeshire, the other from south Glamorgan recalled using DDT for dipping sheep. They had previously used arsenic based products that were deemed so dangerous the police had to be present to ensure appropriate usage. The farmers felt that the arsenic based products were not efficient and preferred the use of DDT which ‘revolutionised the job as it was easy to use and the police signed “the book” when the job was finished’.<sup>234</sup> Farmers were happy to call the police to help as the expense of police officers to be present on farms were of no cost to them as they were paid by the County Council.<sup>235</sup> Sheep blowfly trials were also undertaken on both lowland and mountain flocks by the zoologists at the University of Wales with DDT emulsions being used on two thousand sheep and lambs with positive results.<sup>236</sup>

The dipping of sheep was very important for production and health and throughout the UK there was a stringent programme of compulsory dipping with the organochlorine products. This dipping along with movement restrictions resulted in the eradication of

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<sup>230</sup> Ibid., p.73.

<sup>231</sup> DDT was the common name belonging to this class of pesticide.

<sup>232</sup> Robert Jones, ‘Ffermio Caerberllan’, *JRWAS*, Vol. XXVII, 1958, p.28.

<sup>233</sup> PA, PCC/2/7 Meeting of the County Agricultural Committee 22 September 1945.

<sup>234</sup> Oral testimony of George Mathias MBE and Charles Edward Tamplin.

<sup>235</sup> PA, PCC/2/7 Meeting of the County Agricultural Committee 10 January 1942 where expenditure was £261 and 4 January 1947 the expenditure was £257.

<sup>236</sup> TNA, MAF 33/395, Advisory Centres Reports 1945/6.

sheep scab in Wales by 1951 and the whole of the UK by 1952.<sup>237</sup> However there was very little scientific information available to design dips for maggot fly strike and tick infestation.<sup>238</sup>



**Figure 2. Sheep washing and dipping near Trawsfynydd 1 January 1944**

*Source: Geoff Charles Photographic Collection, courtesy of the National Library of Wales*

The Mid-Wales Investigation Report showed that farmers needed flocks of at least five hundred ewes to yield a livelihood. The period from February to April was reported to be of stark hunger for livestock because of the difficulty of conserving adequate protein-rich fodder for use in mid-winter and the livestock economy was dependent on the wintering of sheep on lowland farms. This became a problem as the development of milk production on traditional wintering grounds in coastal areas of Cardiganshire meant that sheep were competing with dairy cows for the early bite in spring.<sup>239</sup> Therefore the improvement of grazing and in particular that of intakes, enclosures or *ffridd*, was very important to the hill farmers. The ratio of intakes to hill pasture varied and proportions of

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<sup>237</sup> Elizabeth Anne Wells, 'Development of an improved diagnostic test for sheep scab based on biomarkers', (unpublished PhD thesis, University of Edinburgh, 2013), p.1, however sheep scab was reintroduced in 1973 through the importation of infested sheep from Ireland; C. J. Lewis, *op.cit.*, p.73.

<sup>238</sup> PP 1944, (Cmd.6498), Report of the Committee on Hill Sheep Farming in England and Wales, pp.18-19.

<sup>239</sup> PP 1955 (Cmd.9631) Welsh Land Agricultural Sub-Commission, Mid-Wales Investigation Report, p.19.

land at different levels of fertility determined the character and value of farm output. The possibility of increasing production was shown by the work of Sir R. George Stapledon<sup>240</sup> and the Cahn Hill Improvement Scheme as well as by individual farmers and the County War Agricultural Executive (CWAE). The results obtained both in improvements of swards and increased stock-carrying capacity was described as impressive.<sup>241</sup>

Many farmers were seeking to breed flocks with hardiness traits without sacrificing quick growth and progressive breeders were frequently handicapped by a lack of local agreement on dates which rams were turned out. The Agricultural Improvement Council recommended that flock owners exercised control over their rams and ensured that they were not allowed on open hills before the dates agreed and also that inferior rams on open hills were not to be used. These recommendations were made effective in the Hills Rams (Control) Order in 1943.<sup>242</sup>

### **3.4 Science in the Dairy**

Scientific work in the dairy in the early twentieth century was directed mainly towards milk hygiene, its composition, and the prevention of adulteration which had been widespread in the nineteenth century. The Sale of Milk Regulations came into force in 1901 and its aim was to control adulteration and to test for proportions of fat, solids-not-fat and water in milk using scientific instruments for measuring the specific gravity and biochemical and bacteriological methods for testing integrity and hygiene.<sup>243</sup> Early in the twentieth century milk was found to be grossly contaminated and was referred to in the

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<sup>240</sup> Sir Reginald George Stapledon (1882-1960) was considered an eminent agricultural scientist and an authority on grassland. Under his leadership the Welsh Plant Breeding Station became a prestigious research establishment for grassland and plant breeding studies.

<sup>241</sup> PP 1944 (Cmd.6498) Report of the Committee on Hill Sheep Farming in England and Wales, p.6 and p.17; Moses Griffith, 'The Cahn Hill Improvement Scheme', *WJA*, XIII, 1937, pp. 211-12. The work of Sir George Stapledon and the Cahn Hill Scheme are explored in chapter five.

<sup>242</sup> PP 1944 (Cmd.6498) op.cit., p.19 and p.36 Appendix III, Control of Rams.

<sup>243</sup> Peter J. Atkins, 'The Pasteurisation of England: the science, culture and health implications of milk processing' in David F. Smith and Jim Phillips, eds, *Food, Science, Policy and Regulation in the Twentieth Century*, (London: Routledge, 2000), p.38.

trade as ‘liquid dynamite’, as it could be the cause of a high risk of pathogenic infection. It was suggested that ninety per cent of infantile diseases were caused by negligent preparation and that infected milk was linked to diarrhoeal deaths accounting for ten to twenty per cent of infant mortality in the period 1871-1920.<sup>244</sup> Professor Wilson at the London School of Hygiene and Tropical Medicine, defined the terms for a safe milk supply:

It is often assumed that ‘cleanliness’ and ‘safety’ are synonymous. This is a mistake. By ‘cleanliness’ I understand the freedom of milk from extraneous matter, from pus, from blood, and from an undue number of micro-organisms . . . .By ‘safety’ I mean the freedom of milk from pathogenic micro-organisms and its consequent liability to give rise to infective disease in human beings consuming it. Many unclean milks, though aesthetically undesirable, are perfectly safe to drink while very clean milk may, as the literature of milk epidemics shows, be highly dangerous.<sup>245</sup>

During the First World War, the Haverfordwest Medical Officer of Health reported that the cleanliness of milk needed vast improvements. He found that while milking their cows farmers had the dirty habit of wetting their fingers in the milk pail before extracting the milk from the cow and called for the establishment of dairy classes throughout the county.<sup>246</sup> Improvements followed as a National Clean Milk Society was founded in 1916 sponsoring national milk conferences in the 1920s and encouraging research into best methods of clean milk production. This research was undertaken at the National Institute of Research in Dairying (NIRD) and the institute was supported by county advisory

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<sup>244</sup> R. J. Moore-Colyer, ‘Farming in Depression: Wales between the Wars, 1919-1939’, *AHR*, 46(2), 1998, p.189; P. J. Atkins, ‘White Poison? The Social Consequences of Milk Consumption, 1850-1930’, *Social History of Medicine*, 5(2), 1992, pp.219-20.

<sup>245</sup> G. S. Wilson, ‘The necessity for a safe milk-supply’, *The Lancet*, 7 October 1933, p.829.

<sup>246</sup> *County Echo* 28 August 1916.

bacteriologists who advised farmers to adopt new methods in the production of milk to avoid bacterial contamination.<sup>247</sup>

The Public Health and Agricultural Education Authorities in Wales were keen to have clean milk to avoid the transmission of infective diseases and to have the best quality for food. The Milk (Special Designations) Order in 1923 introduced milk grading to ensure that the number of bacteria in the marketed product was minimised.<sup>248</sup> As a result of the public health recommendations there were applications for clean milk lectures from Neyland, Haverfordwest, Milford, Goodwick, Fishguard and Narberth with local councillors and registered milk sellers in attendance. The dairy instructress for Pembrokeshire, Miss Sybil Price, also organised lectures throughout the county and held Clean Milk Conferences in Pembroke Dock and Letterston. She also gave clean milk lectures at ten centres throughout Pembrokeshire, the largest being attended by seventy people at Hayscastle and fifty at Bolton Hill. At two of the centres, Bridell and Eglwysrwr, the lectures were delivered in Welsh.<sup>249</sup>

Clean milk competitions were first organized in Wales in 1925 and by 1932 thirty-six competitions were held in twelve counties. In Pembrokeshire competitions were held at Narberth, Pembroke, Fishguard, Haverfordwest and Crymych agricultural shows and helped improve the standard of milk production by giving farmers and farm workers knowledge of hygiene and how to efficiently sterilise dairy utensils, resulting in many being able to apply for licences to produce graded milk.<sup>250</sup> However, Webber considered

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<sup>247</sup> Professor E. L. Crossley, 'A Half-Century of Dairying: From Tradition to Technology', *Journal of the Society of Dairy Technology*, Vol.29, No.1, 1976, pp.5-7; Peter J. Atkins, 'The Pasteurisation of England: the science, culture and health implications of milk processing', *op.cit.*, p.43.

<sup>248</sup> S. B. Thomas, et.al., 'Some Aspects of the Graded Milk Movement in Wales', *WJA*, Vol. VIII, 1932, p.214.

<sup>249</sup> PA, Agricultural Education Work in Pembrokeshire for the year ended March 31<sup>st</sup> 1925, Pembrokeshire Agriculture Committee.

<sup>250</sup> S. B. Thomas and Phyllis M. Hickson, 'Bacteriological Examination of Milk from Welsh County Clean Milk Competitions', *WJA*, Vol. IX, 1933, p.224.



that the inducement for farmers to take out licences was small, as consumers did not value the guarantee of clean safe milk. His study showed that there was little difference in price for milk that was ‘approximately’ clean compared to that which was ‘really’ clean.<sup>251</sup> Farmers were also deterred by the additional expense of tests, examinations, purchase of specialist equipment and employing knowledgeable labour.<sup>252</sup>

The mechanisation of milk production involved applying mechanical principles to a physiological process. Its success took into account the well-being of the cow as well as the efficiency of the process as both depended on the technique of operation as well as the design of the equipment. In addition to this, the use of steam sterilising equipment for cleansing utensils and of refrigeration for storage and cooling played its part in modern dairy practice along with the standard of hygiene demanded by legislation.<sup>253</sup>

To improve these standards there were regular inspections of dairy facilities and bacteriological examinations leading to accreditation. The Accredited Producers’ Scheme’s aim was the production of a safe milk supply. Of the 11,228 accredited producers in England and Wales in 1935, 553 were in North Wales and 343 were in South Wales and it was these producers who supplied milk for school children at a discounted price.<sup>254</sup>

Producers of Grade A or accredited milk capable of passing the bacterial test, with herds free of any known reactors with buildings of certain standards enjoyed a 1d. per gallon premium. This was considered a substantial return on capital and by 1939 eighteen

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<sup>251</sup> Alan R. Webber, ‘Government Policy and British Agriculture’, (unpublished PhD thesis, University of Kent, 1982), p.168.

<sup>252</sup> G. S. Wilson, ‘The necessity for a safe milk supply’, *The Lancet*, 7 October 1933, p.831.

<sup>253</sup> H. S. Hall, ‘Dairy Equipment and Machinery’, in J. A. Hanley, ed., *Progressive Farming, Vol.III*, London: Claxton, 1949, p.202; D. N. McHardy, *Power Farming for Crops and Stock*, (Reading: Philip Palmer Press, 1938), p.119.

<sup>254</sup> J. R. E. Phillips, ‘The Milk Marketing Scheme in Wales, 1934-5’, *WJA*, Vol. XII, 1936, p.97; Hansard HC Deb 22 March 1939, vol345 cl1297W.

per cent of producers had accredited herds supplying forty per cent of the milk output.<sup>255</sup>

The necessity of installing a steriliser before the granting of a Grade A milk licence was preventing Pembrokeshire farmers taking advantage of the Milk Marketing Board's Accredited Scheme but when the county clerk asked if licences could be given without this condition the Ministry of Health stated that the request for the steriliser was 'reasonable and proper' and was deemed a necessity for granting the licence.<sup>256</sup>

Pembrokeshire dairy farmers in the 1920s had thought that clean milk production was not a practical proposition and treated the idea with ridicule. However, by the mid-1930s they realised that market conditions had changed and accepted that clean milk for liquid consumption was important. The Accredited Schemes also stimulated efforts to get the bonus. New cowsheds were built and old sheds were remodelled, cobbled floors were replaced with concrete and the length of the stalls was adjusted to allow faeces and urine to fall into gutters thereby enabling more efficient cleaning. Some farmers installed tubular fittings to replace wooden partitions and chains, installed water supplies and began to appreciate that sterilising outfits were a necessary adjunct for clean milk production.<sup>257</sup>

By 1935 there were very few wholesale milk producers in Pembrokeshire who qualified under the Accredited Scheme, but one such farmer, Mr D. J George of Llangloffan Farm, installed an up-to-date high pressure steam boiler and sterilising plant in accordance with the stringent regulations. He became a qualified producer under licence of Grade A milk under the Accredited Scheme in April 1935 and his first class herd of shorthorns passed the county veterinarian's examination without an exception.<sup>258</sup>

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<sup>255</sup> Alan R. Webber, *op.cit.*, p.169.

<sup>256</sup> PA, PCC/SE/2/7, minutes of the Agriculture Executive Committee.

<sup>257</sup> PA, Pembrokeshire Agricultural Committee Report (abbreviated hereafter as PACR) year ended 31<sup>st</sup> March 1935.

<sup>258</sup> *County Echo* 16 May 1935.

The Advisory Service Scheme was confined to Pembrokeshire milk producers who had obtained certificates of merit in previous clean milk competitions held in the county. Each farm was inspected by the Agricultural Organiser and marks were awarded for cowsheds, equipment and cleanliness of methods used in milk production. A Challenge Cup was presented to the best milk producer and the competitors were described as being very enthusiastic. The Championship Challenge cup and gold medal of the National Milk Publicity Council went to Mr G. H. Llewellyn of Red Hill, Haverfordwest with silver going to Mr F. D. Phillips, The Dingle, Haverfordwest.<sup>259</sup> Mr Phillips was well known in Pembrokeshire for farming experimentation and welcomed many visitors to the Dingle including Miss B. Chambers of the North Pembrokeshire Farmers' Club who visited several times and decided to take over the running of Castell Farm near Dinas with the chief objective of demonstrating modern farming methods. She experimented along similar lines as The Dingle with help from the Imperial Chemicals Company for the farm work and Aberystwyth University for economic advice and milk recording.<sup>260</sup> The Imperial Chemical Company had already been assisting farmers in the area by securing land near Cilawen for the experimentation of different manures for the production of early grass.<sup>261</sup> These roadside demonstration plots were regarded as the best means of advertising to farmers of the value of improved methods of cultivation, improved varieties or farm management as they could be clearly seen.<sup>262</sup>

Tuberculosis was one of the most prevalent health problems of the eighteenth and nineteenth centuries. A connection between tuberculosis in humans and cattle was first made at the end of the nineteenth century when it was found that cow's milk infected with *Mycobacterium bovis* caused extra pulmonary tuberculosis in humans. Subsequent

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<sup>259</sup> PA, PACR year ended 31<sup>st</sup> March 1935.

<sup>260</sup> *County Echo* 6 February 1930.

<sup>261</sup> *County Echo* 6 February 1930.

<sup>262</sup> D. B. Johnstone-Wallace, 'The work of the County Agricultural Organizer', *AP*, Vol. V, 1928, p.99.

investigations by the Royal Commissioners, medical professionals and veterinary professionals confirmed this by comparing the diseases of bovine and human origin.<sup>263</sup> Bovine tuberculosis and Brucellosis were of great concern to the British farmer as it was a chronic, debilitating disease that undermined meat and milk production.<sup>264</sup> Pulmonary tuberculosis was common in cows and as there was no treatment of affected animals farmers' attention was directed to preventing the spread of infection. The veterinary control of tuberculosis relied less on science and more on control and the Tuberculosis Order of 1925 instructed farmers to report any cow that was suffering from tuberculosis of the udder, or appeared to be suffering from tuberculosis emaciation or from a chronic cough.<sup>265</sup>

Research on tuberculosis problems was supervised by a joint committee of the Agricultural Research Council (ARC) and the Medical Research Council (MRC).<sup>266</sup> There was a great interest placed on the eradication of tuberculosis from herds by tuberculin-testing. Herds free of tuberculosis were maintained by regular testing, the elimination of infected cattle, disinfection and isolation and by rigorous testing and quarantine.<sup>267</sup> Scientific advice given to farmers to obtain T.T. licences included testing with the double-intradermal tuberculin test and then removing all reactors from the herd. Additional

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<sup>263</sup> Rhiannon Kate Fisher, 'The Role of Social Capital in Influencing the Response Capacity of Farmers to Bovine Tuberculosis,' (unpublished PhD, University of Gloucestershire, 2012), p.2-3; PP 1904(Cd.2092) Royal Commission on Tuberculosis (human and bovine) Interim report of the Royal commission appointed to inquire into the relations of Human and Animal Tuberculosis, p.6; PP 1907 (Cd.3322) Royal Commission on Tuberculosis Second Interim report of the Royal commission appointed to inquire into the relations of Human and Animal Tuberculosis, Part I Report, p. 5; Peter A. Koolmees, 'Veterinary inspection and food hygiene in the twentieth century', in David F. Smith and Jim Phillips, eds, *Food, Science, Policy and Regulation in the Twentieth Century*, (London: Routledge, 2000),p.61.

<sup>264</sup> Abigail Woods, 'A historical synopsis of farm animal disease and public policy in twentieth century Britain', *Philosophical Transactions: Biological Sciences*, Vol.366, No.1573, 2011, pp.1943-44.

<sup>265</sup> Henry Thompson, *Elementary Veterinary Science*, (London: Bailliere, Tindall & Cox, 1949), pp.307-311; Kenneth Blaxter and Noel Robertson, *op.cit.*, p.208.

<sup>266</sup> The specific responsibility of the Agricultural Research Council (ARC) was to give advice on agricultural research to the Agricultural Departments and to the Development Commission and its role was mainly advisory. See Timothy DeJager, 'Pure Science and Practical Interests: The Origins of the Agricultural Research Council, 1930-1937', *Minerva*, Vol.31, No.2.

<sup>267</sup> Political and Economic Planning, *Report on Agricultural Research in Great Britain*, (London: PEP, 1938), p.72.

recommendations included the use of steam sterilisers for cleaning cowsheds and dairy equipment or the use of chemical sterilisation if steam sterilisers were not available.<sup>268</sup>

An estimated forty per cent of all cows in dairy herds were infected by bovine tuberculosis in 1934 and the first step to eliminate the disease was the establishment of the voluntary Attested Herds Scheme in 1935.<sup>269</sup> This scheme was a recommendation of the Committee on Cattle Diseases and was intended to eradicate bovine tuberculosis introducing more stringent provisions than those for tuberculin tested milk. In addition to the premiums gained under the Accredited Scheme, there was an additional bonus of 1d. per gallon granted. Initially progress was slow and only 169 herds were attested by March 1936 in the United Kingdom but this increased significantly when grants for tuberculin tested milk were increased under the Agriculture Act, 1937. Tuberculin tested milk also attracted a premium of 1d. per gallon which was added to the other bonuses for which it qualified. The estimated £13 per cow expenditure required to ‘clean up’ a herd to this standard now offered a favourable return, and the number of tuberculin tested licences rose from 1,927 in October 1937 to 3,173 by the end of 1938.<sup>270</sup>

Farmers in West Wales concentrated on raising healthy stock in natural conditions and although yields were moderate, the cows had a constitution and ability to resist disease much better than other areas. Therefore when the Attested Herds Scheme was introduced there were high numbers of herds that could be placed on the register immediately, and it was reported that not a single reactor was found in the first hundred herds tested during the first year of the scheme.<sup>271</sup> Mr Thomas, The Castle, Maenclochog, had the first herd in Pembrokeshire to become attested, and was breeding his heifers and keeping a tested

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<sup>268</sup> NLW C43/33 Farm Topics, November and December, Vol.1, No.11, 1943, p.4.

<sup>269</sup> Sir John Winniffrith, *The Ministry of Agriculture, Fisheries and Food*, (London: Allen & Unwin, 1962), p.100.

<sup>270</sup> Alan R. Webber, *op.cit.*, p.170, the author assumed an output of 400 gallons per cow per annum to give a return of 12.8%.

<sup>271</sup> *The Farmers Weekly*, 1 October 1948, ‘The Land of “Attested Only”’.

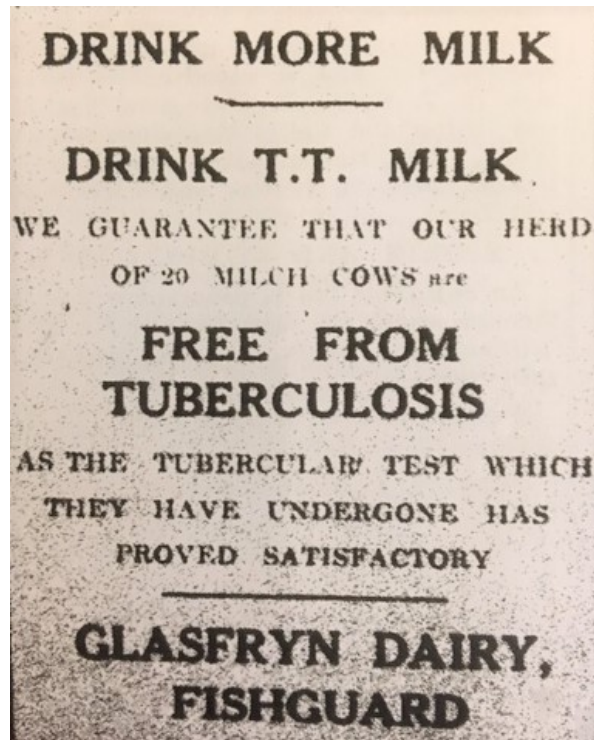
premium bull at his farm. In 1934 his herd passed the test on three separate occasions and it was said that ‘the bracing air of Maenclochog had doubtless played an important part in keeping the herd healthy’.<sup>272</sup>

The value of open air was also acknowledged by Mr Hosier when during his address at a meeting of the Farmers’ Club he spoke of the unnatural conditions of ‘keeping cows in warm byres, congregated together and inhaling each other’s breath, the foul and unsanitary yards and land around the homestead, the mud in wet weather and the germ-laden dust in dry weather’ and that all these factors contributed to tuberculosis. He suggested that cows should be kept in the open air on dry land and explained that his cows living on the hills never developed the disease because it was a sanatorium for them.<sup>273</sup> Other farmers advertised their quality herds by placing advertisements in local papers; Glasfryn Dairy in Fishguard advertised in the County Echo as shown in Figure 3.

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<sup>272</sup> PA, PACR year ended 31<sup>st</sup> March 1935.

<sup>273</sup> Mr A. J. Hosier, ‘Open-Air Dairying’, *Journal of the Farmers’ Club*, Part 6, November 1927, address to a meeting of The Farmers’ Club held at the Surveyors’ Institution, Westminster, 31 October 1927.



**Figure 3. Glasfryn Dairy advertisement**

*Source: County Echo 29 August 1935*

The attestation campaign in Carmarthen and Cardigan was welcomed enthusiastically according to the *Farmers Weekly* and the bonus payments and better stock prices appealed to the farmers' business sense. By 1948 Carmarthen had 4,337 attested herds with 85,363 cattle while Cardigan had 3,467 attested herds with 53,326 cattle. There were discussions of making the counties the first 'closed area' of England and Wales described as 'a reservoir of sound, disease-free stock to provide the nucleus for tuberculosis eradication on a large and possibly national scale'.<sup>274</sup> The scheme made rapid strides after the war and by 1954 more than two-thirds of all cattle in Wales were in attested herds giving a two-fold advantage to the producer, namely a greater confidence for

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<sup>274</sup> *The Farmers Weekly*, 1 October 1948, 'The Land of "Attested Only" ; PA, PCC/SE/2/7 Meeting of the County Agricultural Committee 16 March 1946, there was a request from Mr D Perkins to ask the Ministry of Agriculture to establish the three counties of Cardigan, Carmarthen and Pembroke as a Tuberculosis free area.

the consumer and increased milk consumption and also a reduction of production costs to the farmer as healthy cows would be replaced less frequently.<sup>275</sup>

The quality of milk took into account its chemical composition, its richness in butterfat, its cleanliness, flavour and the requirement for it to be free of taints. As milk could easily be adulterated by the addition of water or the extraction of fat, consumers were protected by law as public analysts sampled the supplies. If on analysis samples contained less than three per cent fat and 8.5 per cent solids-not-fat, it was presumed not genuine. In the interests of fairness to the producer an unsatisfactory first sample was followed by an 'appeal to the cow' and a second sample was taken at the farm.<sup>276</sup> In Pembrokeshire quarterly reports by the County Analyst showed the results of the milk samples tested. Twelve samples of milk were reported as not genuine for the quarter ending June 1942 which resulted in six samples as 'appeal to the cow'. Some samples were curdled resulting in no action but one farmer was fined £3.0s.0d for twenty-seven per cent deficiency in butter fat.<sup>277</sup> In Narberth, Cecil John Lawrence of Ivy Bush Farm, Ludchurch, was summoned for selling milk to the Milk Marketing Board which was certified by the Public Analyst to contain twenty-six per cent added water and was deficient in milk fat to the extent of thirty-one per cent. The farmer was fined £20 with two guineas costs as the bench took a serious view that in times of war it was of the utmost importance that milk quality should be high.<sup>278</sup> David Lewis, a milk vendor in Haverfordwest, was fined 10s. for selling milk that was tested and shown to be forty-five per cent deficient in fat. On appeal the sample was retested and the dairy instructress for Pembrokeshire County Council revealed there was a surplus of 1.65 per cent fat and she

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<sup>275</sup> D. Ifor Jenkins, *op.cit.*, pp.76-77.

<sup>276</sup> E. J. Roberts, 'Production of Milk' in J. A. Hanley Ed., *Progressive Farming, Vol.III*, (London: Claxton, 1949), pp.194-95.

<sup>277</sup> PA, PCC/2/7 Agricultural Executive Sub-Committee 29 September 1942.

<sup>278</sup> *The British Food Journal*, Vol.45, Issue 11, 1943, p.119-120, report of Narberth Police Court, November 26<sup>th</sup> 1943.



knew the vendor's herd of cows were the best in the county. Consequently the method of taking the sample was altered to comply with the Sale of Food and Drugs Act 1875.<sup>279</sup> Milk supplied to the United Dairies depot was also tested and there was a case reported that a Clynderwen farmer was prosecuted for selling milk with six per cent added water. The farmer stated that it was possible that the lid of the churn was not closed tightly and 'possibly a little water was splashed into the milk' when he was cooling it in the stream. Although the farmer pleaded innocence and the farmer's wife suggested 'someone has been playing a trick on us' the defendant was still fined £5.<sup>280</sup>

Pasteur's research in the 1850s had revealed the dangers of disease which could be transmitted through small amounts of dirt in milk. However it was not until the end of the nineteenth century that the process of pasteurisation was used in the dairy industry and farmers were considered to have been more impressed by the power of the process to kill germs and prolong the travelling life of milk than by its public health aspects. Some opponents of the process thought that it was simply a means of making dirty milk saleable and maximising farmers' profits.<sup>281</sup> Organic farmers criticised pasteurisation as they thought it was a failure of modern farming and it was only in the interests of dirty milk producers and large dairy companies. As Balfour stated '...pasteurisation enables the big distributor to sell milk several days old without the customer being aware of the fact. Milk in towns left unsold one day usually goes out on the round the next'.<sup>282</sup>

Propaganda was used to persuade consumers that the science behind tuberculin-tested herds and pasteurisation ensured clean and reliable milk. McKee considered that

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<sup>279</sup> *County Echo* 3 January 1935; legislation.gov.uk Sales of Food and Drugs Act 1875, chapter 63 clause 4 states '...where the food or drug is unavoidable mixed with some extraneous matter in the process of collection or preparation'.

<sup>280</sup> *West Wales Guardian*, 12<sup>th</sup> March 1948.

<sup>281</sup> Francis McKee, 'The Popularisation of Milk as a Beverage During the 1930s', in David F. Smith, ed., *Nutrition in Britain*, (London: Routledge, 1997), p.124.

<sup>282</sup> E. B. Balfour, *The Living Soil*, (London: Faber and Faber, 1943), p.209.

one of the most successful steps in milk promotion was ‘the alliance of its traditional, mythic associations of purity and goodness with the futuristic, clinical domain of the scientific laboratory’ and ‘milk is elevated from the muck of the Victorian byre to the world of the twentieth century’. Milk was also linked to the periodic table and through association ‘lifted milk from the stink of the farm to the realm of science and technology’.<sup>283</sup>

Another social and scientific stimulus to increase the reputation of milk was influenced by the nutritionists and in particular the supply of milk to school children. The National Milk Publicity Council promoted contacts between schools and local suppliers and in 1929 offered ⅓ pint bottles to schools at 1d. per bottle or free to the children of poor families. By 1931 the scheme had grown to provide milk for over 500,000 children and was considered to be nurturing a generation who would grow up thinking milk-drinking a nutritious drink.<sup>284</sup> By 1933 a new market of approximately 9 million gallons per annum evolved in England and Wales. Unfortunately, twenty-three per cent of school milk was found to be of low quality with regard to dirt and bacteria and Atkins commented ‘finding new customers was one thing but poisoning them was quite another’.<sup>285</sup> However, there were over three million children taking milk in schools in England and Wales by 1939 and conditions in the dairies had improved with over forty per cent being accredited standard.<sup>286</sup>

While the cleanliness of milk was questioned, farmers argued that compulsory pasteurisation was unnecessarily expensive as there was not sufficient consumer demand, a

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<sup>283</sup> Francis McKee, *op.cit.*, pp.130-31.

<sup>284</sup> *Ibid.*, pp.129-30.

<sup>285</sup> Peter J. Atkins, ‘Fattening children or fattening farmers? School milk in Britain, 1921-1941’, *EHR*, LVIII, I, 2005, p.58 and p.75.

<sup>286</sup> *The British Medical Journal*, 15 July 1939, p.148.

point they made whenever accused of contributing to tuberculosis in children.<sup>287</sup> When the Milk Marketing Board took over the milk in schools scheme there were a million children receiving milk and by 1938 the amount distributed had risen to 26 million gallons a year.<sup>288</sup> At this time there were 114,126 in public elementary schools in South Wales receiving milk at school.<sup>289</sup>

Small dairy farmers saw many changes from advances in agricultural science and technology; for example from hand milking twice a day to the fully automated dairy; from delivery rounds with churns and measures to delivering glass bottles; and from delivering urns to stations to having collections from creameries. Yerboston farm was bought from the Orierton Estate in 1918 and saw many of these changes. It originally had a small herd of twenty-five cows which gradually increased to fifty with dairy cows bought from Ireland and the farm employed six women to hand milk the cows. In the inter-war years there were nearly seventy milkmen doing the rounds of Pembroke and Pembroke Dock and competition was stiff but Yerboston Dairy was described as being one of the better dairies. Each of the delivery traps was equipped with an 18 gallon churn and a set of measures – a quart, a pint and a half-pint and housewives would carry their own jugs to be filled at the cart and when they had had their measure of milk they would ask for a little extra ‘for the cat’. Butter was also sold on the farm and as there was no refrigeration, they dug a trench for storage and covered the butter with fresh laurel leaves kept cool and damp with fresh water from the well. The first reusable glass milk bottles were introduced in 1880 by the Express Dairy Company and from the 1920s bottles started to bear the name of the local dairy which produced the milk. The name was either pyroglazed or sandblasted onto the glass and as printing technology improved, durable coloured transfers were glued to the

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<sup>287</sup> Francis McKee, *op.cit.*, p.128.

<sup>288</sup> Stanley Baker, *Milk to Market, Forty Years of Milk Marketing*, (London: Heinemann, 1973), pp.84-85.

<sup>289</sup> Hansard HC Deb 22 March 1939 vol 345 c11297W.

bottles bearing advertisements. The Yerboston farmer used this technology for writing ditties and verses:

*Very rich and creamy  
Brucellosis free  
From Yerboston Dairy  
The best it will be  
Pasteurised, sterilised  
Tuberculin tested too  
All grades of everything  
we supply to you.*<sup>290</sup>

The Milk Marketing Scheme came into operation in October 1933 at a time of economic depression when supplies of food exceeded demand. Its immediate aim was to stabilise the market for milk and to secure a larger market for dairy farmers at the best possible price.<sup>291</sup> Its formation was deemed a success by farmers and was described by W. R. Morgan as saving the lives of milk producers in West Wales giving them an assured market a guaranteed milk cheque every month. In the 1930s the milk cheque was about £25 at Craig-y-Borian farm which was enough to indicate a prosperous future. Farmers no longer had to harness horses to take the churns to the station as all their bulk milk was collected by the creamery's transport. The Whitland Creamery received 330,000 gallons of milk daily from more than 1600 farms in west Carmarthenshire, and north, mid and south Pembrokeshire.<sup>292</sup>

However the security of the monthly milk cheque was of concern to the Ministry of Agriculture as they thought it may have induced a greater concentration in milk production

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<sup>290</sup> 'Old Pat Russell had a farm...', *Pembrokeshire Life*, March 2014, pp.4-5, memories of Pat Russell who took over the farm from his father L M G Russell; Mike Bennet, 'The White Stuff', *Pembrokeshire Life*, February 2014, pp.20-23.

<sup>291</sup> W. D. Bigmore, 'The Milk Marketing Board of England and Wales' in A. H. Bunting, ed., *Change in Agriculture*, (London: Gerald Duckworth, 1970), pp.545-46.

<sup>292</sup> W.R. Morgan, op.cit., p.59-60.

than was in the farmers' long-term interests. Referring to mid-Wales, the Welsh

Agricultural Land Sub-Commission reported that;

...there has in recent years been a widespread development of milk production on small poorly-equipped farms, many of them on wet exposed land not suited to dairying. The occupiers are by now dependent on the larger turnover and the monthly milk cheque and it would, therefore, be hard for them to revert to their previous practice of livestock rearing.<sup>293</sup>

However, there was an argument that as Wales was very well suited climatically to the production of milk and the milk produced was reportedly more hygienic than that of England, Welsh farmers were right to take advantage. As Nash commented, 'if I was a small farmer in Wales I should undoubtedly be producing milk. I should be doing so because money made in producing milk smells as sweet as money made in any other way and has the great advantage of being easier to get.'<sup>294</sup>

The decades of this study showed significant improvement in the cleanliness of milk with farmers using improved methods of production and scientific testing being used ensure quality. The National Milk Testing and Advisory Scheme was launched by the Ministry of Agriculture in conjunction with the Ministries of Food and Health in 1942 and this scheme was based on testing milk for bacteria in order to ensure quality. A routine Resazurin test was introduced and this dye changed colour when added to milk containing a high bacterial content. Within two years of the introduction of this scheme, ninety-one per cent of producer-wholesalers and twenty-six per cent of producer-retailers were using this bacteriological test and it was estimated that 525,000 milk samples were examined at the thirty-two licensed bacteriological laboratories in the mid and south Wales provinces. Unsatisfactory samples were followed up by visits to farms by experienced advisors to

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<sup>293</sup> PP 1955 (Cmd.9631) Welsh Land Agricultural Sub-Commission, Mid-Wales Investigation Report, p.24.

<sup>294</sup> E. F. Nash, 'The Present Economic Position of Agriculture', *JRWAS*, Vol. XXVII, 1958, p.78.

remedy the defective methods or apparatus. Churn testing and advisory work at the creameries were also included in this scheme.<sup>295</sup>

This timeframe also saw a significant increase in the demand for milk for liquid consumption. In 1900 the agricultural returns showed a total of 2,150,000 cows and heifers in milk and in calf compared to 3,482,000 in 1944, an increase of sixty two per cent.<sup>296</sup> Dairy farmers were shown to change their working practices and grow their industry by improving milk production, milk management and milk marketing.

This chapter has demonstrated the impact of agricultural science on productivity and improvement in livestock. Despite the economic challenges of the two wars and the inter-war depression, farmers in West Wales are shown to have developed their industry using the available scientific advice and research. The science of nutrition allowed farmers to optimise production of their stock and their knowledge of selective breeding techniques and with cooperation and support of government schemes improved the quality of output. The application of new science has been seen here to improve the farm and the transfer of knowledge from the laboratory to the land is achieved by the understanding and perception of the farmer. Science is seen to facilitate and support better land use and improvement of the health, hardiness and management of stock. The combination of good science and good farming produced better animals free from disease for the marketplace. Scientific work in the dairy led to improved milk yields and volume for the liquid market and there was a substantial increase in the cleanliness and purity of the milk produced.

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<sup>295</sup> E. J. Roberts, op.cit., p.196; S. B. Thomas, 'The Routine Resazurin Test', *WJA*, Vol. XVIII, 1945, p.81. Resazurin is a dyestuff which changes colour when added to milk containing large numbers of the type of bacteria responsible for souring. The resulting shade is compared with standard colour discs, which are numbered 0-6, so giving a "disc number" result. Disc reading 4-6 indicates good keeping quality (Category A), 1-3½ indicates moderate keeping quality (Category B), and disc reading ½-0 indicates poor keeping quality (Category C).

<sup>296</sup> James Mackintosh, 'Fifty Years of Dairying in England and Wales', *AP*, Vol. XIX, 1944, p.49.

## CHAPTER FOUR: SCIENCE AND CROP HUSBANDRY

### 4.1 Introduction

First class arable land was described as land that was capable of intensive cultivation, retained moisture and fertiliser, was rich in humus and mineral salts and was well drained.<sup>297</sup> At the time of the Land Utilisation Survey, Pembrokeshire was regarded as one of the most cultivated of the Welsh counties but the distribution of arable land was not uniform concentrated mainly in the coastal areas and the north-eastern district.<sup>298</sup> Genetic research built on the cross-breeding experiments of Gregor Mendel<sup>299</sup> was regarded as valuable to bring economic benefits to agriculture. However, it was acknowledged that trialling and testing new varieties or breeds was costly to the farmer and that more had to be done by agricultural scientists. It was recommended that the new varieties of crops should be trialled over a few years before the scientists gave any advice of value to farmers because there was too much guess work and speculation.<sup>300</sup>

Improved varieties of cereals, potatoes and root crops were continually introduced by specialist breeders and farmers were expected to choose and then change either the types or grade of crops to produce in response to consumer demand. Many agricultural scientists focussed on crop health and were researching cultural, mechanical, biological and chemical methods of controlling insects and weeds. Other scientists were researching the practical application of growth substances such as hormones in order to regulate the growth of crops. Plant research was considered to have an economic outlook to increase

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<sup>297</sup> L. Dudley Stamp, *Fertility, Productivity and Classification of Land in Britain*, (London: Published for the Land Utilisation Survey of Britain by Geographical Publications Ltd., 1941), p.10-12.

<sup>298</sup> Margaret F. Davies, *op.cit.*, p.132.

<sup>299</sup> Gregor Johann Mendel (1822-1884) was an Austrian scientist and Augustinian friar. Mendel's work formed the foundation of the modern science of genetics. When he began his crossbreeding experiments he chose to work with a self-fertilising plant, the garden pea. He decided to use genetically constant lines differing from one another in a few, well-pronounced qualitative characteristics, such as the form and colour of the seeds or the colour of the flowers.

<sup>300</sup> Professor J. A. Scott Watson, Chair of Agricultural and Rural Economy, Inaugural Address, 'Plant and Animal Breeding', University of Edinburgh, 11<sup>th</sup> October 1922, pp.5-9; Ivar Johansson and Jan Rendel, *op.cit.*, pp.41-2.

production by both improving the plant itself and its environmental conditions. It was suggested that although there were strong links between genetic research and plant breeding there were weaker links between the breeders and the farmers. Some agricultural scientists were criticised because they had an attitude that they could do their work without involving the farmer and some farmers were criticised because their lack of confidence in science was potentially damaging the progression of science and the farmers were not giving the scientists the statistical information that they needed. However there were also those who advocated that the farmers played an important role and were the agents of scientific improvement.<sup>301</sup>

## 4.2 Crop rotation

The scientific principles of crop rotation relate to keeping the land free of toxins and impurities with the farmer introducing a change of crops in order to diminish the effects of noxious residues.<sup>302</sup> There were many rotations in use in different parts of the country, but most of them were based on the famous Norfolk four-course rotation. Variations, however, were often necessary as the farmer needed to consider climate and soil and it may have been desirable to substitute cereal crops. The Norfolk rotation was generally applied in Pembrokeshire but was considerably lengthened by the addition of clover and grass seed followed by temporary leys of varied duration. These temporary leys may have been left down for three to six years and sometimes longer in the south-west of the county and from

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<sup>301</sup> Noel Kingsbury, *Hybrid, the History and Science of Plant Breeding*, (Chicago: UCP, 2009), p.172; Paolo Palladino, 'Between Craft and Science: Plant Breeding, Mendelian Genetics, and British Universities 1900-1920', *Technology and Culture*, Vol.34, No.2, 1993, p.310-18; Kathy J. Cooke, 'From Science to Practice, or Practice to Science?', *Isis*, Vol.88, No.1, 1997, pp.64-65.

<sup>302</sup> John W. Paterson, *Science in Agriculture*, (London: Longmans, 1944), p.213; D. H. Robinson, 'Tillage Crops' in J. A. Hanley, ed., *Progressive Farming, Volume I*, (London: Caxton, 1951), p.100.



four to eight years in the rest. This longer rotation was beneficial to Pembrokeshire farmers as fresh grazing areas were available for stock.<sup>303</sup>

The succession of crops allowed farmers to maintain fertility, control weeds and pests, and ease labour problems. Roots such as potatoes, sugar beet, turnips and mangolds were used as cleaning crops in rotation. Crops grown year after year on the same land would become vulnerable to attack by fungus and insects; for example Finger-and-toe (or club root) in turnips and cabbages, rot in red clover, and wart disease in potatoes are classic examples of fungus diseases which develop when these plants follow each other too closely on the same land. Similarly, eelworm disease in sugar beet, potatoes, peas and oats was very serious in some parts of the country where farmers did not employ the correct rotation of crops.<sup>304</sup> In 1935 the Pembrokeshire Agricultural Organiser, W.E.D. Jones, and the Advisor on Insect Pests, Mr J. R.W. Jenkins, visited all the potato eelworm experiments ongoing in the county on several occasions and found that there was no positive evidence in favour of the chemical agents recommended. Results published in the *Journal of the Ministry of Agriculture* indicated that the disease was associated with an imbalance in the chemical composition of the soil and recommended large dressings of sulphate of potash.<sup>305</sup>

One of the oldest rules of crop rotation was that wheat must not follow wheat as it was an exhausting crop which needed to be followed by a restorative one. One farmer, however, broke the rules of this perceived husbandry by having most of his farm in wheat with no livestock, sold the straw and ignored the traditional rotations practiced around him. In the 1930s, with a guaranteed price for wheat many farmers tried following this

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<sup>303</sup> John W. Paterson, op.cit., pp.211-12. The rotation was introduced about 1730 by Viscount Townsend, the usual sequence being wheat, roots, barley, and clover. When the clover had finished growth in September it left the farmer time to plough the land for wheat that was sown in the autumn of the same year; Margaret F. Davies, op.cit., p.134-35.

<sup>304</sup> D. H. Robinson, op.cit., pp.100-01.

<sup>305</sup> PA, PACR year ended 31<sup>st</sup> March 1935.

continuous wheat cropping without success, not because their soils were exhausted but because their land contained a build-up of soil-borne disease from the previous rotations. This was an example of the wheat farmer knowing the exceptional quality of his land and choice of seed and managed to use the combination of science and tradition to his advantage.<sup>306</sup>

### **4.3 The Development of Root Crops**

There were many experiments and trials of new crops by progressive farmers of Pembrokeshire during the period of this study. Emphasis is placed here on potato crops because it serves as an example of how the industry developed from a two acre scientific experimental trial of early potatoes to an industry that grew to over 1000 acres by the start of the Second World War. Following the First World War the Ministry of Agriculture promoted the idea of experiments to grow immune varieties of potatoes in every county in England and Wales. From the spring of 1920 the Pembrokeshire County Council Agricultural Committee carried out a large number of experiments on potatoes including trials of varieties and experiments with manures together with varying cultivations. The average results from all of the 1920 trials from seventeen centres in Pembrokeshire showed that Kerr's Pink was the heaviest yielder in the nine varieties trialled. One such trial on a Pembrokeshire farm is shown in Table 4.

*Kerr's Pink* was a new variety to the county and the Agricultural Organiser published trial results in the local Press and discussed them at winter lectures and classes resulting in farmers growing *Kerr's Pink* in the next season. The rapid adoption of this variety showed that local farmers were ready to respond to the Ministry's propaganda once they were satisfied that the adoption of the new variety was to their financial advantage.

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<sup>306</sup> Sir James Scott Watson, 'Some Traditional Farming Beliefs in the light of Modern Science', *AHR*, Vol. 1, 1953, p.7.

These experiments were repeated at a larger number of centres in 1921 and the lower yields of the trials from the previous year were left out of the experimental trials to make room for varieties such as *Lochar*, *Ally* and *Early Market*.<sup>307</sup>

**Table 4. Trials of Potato Varieties in Pembrokeshire 1920**

<i>Kerr's Pink</i> .....	11 tons 3 cwts per acre
<i>Great Scott</i> .....	10 tons 9 cwts per acre
<i>Majestic</i> .....	9 tons 12 cwts per acre
<i>Arran Comrade</i> .....	9 tons 4 cwts per acre
<i>Tinwald Perfection</i> .....	8 tons per acre
<i>Resistant Snowdrop</i> .....	6 tons 8 cwts per acre
<i>Dargill Early</i> .....	5 tons 13 cwts per acre
<i>Golden Wonder</i> .....	5 tons 8 cwts per acre
<i>Dobbie's Favourite</i> .....	3 tons 15 cwts per acre

*Source: Pembrokeshire Archives Report on Agricultural Work for the year ended March 31<sup>st</sup> 1921, Pembrokeshire Agricultural Committee.*

In 1922 experiments were conducted in south Pembrokeshire on two acres of land, co-ordinated by the County Agricultural Organiser to determine the financial possibilities of growing early potatoes in the county. It was acknowledged that an early variety should produce a heavy marketable crop as early in the season as possible and very early potatoes were considered a luxury product by both farmer and consumer. The soils on the farms chosen for the experiments were improved by using farmyard manure, superphosphate, sulphate of ammonia, steam bone flour and sulphate of potash. The potatoes grown on the one acre trial at Home Farm, Angle, sold for £120 12s 10d and had a production cost of £40 19s 1d which gave a net profit of £79 13s 9d. On the second farm, Gellyswicke, near Milford Haven, a similar profit of £73 4s 8d was realised. These trials were observed by a

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<sup>307</sup> PA, PACR year ended March 31<sup>st</sup> 1921; Handbook published for the Field Day 30<sup>th</sup> July 1943 by Pembrokeshire Technical Development Sub-Committee in conjunction with the Crymmych Seed Potato Growers' Society.

number of local farmers who decided to repeat the tests and despite the season being unfavourable, four more experiments showed an average net profit of £16 4s 11<sup>3</sup>/<sub>4</sub>d per acre.<sup>308</sup> Pembrokeshire's coastal conditions were favourable for this crop and the Agricultural Organiser encouraged farmers to grow early potatoes in good time to glean their fair share of the South Wales orders. He was confident that the soil and climate supported this venture but was uncertain of the 'human factor' and suggested that in order to develop the industry the farmers would have to 'pull the chestnuts out of the fire'.<sup>309</sup> It was considered that the successful growing of earlies depended on the attitude of Pembrokeshire farmers towards a new enterprise, especially one that required human proficiencies different from those demanded by livestock husbandry.<sup>310</sup>

Trials of early potatoes continued in 1924 in order to ascertain the financial possibilities for early potato growing on a field scale. Net profits of £60.8s.0d and £41.9s.2<sup>1</sup>/<sub>4</sub>d per acre were reported and despite the cold late season preventing the lifting of potatoes until two weeks later than usual, the crop was proved to be satisfactory.<sup>311</sup>

The following year early potato experiments were carried out at Calvesland, Manorbier with Mr Allison of Calvesland growing half an acre of early potatoes and shared the information to indicate the value of the crop to a small holder:

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<sup>308</sup> W. E. D. Jones, 'Experiments on the Growing of Early Potatoes', *WJA*, 1925, Vol.I, pp.116-19; G. D. H. Bell, *Cultivated Plants of the Farm*, (Cambridge: CUP, 1948), p.147.

<sup>309</sup> W. E. D. Jones, 'Experiments on the Growing of Early Potatoes', *op.cit.*, p.119.

<sup>310</sup> J. Morgan Jones and J. Llefelys Davies, 'Report on Production and Marketing of Potatoes in Pembrokeshire', Department of Agricultural Economics, University College, Aberystwyth, 1929.

<sup>311</sup> PA, PACR year ending March 31<sup>st</sup> 1925.

Half ton <i>Epicure Scotch Seed</i> at £15 per ton.....	£7 10 0
Manures: 2 cwts Superphosphate; ½cwt Sulphate of Potash; ½cwt Sulphate of Ammonia.....	£1 3 0
5 tons of Farmyard Manure were 'ploughed in' during the autumn on this half acre	

The crop that was lifted was:

3 tons 17 cwt ware at £10 per ton.....	£38 10 0
10 cwts seed valued at .....	£5 0 0
	<hr/>
	£43 10 0

The farmer assumed the cost of production to be £30 per acre, therefore the cost for this experiment for half-acre was £15, leaving a profit of £28 10s 0d.<sup>312</sup>

By 1934 early potatoes grown in Pembrokeshire averaged sixty acres and increased rapidly to two hundred acres the following year. Experiments were carried out in Pembrokeshire in 1936 in consultation with the Ministry of Agriculture and the National Institute of Agricultural Botany, Cambridge, to compare the values of the more popular early potato varieties available. These were carried out by Mr Thomas, Lower Treginnis, St Davids and Mr A.W.Gutch, Home Farm, Angle, Pembroke with the plots on the farms being replicated eight times to give more valued results. The experiments at Lower Treginnis are shown in Table 5.

This trial at Lower Treginnis showed that the variety *Sharpes Express* yielded nearly sixty per cent of that of *Arran Pilot*, a surprising result as the greatest acreage under early potatoes in the county was planted with *Sharpes Express*. It was noted that these results were specifically for the soils of St Davids for the 1936 season and not the average

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<sup>312</sup> PA, PACR year ending March 31<sup>st</sup> 1926.

for the county although the Agricultural Organiser commented that the results suggested very strongly that growers should try *Arran Pilot*.<sup>313</sup>

**Table 5. Results of Potato Experiments at Lower Treginnis**

Variety	Total weight lifted
<i>Arran Pilot</i> .....	624½ lbs
<i>Ninetyfold</i> .....	603 lbs
<i>Epicure</i> .....	540½ lbs
<i>Ballydoon</i> .....	502 lbs
<i>Duke of York</i> .....	493½ lbs
<i>Sharpes Express</i> .....	370½ lbs
<i>May Queen</i> * .....	203 lbs

(\* Agricultural Organiser noted that this seed appeared to be damaged by wireworm and scab on arrival)

*Source: Pembrokeshire Archives, Agricultural Educational Work in Pembrokeshire for the year ending March 31<sup>st</sup> 1936, Pembrokeshire Agricultural Committee*

The crops at Angle were reported as very uniform and less vigorous than at St Davids as birds had been interfering with some of the plants. The red soil had a tendency to set compared with the loose soil of St Davids. The results of the trials at Angle are shown in Table 6.

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<sup>313</sup> PA, PACR year ending March 31<sup>st</sup> 1936; Handbook published for the Field Day 30<sup>th</sup> July 1943 by Pembrokeshire Technical Development Sub-Committee in conjunction with the Crymmych Seed Potato Growers' Society.

**Table 6. Potato Variety Trials at Angle in Pembrokeshire 1936**

Variety	Total Weight Lifted
<i>Arran pilot</i> .....	352½ lbs
<i>Ballydoon</i> .....	351½ lbs
<i>Epicure</i> .....	344½ lbs
<i>Ninetyfold</i> .....	339½ lbs
<i>Duke of York</i> .....	328½ lbs
<i>Sharpes Express</i> .....	303½ lbs

*Source: Pembrokeshire Archives, Agricultural Educational Work in Pembrokeshire for the year ending March 31<sup>st</sup> 1936, Pembrokeshire Agricultural Committee*

The results of both trials showed that *Arran Pilot* gave a yield forty five per cent higher than *Sharpes Express*, for every six tons obtained from *Sharpes Express*, *Arran Pilot* gave 8 tons 14 cwts.<sup>314</sup> Whilst these trials were taking place, there was a widely publicised clearing and cultivation of two hundred acres of early potatoes on Williamston Mountain, near Houghton. It was said that these trials encouraged other farmers to produce early potatoes and by 1939 there were over one thousand acres being grown in the county.<sup>315</sup>

Although farmers were aware of the appropriate variety of potato to cultivate a profitable crop, it was also important that it was a healthy and reliable crop and therefore the choice of seed was crucial. It was due to the potato virus diseases that elaborate schemes for growing and certifying potato stocks for seed were developed. Farmers were aware that varieties like *Sharpes' Express* were susceptible to wart disease and sales were

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<sup>314</sup> PA, PACR year ending March 31<sup>st</sup> 1936; Handbook published for the Field Day 30<sup>th</sup> July 1943 by Pembrokeshire Technical Development Sub-Committee in conjunction with the Crymmych Seed Potato Growers' Society.

<sup>315</sup> W. L. Thomas and P. W. Eyre, *Early Potatoes*, (London: Faber and Faber, 1951), p.25-26; Paul Watson Eyre, 'A Study and Examination of a Specialized Method of Early Potato Production on a Farm in South Pembrokeshire', (unpublished M.Sc, University of Bangor, 1949), p.4; W. E. D. Jones, 'Increase in Early Potatoes', *Telegraph Almanac*, 1936; Keith Johnson, 'On the Spuds', *Pembrokeshire Life*, April 2003, p.4; David W. Howell, 'Farming in Pembrokeshire 1815-1974', in *Pembrokeshire County History Volume IV*, (Haverfordwest: Pembrokeshire Historical Society, 1993), p.102.

controlled under the Wart Disease Order 1923 and therefore looked for better quality.<sup>316</sup> It was recognised that the quality of Scotch and Irish seed potatoes were superior and this led to government certification to help farmers obtain the best product. The large demand for quality seed prompted experiments at universities and agricultural colleges and these studies showed that seed from Ireland and Scotland were more prolific in cropping than that of English origin and the County Agricultural Organisers were keen to demonstrate the differences to farmers.<sup>317</sup>

When the Potato Marketing Scheme was formed, Wales as a region was entitled to have one member on the Board and was represented by Mr W Rees Owen of Roch, Haverfordwest. The object of the Scheme was to ensure adequate remuneration to growers. The decline of the potato industry in Wales was thought to be caused by competition from Eastern counties of England, Ireland and France and therefore the dilemma facing Mr Rees was that of promoting the industry of Wales without ‘robbing’ the growers in other markets of which the Potato Marketing Scheme was responsible for. He found that there was a period, May to September, where Wales was fairly free from competition and a survey of Wales was made to see where first earlies and second earlies could be grown to come onto the market in these months. Another consideration was also the fact that imports of earlies from the Continent could be cut off due to the Colorado Beetle infestation and there could be an opportunity to establish an early potato industry as a precaution and the suitability of parts of Pembrokeshire had been proven as a lot of work had already been done to show that early potatoes could be grown.<sup>318</sup> A comprehensive

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<sup>316</sup> G. D. H. Bell, op.cit., p.148; W. L. Thomas and P. W. Eyre, op.cit., p.26.

<sup>317</sup> Ministry of Agriculture and Fisheries, *Report of the Marketing of Potatoes in England and Wales*, (London: HMSO, 1926), p.77.

<sup>318</sup> Handbook published for the Field Day 30<sup>th</sup> July 1943 by Pembrokeshire Technical Development Sub-Committee in conjunction with the Crymmych Seed Potato Growers’ Society.



survey of potato growing highlighted that even though it was possible to grow early potatoes in Pembrokeshire the main problem was marketing them; as the report comments:

....in the event of early potatoes becoming an established industry in Pembrokeshire the produce will have to be dispatched in quantities sufficient to be dealt with in the distant wholesale markets. To state that the problem is one of assembling and organised marketing, does not minimise the importance of production, but the Pembrokeshire farmer can not be expected to produce without having an assurance that he can market his crop remuneratively.<sup>319</sup>

Professor T. Whitehead, the Agricultural Botanist at Bangor, pioneered the potato seed industry in Wales in the inter war years. He used scientific surveys of suitable districts and persuaded farmers in the chosen localities to combine and form local seed-raising associations to grow high grade virus free seed. The Agricultural Department at Aberystwyth also supported the industry; Mr D. Walters Davies, Advisory Mycologist and Mr J. R. W. Jenkins, Advisory Entomologist, surveyed the Preseli district and concluded that conditions were good for starting a seed growing scheme.<sup>320</sup> By 1936 potato seed growing began in the Crymych area of North Pembrokeshire. It was said that virus free stocks could only be grown where the greenfly population was small. The greenfly population did not flourish in places such as Crymych because it was well above sea level and very windy. Data on the incidence of greenfly was collected by the Advisory Entomologist, who found that the average number of greenfly present per hundred leaves was extremely low and even absent in certain crops.<sup>321</sup>

The Crymych Seed Growers' Association was formed to grow a new immune variety of *Arran Pilot* to supply the early potato growers in the south of the county.

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<sup>319</sup> J. Morgan Jones and J. Llefelys Davies, op.cit.

<sup>320</sup> Redcliffe N. Salaman, *The History and Social Influence of the Potato*, (Cambridge: CUP, 1985 first published 1949), pp.422-3; Handbook published for the Field Day 30<sup>th</sup> July 1943 by Pembrokeshire Technical Development Sub-Committee in conjunction with the Crymych Seed Potato Growers' Society.

<sup>321</sup> Handbook published for the Field Day 30<sup>th</sup> July 1943 by Pembrokeshire Technical Development Sub-Committee in conjunction with the Crymych Seed Potato Growers' Society.

Scientific studies showed that the Crymych grown *Arran Pilot* was superior to commercial seed stocks with only a four per cent virus infection in comparison with the Northern Ireland seed that showed nine per cent and the English once grown which showed forty-nine per cent. The Association started with a membership of twenty-one growing ten acres of seed and by 1939 had increased to thirty-one members growing fifty-five acres and by 1944 the membership had increased to seventy-eight.<sup>322</sup>

The conditions and regulations of the Crymych Seed Potato Growers' Association included that *Arran Pilot* was the only variety to be grown. Stocks of seeds were bought from approved sources and each member would grow not less than half an acre on a plot to be at least thirty yards from any other potato crop and would be open to health inspections by Advisory Officers.<sup>323</sup> By 1939 Crymych grew two hundred acres of potato seed which expanded to two hundred and ninety four acres during the war period and North Wales grew one hundred and ten acres in 1939 which expanded to four hundred and twenty four acres during the war.<sup>324</sup> To aid farmers at this time the Pembrokeshire Agricultural Committee established a demonstration plot for experimenting in seed potato growing on one acre at Penrhiw Farm, Crymych on 15 February 1943.<sup>325</sup>

During the Second World War the Ministry of Agriculture issued two kinds of certificates for seed potato growers in England and Wales: 'A' certificates were issued for crops which had not more than one per cent of virus disease grown by members of approved seed potato growers' association; and 'H' certificates for crops grown that had not more than three per cent of virus at the time of inspection. Both the Crymych Association and North Wales Certified Seed Potato Growers Ltd were awarded 'A'

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<sup>322</sup> PA, DSO/54 1939-79 Crymych Seed Potato Growers' Association; W. L. Thomas and P. W. Eyre, *op.cit.*, p.26.

<sup>323</sup> PA, DSO/54 1939-79 Crymych Seed Potato Growers' Association.

<sup>324</sup> Redcliffe N. Salaman, *op.cit.*, pp.422-23.

<sup>325</sup> PA, PCC/SE/71/59 Agreement for letting of land at Penrhiw Farm Crymych, Mr John Edwards and Pembrokeshire County Council, 15 February 1943.

certificates and this grading probably reflected that the farms of the association members were situated on high ground or in exposed and windy situations which were unfavourable for the multiplication of the greenfly that spread the virus.<sup>326</sup>

Two other associations were also formed by 1945; Brecon and Radnor and Powysland.<sup>327</sup> The expansion of the Brecon and Radnor seed potato district showed that by 1948 nearly four hundred acres yielded over a thousand tons supplying Pembrokeshire growers and it was reported that the upland farmers in Brecon and Radnor were growing the right and best seed and the lowland farmers of Pembrokeshire were growing the best ware.<sup>328</sup> The growth of the potato industry was encouraged by the Pembrokeshire Agricultural Executive Committee, under the guidance of the executive officer Mr W. H. Jones, and Pembrokeshire saw increases from just over 1000 acres in 1939 to 4,741 acres by 1945. This increased further to nearly 7,500 acres by the end of the decade and was worth approximately £1,000,000.<sup>329</sup>

The late or main crops of potatoes were usually stored in clamps for winter use and the good keeping quality was related to the resistance of the variety grown to tuber infections. Agricultural scientists had shown that the loss of weight in stored potatoes could be decreased by the use of growth substances that inhibited sprouting. Scientists had shown that farmers could lower their potato clamp losses by 14 per cent by treating the potatoes in the autumn and reports showed that untreated potatoes were much softer than those whose sprouting had been suppressed.<sup>330</sup>

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<sup>326</sup> PA, DSO/54 Ministry of Agriculture and Fisheries, Certification of Seed Potatoes grown in England and Wales.

<sup>327</sup> Redcliffe N. Salaman, *op.cit.*, pp.422-23.

<sup>328</sup> *Farmers Weekly*, 9 July 1948.

<sup>329</sup> W. L. Thomas and P. W. Eyre, *op.cit.*, pp.26-27; David W. Howell, 'Farming in Pembrokeshire 1815-1974', *op.cit.*, p.102.

<sup>330</sup> *Farmers Weekly*, 3 September 1948; G. D. H. Bell, *op.cit.*, p.14; Arable Crops, Young Farmers' Club Booklet, No.14, p.32.

Other scientific experiments geared towards improving farmers' potato crops included the environmental conditions of the soil. It was shown that deficiencies of nitrogen, potassium, phosphorous, calcium and magnesium affected a range of six potato varieties in varying degrees. *Gladstone* was least tolerant in acid conditions while *Dunbar Rover* and *Kerrs Pink* were the most successful varieties on limed plots. Investigations into quality factors, for example blackening on boiling, showed that liming improved the external appearance, texture and flavour in all the varieties tested except *Gladstone*. However, it was shown that if potassium was omitted liming increased blackening in all varieties except *Kerrs Pink*.<sup>331</sup>

#### **4.4 The Development of Cereal Crops**

In Britain the choice of cereal crops grown by farmers was primarily governed by the climate and whether the farmer was producing crops for the market or for feeding to livestock. Wheat, oats and barley cultivation were considered very important for their nutritional value and the agricultural economy and were seen as a valuable rotational crop adaptable to different growing conditions. These three cereals not only gave high grain production for human and animal food, farmers also benefitted from the secondary product of fodder from the straw. The goals for agricultural scientists and amateur breeders were to introduce new plant characteristics of value and to remove old detrimental traits. Examples produced early in the twentieth century were the *Yeoman* wheat from Professor Biffen of Cambridge, *Plumage Archer* barley from Mr Beaven of Warminster, and *Blue Cone* wheat from Professor Percival of Reading.<sup>332</sup>

Benefits such as improved yields, plant strength and rust resistance were regarded as the first practical use of the new plant breeding science and of applied genetics. This

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<sup>331</sup> *Farmers Weekly*, 3 September 1948.

<sup>332</sup> Professor J. Arthur Thomson, 'Science and the Farmer', *Journal of Ministry of Agriculture*, Vol.29(4), 1922-23, pp.218-19; G.D. H. Bell, op.cit., p.57.

success was the product of scientific research solving economic problems; a wheat giving increased yield and withstanding weather conditions put money in the pockets of farmers and lessened the dependence on imports. Most soils were suitable to grow wheat but the best were the heavier fertile loams and it was because of this that the farmers of East Anglia were the first beneficiaries of Mendelism as new varieties of wheat were ideal for growing in that region.<sup>333</sup> Wheat was not seen as a cash crop in Wales and was not suited to the Welsh pastoral economy. It was not an important crop in Pembrokeshire as it only accounted for one or two percent of the total arable area and was confined to the coastal areas as it did not thrive more than six hundred feet above sea level. The acreage increased with the passing of the Wheat Act and the amount grown increased from 714 acres in 1923 to over 2,000 acres in 1936 but the quality was seen to be below average and was only grown to a small extent for human consumption and was mixed with barley to feed livestock.<sup>334</sup>

As wheat breeding was extensively researched at the Cambridge Plant Breeding Station a programme for wheat breeding was not high on the schedules of the Welsh Plant Breeding Station (WPBS). However, as the Station was established immediately after the end of the First World War, some attention was given to wheat in the early years. Welsh farmers were growing the hardy naturalized *Hen Gymro* in preference to the modern wheat varieties and the WPBS collected a number of samples for early exploration work. Professor Thomas James Jenkin was responsible for the study the *Hen Gymro* variety. By a process of selection he produced pure lines which showed improvement in grain

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<sup>333</sup> Paolo Palladino, 'Between Craft and Science: Plant Breeding, Mendelian Genetics, and British Universities 1900-1920', op.cit., p.312; Noel Kingsbury, op.cit., p.169; Professor J. Arthur Thomson, op.cit., p.219; Margaret F. Davies, op.cit., pp.136-37; G.D. H. Bell, op.cit., p.61; P. S. Hudson, 'The present position of plant breeding', *AP*, Vol. VII, 1930, p.25.

<sup>334</sup> A. W. Ashby and I. L. Evans, op.cit., pp.19-21, although there were advances in agricultural science relating to cereal plant breeding during the first half of the twentieth century, the acreage of wheat, barley and oats in Wales declined significantly between 1871 and 1939; wheat went from 147,000 acres in 1871 to just 13,000 acres in 1939; Barley was 182,000 acres in 1871 and declined to 22,000 acres in 1939; and oats declined from 261,000 acres in 1871 to 160,000 acres to 1939.

production and ability to stand. Three varieties were released to Welsh farmers, namely the S.70, S.72 and S.73. These strains were eventually reduced to one, S.70, largely based on farmers' preferences. The seed was released by the WPBS either to agents or direct to farmers and production and distribution was entirely the responsibility of the farmer-grower.<sup>335</sup>

During the period of this study barley cultivation was primarily concerned with malting and brewing, but agricultural scientists also produced hybrids for feeding. The barley produced for malting was worth considerably more to the farmer being valued at sometimes fifty to two hundred per cent more than barley for feeding, and it was said that a farmer would not attempt to grow barley unless there was a reasonable expectation that it was good enough for malting. In Pembrokeshire, barley accounted for only eight per cent of the arable land and although it was originally considered important as a bread corn it was primarily grown for feeding pigs and sheep. At Orielton Farm, the account books show that 13¼ cwts of barley was produced with an associated value of £9.18s.9d and it was all used for feeding the pigs. As beer was considered an 'essential article of diet' a small amount of barley grown in Pembrokeshire was used in brewing in the farm houses.<sup>336</sup>

When the WPBS was formed it considered that research in the breeding of oat crops would be successful in helping farmers and agricultural development in Wales.<sup>337</sup> When Professor Evan Thomas Jones took over the Cereal Department his work was not only successful in developing new varieties suitable for Wales but having been brought up

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<sup>335</sup> TNA MAF 113/25, S.S.C.5, The Distribution of Foundation and of Stock Seed of Varieties and Strains produced by the Station, pp.1-2; Gwilym Evans, *Pioneers of Gogerddan*, (Cambrian News, 1987), pp.30-31.

<sup>336</sup> Ralph Wightman, *Arable Farming*, (London: Nicholson and Watson, 1951), p.98; G.D. H. Bell, op.cit., p.61 and pp.78-9; Margaret F. Davies, op.cit., pp.135-6; PA, D/PR/278 Farm Accounts and Valuations for Orielton Farm.

<sup>337</sup> TNA MAF 113/25, S.S.C.5, p.1, The Distribution of Foundation and of Stock Seed of Varieties and Strains produced by WPBS.

on the family farm had clear ideas of the farmers' requirements and the needs of varieties for mechanised farming. Professor Jones was considered well justified in confining his attention to oats as the grain and straw provided valuable animal feed.<sup>338</sup>

Oats were primarily cultivated for stock food, although some was used for making oatcakes and other cooked cereal foods. At Orielton Farm, 39 cwts of oats was produced of which 12<sup>3</sup>/<sub>4</sub> cwts was fed to the pigs and 26<sup>1</sup>/<sub>4</sub> cwts were fed to poultry. Oat was the most important cereal crop for Pembrokeshire because of its adaptability to a wide range of soils, including lime deficient peaty soils, and was grown up to eight hundred feet on the Preseli Mountains where other cereals could not be grown. Ashby considered that the increase in yields of oats was due to Welsh farmers realising the importance of choosing the most suitable seed and although the new commercial varieties that had been developed had improved, there could have been further increases if sufficient attention had been paid to the lime status of the soil.<sup>339</sup>

The value of a new variety for use in Wales needed to be ascertained by observations, tests and trials and although the WPBS submitted new oat varieties for inclusion in the National Institute of Agricultural Botany (NIAB) at Cambridge, they regarded any trials carried outside of Wales to be additional rather than offering an alternative variety.<sup>340</sup> Although there were collaborations between the WPBS and the NIAB, scientists in Aberystwyth were against trials that were remote from Wales and local conditions because results arising from Cambridge would not gain the confidence of

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<sup>338</sup> Gwilym Evans, *op.cit.*, pp.52-3; Robert Waller, *op.cit.*, p.118, the author comments that this work had been overshadowed by the international publicity given to Aberystwyth grasses but was equally deserving of fame; Jubilee Report of the Welsh Plant Breeding Station, 1919-1969, (University College of Wales, Aberystwyth, 1970), p.101.

<sup>339</sup> A. W. Ashby and I. L. Evans, *op.cit.*, pp.20-21 and p.27; Margaret F. Davies, *op.cit.*, pp.136-37; PA, D/PR/278 Farm Accounts and Valuations for Orielton Farm.

<sup>340</sup> TNA MAF 113/25, S.S.C.5, p.2.

Welsh farmers as these results may be highly important in one set of conditions but may be of little or no significance in another.<sup>341</sup>

Oat variety trials were co-ordinated by the County Organiser at Cilwendeg; each plot was a quarter of an acre and manured with four cwts. of Superphosphate per acre and the oats were sown April 28<sup>th</sup> 1920 and cut September 8<sup>th</sup> 1920. The results of the trial are shown in Table 7. The farmer found that the *Ceirch du bach* variety yielded the highest amount of straw but it had thick growth and thin stalk while the *Black Tartar* straw was strong and had good colour and *Radnorshire Sprig* was soft with good colour.<sup>342</sup>

**Table 7. Oat Varieties Trials at Cilwendeg in 1920**

Variety	Number of days to ripen	Weight of grain per acre in lbs	Bushel weight
<i>Black Tartar</i>	131	1885	36¼
<i>Radnorshire Sprig</i>	126	1656	35¼
<i>Yielder</i>	128	1540	38½
<i>Record</i>	130	1534	37¼
<i>Ceirch du bach</i>	133	1525	33¼
<i>Bountiful</i>	127	1510	37¾
<i>Potato</i>	132	1357	36½
<i>Banner</i>	129	1434	37¾

*Source: Pembrokeshire Archives, Report of Agricultural Work for year ended March 31<sup>st</sup> 1921, Pembrokeshire Agricultural Committee*

Oat trials at Somerton Farm, Milton, compared different varieties and the results were shared by the County Organiser for farmers to see which gave better straw and weights of grain. The results of these trials are shown in Table 8.

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<sup>341</sup> TNA MAF 113/29, T. J. Jenkin of WPBS comments on Scheme for Testing and Distribution of New Varieties, pp.1-2; TNA MAF 113/25, S.S.C.5, p.2.

<sup>342</sup> PA, PACR year ended March 31<sup>st</sup> 1921.



**Table 8. Oat Trials at Somerton Farm 1926**

<b>Variety</b>	<b>Weight of grain</b>	<b>Days to Harvest</b>
<i>Record</i>	1434lbs and 30lbs seconds	126 days
<i>Golden Rain</i>	1435lbs and 39lbs seconds	118 days
<i>Tartarian</i>	1042lbs and 78lbs seconds	122 days
<i>Victory</i>	1437lbs and 27lbs seconds	121 days
<i>Englebrecht</i>	1160lbs and 111lbs seconds	117 days
<i>Crown</i>	1395lbs and 30lbs seconds	120 days
<i>Supreme</i>	1095lbs and 30 lbs seconds	116 days

*Source: Pembrokeshire Archives, Report on the Agricultural Educational Work in Pembrokeshire during the year ended March 31<sup>st</sup> 1926*

Mr J. Morris, the farmer responsible for these trials summarised the results to be shared by the Agricultural Organiser:

*Record* stood up best, and the others, compared with *Record*, were *Record*, 100 marks; *Englebrecht*, 99; *Golden Rain* and *Crown*, 95; *Tartarian* and *Victory*, 94; *Supreme*, 90. Of the four white varieties, *Golden Rain* gave the nicest sample, and *Victory*, *Record*, *Crown* followed in this order. Of the black varieties, *Supreme* was easily first. The sample of *Englebrecht* grown was better than the original. *Tartarian* was a poor sample. *Englebrecht* gave the greatest quantity of straw and the best quality straw. *Record* gave the coarsest straw, but it stood best. The three white varieties gave shorter, harder and stiffer straw. *Tartarian* and *Supreme* were not very good for straw.<sup>343</sup>

Other experiments were organised to test the behaviour of the imported seed

*Black Bell III* compared with 'once grown' seed and the results are shown in Table 9.

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<sup>343</sup> PA, PACR year ended March 31<sup>st</sup> 1926.

**Table 9. Experiments comparing Imported Oat Seeds**

	<b>Imported Seed</b>	<b>1925 Produce Seed</b>
Date of Sowing	March 28 <sup>th</sup> 1926	March 28 <sup>th</sup> 1926
Amount	Five Bushels	Five Bushels
Germination	Excellent	Not as good possible because seed not cleaned as well as imported seed
Early Growth	Rapid	Ordinary
Summer Growth	Slow	Continuous
Height	4ft to 4ft 6ins	4ft 6ins to 5ft
Straw	Stiff	Stiff
Harvested	12 <sup>th</sup> August	18 <sup>th</sup> August
Yield	64 Bushels, 1 <sup>st</sup> Quality	56 Bushels, 1 <sup>st</sup> Quality

*Source: Pembrokeshire Archives, Report on the Agricultural Educational Work in Pembrokeshire during the year ended March 31<sup>st</sup> 1927*

The experiments showed that farmers found the imported seed, *Black Bell III*, to be more suitable for the rich corn lands in Pembrokeshire than the ordinary *Tartarian* which generally produced a poor yield of grain.<sup>344</sup>

The challenge for the plant breeder was to develop varieties with strong straw and high feeding value and the agricultural scientists at the WPBS conducted a survey in the 1930s to find out what varieties the Welsh farmers demanded. They used the information generated by seed oat sales from thirty-seven societies in Wales including the Haverfordwest Agricultural Co-operative Society, the Crymych and District Farmers' Association and the Pembroke and District Agricultural Co-operative Society.<sup>345</sup> The results of the survey showed that the newer classified grade I varieties were chosen by farmers who were producing large and heavy grain and *Victory* was the most popular. In the grade II varieties, *Black Tartarian* was preferred by Pembrokeshire farmers and *Scotch*

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<sup>344</sup> PA, PACR year ended March 31<sup>st</sup> 1927.

<sup>345</sup> E. T. Jones, 'Sales of Varieties of "Seed" Oats by Farmers' Co-operative Societies in Wales', *WJA*, Vol. XIII, 1937, pp.231-33.

*Potato* was preferred in Cardigan. Of the grade III varieties, Pembrokeshire and south Cardiganshire chose *Ceirch-du-bach*, while those in the north of Cardiganshire preferred the *Ceirch Llwyd* variety. These varieties were described as being suitable for the high rainfall in the West and produced high quality leafy forage which could be cut green in addition to producing top quality grain.<sup>346</sup>

At the time that the WPBS and the agricultural societies were trying to help farmers with best products and best prices, the government were also making policy commitments to help cereal farmers. Baldwin's General Election message to the agricultural industry was that 'farmers must be secured against dumping'.<sup>347</sup> The newly appointed Minister of Agriculture, Christopher Addison, launched a series of plans to increase food production and pressed for import boards for cereal growers, quotas for production and brought in the Agricultural Marketing Bill of 1931.<sup>348</sup> This Bill was not popular amongst the farming community and the NFU as it was perceived to handicap home production in favour of foreign imports and did not offer farmers any protective provisions. Not only did Addison fail to get the marketing schemes supported he was also accused of criticising farmers technical ability, as humorously portrayed in Figure 4.<sup>349</sup>

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<sup>346</sup> Ibid., pp.237-239; G.D. H. Bell, op.cit., p.87.

<sup>347</sup> F.W. S. Craig, *British General Election Manifestos*, (Chichester: Political Reference Publications, 1970), p.65; Iain Dale, ed., *Conservative Party General Election Manifestos 1900-1997*, (London: Routledge, 2000), p.51.

<sup>348</sup> PP 1931(Bill 156) Agricultural Marketing Bill.

<sup>349</sup> *The Times*, 21 January 1931. Regulation of imports policies followed in 1933 when the marketing schemes offered control of the volumes of imports.



### THE UNFAIRY GODFATHER.

DR. ADDISON. "I AM HERE TO PROTECT YOU."

BRITISH FARMER. "PROTECT ME FROM WHAT? FOREIGN COMPETITION?"

DR. ADDISON. "NO! NO! FROM YOUR OWN INCOMPETENCE."

BRITISH FARMER. "THANK YOU VERY MUCH."

[Under Dr. Addison's Bill, home producers are to have their output controlled, but foreigners may continue to send their produce here in unrestricted quantities. Meanwhile, as *The Times* points out, he has irritated the farmers "by unnecessary criticism of their technical ability."]

**Figure 4. The Unfair Godfather by Leonard Raven-Hill, 1931, reproduced with permission of Punch Limited**

## 4.5 Disease and Pest Control

In the inter-war years there were no legislations to help farmers protect their crops from the invasion of rabbits from neighbours who neglected rabbit control. This problem was made worse with the widespread splitting up of estates where organised rabbit destruction might otherwise have taken place with sporting rights being given to shooting syndicates which did not necessarily support the farming community. In 1927 Lord Bledisloe, the then parliamentary secretary to the Ministry of Agriculture and Fisheries, stressed the need to control the growing number of rabbits as social conditions were changing and traditional control measures were reduced, leading to a subsequent increase in rabbits and crop damage.<sup>350</sup>

Although rabbits had a sporting, meat and pelt value, by the 1930s wild rabbits were considered serious vertebrate pests that damaged crops and grassland and significantly affected agricultural output. As John Martin commented, they changed the composition of the grassland by close cropping of the best clovers and grasses and left behind unpalatable species.<sup>351</sup> Rabbits also caused considerable damage to the finger and toe experimental plot at the college farm and the scientists showed that fifty rabbits destroyed approximately 4.5 cwt of the swede crop. They were also able to discover that the rabbits showed ‘a most epicurean taste’ as only the Danish variety was destroyed probably due to the high sugar content of the Danish swedes.<sup>352</sup>

Rabbits were considered a hindrance to agricultural progress in many districts, especially in coastal counties like Pembrokeshire and Cornwall. Stapledon considered that

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<sup>350</sup> Peter W. J. Bartrip, *Myxomatosis, A History of Pest Control and the Rabbit*, (London: Tauris Academic Studies, 2008), p.29.

<sup>351</sup> John Martin, ‘The wild rabbit: plague, policies and pestilence in England and Wales, 1931-1955’, *AHR*, 58(2), 2010, p.262.

<sup>352</sup> T. Whitehead, ‘Experiments with Finger and Toe Disease of Swedes; with a note on loss caused by rabbits’, *WJA*, Vol 1, 1925, pp.183-84.

‘...a million pounds or so might not have been as well devoted to the killing of the last female rabbit in this country as to the plough-up policy’.<sup>353</sup> Some farmers resigned themselves to the damage done by rabbits as agricultural prices were low and they could at least generate an income by selling the trapping rights.<sup>354</sup> When the government proposed a Gin Traps (Prohibition) Bill<sup>355</sup> some members of the Pembrokeshire Agricultural Committee were of the opinion that if traps were abolished then rabbits would not only become a greater pest but they would be the sole occupiers of the land. However there were also some who thought the traps cruel:

I consider the gin trap a terrible instrument of torture, I have seen many animals caught in them in the open, dogs, cats and all sorts of pests. Anyone who rough shoots in Pembroke knows that from 25 to 50 per cent of the pheasants and partridges have one leg.<sup>356</sup>

After discussions the Committee voted in favour of the Bill asking for the government to pass into law at the earliest possible date and at the same time requesting that consideration be given for compensation to trappers.<sup>357</sup>

Plant breeding as a means of dealing with plant disease was not always practicable and methods of direct attack or prevention were a necessary routine for the farmer. The methods available to the farmer included the use of fungicides and insecticides, biological control by the introduction of parasites and plant hygiene to improve the environment to render the plant less susceptible or to remove the source of the infection.<sup>358</sup>

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<sup>353</sup> Professor Sir George Stapledon, *The Plough-Up Policy and Ley Farming*, (London: Faber and Faber, 1939), p.159. The plough-up policies and rabbit control are discussed in chapter 10.

<sup>354</sup> John Martin, ‘The wild rabbit: plague, policies and pestilence in England and Wales, 1931-1955’, op.cit., p.264.

<sup>355</sup> PP 1938-39 (200) Prevention of Damage by Rabbits, this Bill prevented the use of spring traps above ground but could be used in a rabbit hole.

<sup>356</sup> *County Echo*, 23 May 1935.

<sup>357</sup> PA, PCC/SE/2/7 Minutes of the County Agricultural Committee, 6 April 1935.

<sup>358</sup> PP 1934 (Cmd.4718) Report of the Agricultural Research Council, pp.48-49.

Entomological research in the period of this study was focussed on insect infestation which caused crop failures and as the direct attack of insect pests by chemical means was rarely possible, farmers were encouraged to create an environment as incompatible as possible to the insects survival. For example, during the farm rotation the insects that attack clover were forced to go elsewhere or die when the clover was broken up and oats were sown. Farmers were also persuaded to grow crops when the risk of infestation was lower; for example carrots sown early in March were more heavily infested by carrot fly larvae than those sown later in May as the first brood of flies had partially died off by the time the May sown carrots were above ground.<sup>359</sup>

Another problem for West-Walian farmers was potato wart which was a quarantined disease of the cultivated potato. Soil fungus which caused the disease was discovered in 1896 and resistance to wart was among the first traits studied for Mendelian inheritance. Conventional breeding schemes during the first half of the twentieth century were successful in developing resistant varieties.<sup>360</sup> The Ministry of Agriculture introduced the Wart Disease of Potatoes Order in 1923 to prevent the spread of the disease to other potato growing districts and the whole of Wales was scheduled as an infected area. As this meant that Pembrokeshire farmers were restricted to selling their potatoes to profitable markets the Order was challenged by the Pembrokeshire Agricultural Committee in 1937 affirming there had been no fresh outbreaks of the disease recorded in the county for several years. The Agricultural Organiser had not seen any cases since 1920 and commented that prior to that the disease was only found in small gardens and not on commercial farms. However the Ministry of Agriculture stated that the infected soil

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<sup>359</sup> J. C. F. Fryer, 'The Insect Enemies of Farm Crops', *WJA*, Vol. I, 1925, pp.190-93.

<sup>360</sup> Jude Ejikeme Obidiegwu, Kerstin Flath and Christiane Gebhardt, 'Managing potato wart: a review of present research status and future perspective', *Theoretical Applied Genetics*, Vol.127, 2014, pp.763-64.

remained infective for a long time and the practice of planting immune varieties of potatoes had the effect of masking the possible presence of the fungus in the soil.<sup>361</sup>

The main work of the Potato Virus Research Station at Cambridge was the study of several viruses affecting the potato and the characteristics of their effect. Some varieties of potato were shown to carry a dangerous virus and yet not show any outward symptoms, thus increasing the difficulty of maintaining healthy stocks by rogueing (eliminating inferior plants).<sup>362</sup> Experiments were also established to look at resistant varieties of swedes to finger and toe and local seed and foreign seed were planted in May 1927 at Tregadwgan, Solva. The local seed failed completely but the foreign seeds did well and proved to be highly resistant. Farmers who came to see the plots were impressed with the contrast between the varieties and those farmers whose land was infected with finger and toe were offered an opportunity of improving their crops.<sup>363</sup>

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<sup>361</sup> PA, PCC/SE/2/7, Meeting of the County Agricultural Committee, 26 June 1937; PA, PCC/SE/2/7, Meeting of the County Agricultural Committee, 10 April 1937; PA PCC/SE/71/55 correspondence file W. E. D. Jones.

<sup>362</sup> PP 1934 (Cmd.4718) Report of the Agricultural Research Council, July 1931 to September 1933, pp.68-69, this department was started with a grant of £1,200 from the Development Fund and received grants for maintenance of about £2,700 to £2,900 a year.

<sup>363</sup> PA, PACR year ended 31<sup>st</sup> March 1928.





**Figure 5. Finger and toe experiments at Tregadwgan, Solva, 1928**

*Source: Pembrokeshire Archives, Report on the Agricultural Education Work in Pembrokeshire for year ended 31<sup>st</sup> March 1928*

Frequent failures of susceptible crops such as oats, beet and potatoes led agricultural scientists to experiment with sulphur compounds as they found that the crop failures were due to manganese deficiencies in the plants. The results of these experiments meant that farmers were encouraged to use thiosulphates in the soil and the field experiments showed that the addition of these sulphur compounds increased the manganese uptake in beet.<sup>364</sup> Other soil treatments included liming; the large number of field trials from the late nineteenth century to the 1930s established the usefulness of liming as a soil treatment against finger and toe (clubroot) disease. However, although the tests agreed that acidic soils favour disease development and alkaline conditions partially or wholly inhibit the disease, the lack of comparable information on soil texture and other soil dressings impeded the agricultural advisers helping farmers. For example there were eight standard reference books which gave the amount of dressing of quick lime per acre to

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<sup>364</sup> *Farmers Weekly*, 1 October, 1948.

reduce finger and toe as anywhere between thirty-five bushels to eight tons.<sup>365</sup> The Agricultural Research Council acknowledged that although the farmers had confidence in the advice given on the quantities of artificial manures to be used, the advice given for the use of lime was largely a guess.<sup>366</sup> Similarly, charlock spraying demonstrations in fields of oats and barley carried out at Wood Park, Clarbston Road, showed that solutions of four per cent copper sulphate solution and mixtures of sulphate of ammonia and copper sulphate eradicated the weed charlock. These results show that definitive recommendations were not available to farmers and local trials would still be needed.<sup>367</sup>

Wireworms were also a problem for farmers because they attacked many crops particularly potatoes, carrots and onions. Although difficult to eradicate, farmers were able to test the soil to estimate the wireworm population in order to identify which crops could be grown safely. If the wireworm content was high it was best to grow crops which were immune such as flax, if medium it was safe to grow barley, and only if the content was low the farmer would choose to grow wheat and potatoes. This improved knowledge of the soil and the ability to test it was a significant factor for better crop production in the Second World War.<sup>368</sup>

This chapter has shown the wide application of agricultural science on the farm for arable crop production and how the Welsh farmer learnt to modify methods in accordance with the new science available. One of the major agricultural crop successes was seeing how the potato industry evolved from the experimental plot to a substantial remunerative crop and how farmers adapted to changing economic circumstances. Evidence for improvement through Mendel's principles of genetics enabled plant breeders to produce

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<sup>365</sup> T. Whitehead, 'Experiments on the Use of Lime in Controlling Finger and Toe Disease of Brassicae', *WJA*, Vol. XII, 1936, p.183.

<sup>366</sup> PP 1934 (Cmd.4718) op.cit., p.27.

<sup>367</sup> PA, PACR year ended 31<sup>st</sup> March 1927.

<sup>368</sup> *Land at War*, prepared by the Ministry of Information, London: HMSO, 1945, p.54.

new varieties capable of giving farmers optimum yields in their local conditions. Farmers and scientists have been seen to collaborate for mutual benefit; the farmer trials new seeds on his farm and the scientists obtain experimental information to share. Welsh farmers have been shown to have adopted new ways of crop control by using the combined knowledge of chemistry and biology with their local soil conditions. Also the collaborations between farmers and the scientists have been seen to have functioned effectively encouraging increased production by the use of pesticides and fungicides.

## CHAPTER FIVE: SCIENCE AND GRASSLAND MANAGEMENT

### 5.1 Introduction

Although studies of grassland can be traced back to the eighteenth century, it was the early decades of the twentieth century that scientific studies contributed to improvements of grassland production and management. Scientific studies of seeds, feeding values of grass and conservation methods contributed to the more cost-effective and higher productivity farming. It was said that grassland had always played an important role in agricultural development by extending man's food supply to areas where crops could not be grown for direct human consumption. Until the twentieth century grassland was accepted as natural herbage and very little was done to improve it until the research work at Aberystwyth and Cambridge universities led to methods for the improvement of grassland conditions using better strains with enhanced feeding values with results described as revolutionising grassland farming.<sup>369</sup>

Grass varies considerably in its feeding value and depended on the quality of the soil, the climate of the region and its botanical composition. The soils of Pembrokeshire contain a high proportion of fine sand and silt and when sufficiently fertilised produced quality grassland, described as the most important crop in Wales providing summer and winter keep for sheep and a high proportion of the winter keep for cattle and horses.<sup>370</sup>

John Bennion of Stackpole considered grass 'the foundation of prosperity' and the 'mother of milk and the grandmother of feeding'. He also believed that a 'very fair yard stick of a farmer's ability can be gauged by his treatment of grass'.<sup>371</sup>

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<sup>369</sup> H. I. Moore, *Grassland Husbandry*, London: Allen & Unwin, 1944, pp.13-15; John Frame and A. S. Laidlaw, *Improved Grassland Management*, (Marlborough: Crowood Press, 2014), p.11.

<sup>370</sup> A.W. Ashby and I. L. Evans, *op.cit.*, p.22; Margaret F. Davies, *op.cit.*, p.99; L. Dudley Stamp, *Fertility, Productivity and Classification of Land in Britain*, *op.cit.*, p.11.

<sup>371</sup> John E. Bennion, *Stackpole and The Bennions*, (Llandysul: Gomerian Press, 1964), p.105-06.

It was shown that genetic differences within the grass species effected differences in animal production and in order to maximise production on a single farm the farmer had to manage and optimise the varieties of grass as well as taking into account the breeds of the animal.<sup>372</sup> For example, scientific studies of grasses and soils showed that pastures containing rye grasses and wild white clover could fatten animals without subsidiary feeding and could therefore form the basis of productive grassland farming.<sup>373</sup> The grassland map of England and Wales showed that there were patterns of good and bad swards. William Davies<sup>374</sup> reported that the quality of permanent pasture showed a considerable relationship to soil fertility especially in hilly districts where there was a close correlation between elevation and fertility.<sup>375</sup> Combining grassland with science and correlating feeding by manuring gave farmers the best possible use of their grass.<sup>376</sup>

## 5.2 Science and Grassland Management Improvement

British grasslands were divided into two types; uncultivated grasslands which included the rough and hill grazings and the cultivated grasslands which included the permanent pastures and meadows of the lowlands. These cultivated grasslands were grouped into two classes; the temporary leys and the permanent grassland.<sup>377</sup> The distinction between the two was considered empirical; good old grasslands may be regarded as long-duration leys. It was also acknowledged that the transition from ley to permanent pasture was

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<sup>372</sup> William R. Kneebone, 'Grass Breeding and Livestock Production', *Economic Botany*, Vol.14, No.4., 1960, p.310.

<sup>373</sup> Margaret F. Davies, op.cit., p.99; L. Dudley Stamp, *Fertility, Productivity and Classification of Land in Britain*, op.cit., p.11.

<sup>374</sup> William Davies (1899-1968) was a botanist and grassland specialist and was head of the department of grassland agronomy at the WPBS between 1933 and 1940 and became director of the Grassland Improvement Station in 1945.

<sup>375</sup> William Davies, 'The Grassland Map of England and Wales', *JMA*, Vol.48, 1941, pp.114-16, the grassland map produced was based on botanical groupings and the classifications were divided into Group A, lowland and cultivated pastures, Group B, intermediate types and Group C, rough and hill grazings.

<sup>376</sup> A. L. Stickland, 'The Cambridge Grassland Conference', *AP*, Vol. V, 1928, p.117.

<sup>377</sup> Sir R. George Stapledon and William Davies, *Ley Farming*, (Harmondsworth: Penguin, 1941), pp.19-21.

gradual and the ley would have been considered to have ceased its function when the seeds originally sown were replaced by unsown grasses and other plants.<sup>378</sup>

William Davies commented that:

The farmer who wants to maintain his grassland at the highest possible level of production and has in mind doing this year after year has, therefore, to regard his grass swards as a major crop on the farm. He must be prepared to maintain a high standard of fertility after ensuring that the seeds he sows are of the quality he desires and can produce the type of sward for which he seeks.<sup>379</sup>

He believed that the number of grazing weeks on most farms could be improved from the average twenty-six weeks a year by farmers adopting the research findings of agricultural scientists. Plant breeders and farmers using leys with specially bred strains of grasses and clovers had improved grazing weeks, some up to forty weeks, and all-year-round grazing was anticipated by researchers as becoming normal practice as far as soil conditions permitted.<sup>380</sup>

Ley farming, a modern term for the science of grass usage, was developed by progressive farmers in the nineteenth century.<sup>381</sup> It was the work of Robert Elliot of Clifton Park that was acknowledged as advocating the four year ley and based his system as simply as:

The success of our agriculture depends on the cheapening of production; the cheapest food for stock is grass; the cheapest manure for soil is turf composed largely of deep-rooting plants; and the cheapest, deepest, and best tillers, drainers,

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<sup>378</sup> William Davies, *The Grass Crop, Its Development, Use and Maintenance*, (London: E & F N Spon, 1960), p.129; Sir R. George Stapledon and William Davies, *Ley Farming*, op.cit., p.19.

<sup>379</sup> William Davies, *The Grass Crop, Its Development, Use and Maintenance*, op.cit., p.19.

<sup>380</sup> *Farmers Weekly*, 18 April 1947.

<sup>381</sup> PP 1896 (C.8021) Royal Commission on agriculture, minutes of evidence taken before Her Majesty's Commissioners appointed to inquire into the subject of agricultural depression, p.596, communications between Lord Leicester and Mr Shaw-Lefevre describe Lord Leicester's ley farming and his temporary pasture laid down from 1 to 16 years.

and warmers of the soil are roots.<sup>382</sup>

The essence of ley farming was to grow crops and grass and Stapledon defined ley-farming as a system which postulated high skill both in the arts of crop and animal husbandry. His many publications stressed the importance of the ley and his communications with farmers, officials and scientists emphasised how ley farming had a large part to play in the production of crops as well as grass and that it could form the foundation of any commodity production.<sup>383</sup> He commented:

The farmer adopting this system will find that he can greatly extend the opportunities for conducting ploughing and other operations under weather conditions short of the ideal. He can be a wheat and bean man and still a ley-farmer; he can be a grass-feeder and still a ley-farmer, and, best of all, by becoming a ley farmer he can become a dairy farmer instead of a cow-keeper.<sup>384</sup>

In general, ley farming was attractive to dairy farmers because it met two of their greatest needs; more pasture, and more hay or silage for winter keep.<sup>385</sup> In order to have the best swards farmers were encouraged to sow persistent grass strains and in Pembrokeshire experimental trials were designed to compare ordinary commercial perennial rye-grass and Aberystwyth S.23 rye-grass.<sup>386</sup> Both types of seeds with wild white clover were sown at equal rates on replicated plots. After eight years from sowing only six per cent of the ground was covered by the commercial rye-grass compared to thirty per cent of the S.23 strain. Scientists advocated that the persistent and leafy types of

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<sup>382</sup> Robert H. Elliot, *The Clifton Park System of Farming*, (London: Faber and Faber, 1948, original publication 1898), p.25.

<sup>383</sup> *Ley Farming*, War Food Production Advisory Bulletin No.2, (University College of Wales, Welsh Plant Breeding Station, 1941), pp.1-3; Sir R. George Stapledon and William Davies, *Ley Farming*, op.cit., p.41; William Davies, *The Grass Crop, Its Development, Use and Maintenance*, op.cit., p.130, the author defined the ley as 'a grass-legume sward explicitly sown as part of a pre-designed rotation of crops, the intention being to plough up again after a pre-determined number of years'.

<sup>384</sup> *Ley Farming*, War Food Production Advisory Bulletin No.2, (University College of Wales, Welsh Plant Breeding Station, 1941), p.5.

<sup>385</sup> J. F. Robinson, 'Stocking the Leys', *WJA*, Vol. XVIII, 1945, p.17.

<sup>386</sup> The letter "S" is an abbreviation of "Strain" and its significance grew to be a symbol and an unofficial trade mark of the Welsh Plant Breeding Station.

grass were the true foundation of ley farming and one of the chief aims of the WPBS was to produce strains with this characteristic.<sup>387</sup>

The main objective of Norman Perkins of Trefelyn Farm, Pembrokeshire, was to grow the maximum amount of arable crops whilst maintaining the land's fertility and each of his fields was rested in turn under a temporary ley for three years. He created a balance between arable land and leys in relation to summer grazing and wintering and this balance was achieved by managing the amount of hay, silage or dried grass produced, having sufficient stock in the summer to keep growth under control, and to provide wintering stock to consume and convert into manure all the straw and other by-products of the arable land. This system of ley-farming was a success because Mr Perkins was able to dove-tail all the aspects of managing the farm and considered the priority was to maintain fertility and capacity. This depended on the establishment of good leys to carry a large head of stock which meant that the soil was in good condition when ploughed because of the abundant animal manure. His scientific knowledge of seeds and grasses contributed to the choice of seeds mixture used for the three year ley and he chose to use leafy perennial ryegrass as the main constituent, Italian ryegrass for the early bite in the first year of ley, Cocksfoot for its 'earliness' and advantage over other grasses in a dry year owing to its depth of rooting, Montgomery red clover, white clover and wild white clover for its ability to restore fertility to the soil ready for the next arable crops.<sup>388</sup>

### **5.3 Improvement of Hill Land**

The scarcity of grass during the lambing period was known to be a serious loss for the upland farmer; the lack of natural keep and nutritious herbage essential to the breeding ewe caused a reduction in the number of lambs. This problem became of interest to the

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<sup>387</sup> T. J. Jenkin, 'The Foundations of Ley Farming', *WJA*, Vol. XVIII, 1945, p.6.

<sup>388</sup> Norman S. Perkins, 'Experience in Ley Farming, Ley Farming on Pembrokeshire Farms', *WJA*, Vol. XVIII, 1945, pp.32-34.



agricultural scientists because they felt that if there could be a way of improving the character of the herbage by promoting earlier growth and by increasing its nutritional value there would be a great benefit for upland farmers. Experiments were designed to see if the lowland grasses and clovers could be successfully grown at higher altitudes and make an earlier growth than existing herbage. It was found that the fine leaved red fescue and cocksfoot grew well on the hills and compared favourably in their nitrogen and mineral content with the same grasses grown on the lowland plots, indicating that if suitable species and strains were chosen there could be considerable improvement to the upland hills.<sup>389</sup>

George Stapledon had studied the Welsh hills for many years following his first botanical survey of Cardiganshire in 1914 and advocated that the hills could be greatly improved by practical scientific treatment; the supply of nutritious and mineral-rich herbage would raise the carrying capacity of the land, improve the health of sheep and minimise the costly necessity for wintering in the lowlands. He was of the opinion that the carrying capacity of sheep-walks in Wales could be doubled.<sup>390</sup> To enable his research to develop from small experimental plots to large-scale investigation he appealed for funds through the columns of *The Times*:

Sir – knowing your keen interest in British agriculture, we ask the hospitality of your columns in order to make known what we consider to be an urgent need ...we appeal to all who have the future of British agriculture at heart for financial assistance in order to enable the Plant Breeding Station to conduct the necessary experiments on a larger scale and on a basis that would demonstrate to the farmer that both seed production and drastic improvement of grassland can be undertaken as an economic proposition...we estimate the sum required to meet these needs at

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<sup>389</sup> Professor T. W. Fagan and W. E. J. Milton, 'The Effect of Manures at Different Altitudes on the Nitrogen and Mineral Content of Grass and Clover Species', *WJA*, Vol. X, 1934, pp.174-89.

<sup>390</sup> *The Times*, 4 January 1932.

about £20,000.<sup>391</sup>

Sir Julien Cahn responded to the appeal and offered an annual sum of £3000 for seven years declaring that ‘the object for which you are appealing is of an importance which it is scarcely possible to exaggerate’. Although the Station would have hoped the money was for general purpose, Sir Julien stipulated that the money was to be used for Stapledon’s scheme only.<sup>392</sup> Sir Julien Cahn’s benefaction made possible the large-scale experiment, the Cahn Hill Improvement Scheme, designed to improve hill land at high elevations in order to make it possible to winter large flocks of sheep on the upland areas.<sup>393</sup> Approximately two thousand and eight hundred acres of hill land was leased on the Hafod Estate which comprised Pwllpeiran, Prignant and Banc y Bont, and Nant Rhys, and also one hundred and twenty acres on the Whitton Hill near Knighton, Radnorshire. Under the direction of Stapledon and Dr Moses Griffith, the almost derelict moors were invaded by caterpillar tractors and ploughs which killed the bracken and tore the turf making it ready for the sowing of rape, ryegrass and wild clover. The result was an increase in quality pasture and quality of grazing livestock giving an appearance of ‘strangely green and different from the sombre herbage of West Wales’.<sup>394</sup>

Quantitative results were produced by agricultural scientists for a number of criteria of interest to hill farmers; for example the yield of herbage, stock carrying capacity, number of lambs reared, gain in the live weight of stock, gain in the value of stock and the gross income.<sup>395</sup> Additional experiments at Pwllpeiran were established to show the improvements and efficiency of commercial seeds compared to the WPBS seeds. Two

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<sup>391</sup> *The Times* 11 July 1932.

<sup>392</sup> Miranda Rijks. *The Eccentric Entrepreneur, Sir Julien Cahn Business Man, Philanthropist, Magician & Cricket-Lover*, (Stroud: The History Press, 2011), p. 85.

<sup>393</sup> E. L. Ellis, *The University College of Wales Aberystwyth 1872-1972*, (Cardiff: UWP, 1972), p.238.

<sup>394</sup> Moses Griffith. ‘The Cahn Hill Improvement Scheme’, *WJA*, XIII, 1937, pp. 211-212; *The Times*, 1 October 1934; E. L. Ellis. op. cit., p.238; PP 1944 (Cmd.6498) op.cit., p.6 and p.17.

<sup>395</sup> Ll. Iorwerth Jones, *Studies on Hill Land in Wales*, Welsh Plant Breeding Station, Technical Bulletin No. 2, 1967, p.104.

plots were cultivated during the Cahn Hill Improvement Scheme with one sown with commercial grass seed and the other with the WPBS bred seed. On cultivation, the latter showed a seventy per cent increase over the native sward in the number of breeding ewes maintained per acre, 106 per cent increase in the number of grazing days per acre, and 119 per cent increase in number of lambs reared. There was also a 165 per cent increase in weight of lamb reared per acre, 194 per cent increase in the value of lamb reared and 372 per cent increases in gross income.<sup>396</sup>

Between 1934 and 1948, Mr H. E. Williams, of Bwlchcrwys ploughed, applied lime and fertiliser and reseeded an area of hill land every year and during this period of reclamation his cattle population increased from fourteen to forty-two and his breeding flock had increased from two hundred and forty ewes rearing about two hundred lambs to four hundred and sixty ewes rearing around five hundred and fifty lambs. His annual sale of stock also increased in this period: from six poorly grown store cattle to eighteen well grown semi-fat cattle; from fifty mature Welsh mountain ewes to one hundred and twenty well grown three and four year old ewes; and from one hundred store wether lambs to four hundred fat lambs. There was also a marked improvement in growth and condition of the animals resulting in a higher price per animal with the increase in financial returns being even more pronounced than the increase in stock numbers.<sup>397</sup> Farmers could usually estimate the economic success by three criteria; the production per acre or per animal, production per man employed and production per unit of capital invested. Any new techniques or processes could then be evaluated by these standards. By these criteria the success shown at Bwlchcrwys demonstrated a combination of science and skill; the science provided the farmer with the knowledge to increase efficiency which led to an increase in return of his expenditure of labour and capital.

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<sup>396</sup> Ibid., pp.87-105.

<sup>397</sup> Ibid., pp.138-39.

## 5.4 Eradication of Bracken

Scientists believed that land which was densely covered with bracken was capable of producing good crops and pastures and it was said that in Wales ‘... land which would grow bracken could be valued in gold, land where gorse and furze grew in silver, and heather-covered land in copper’.<sup>398</sup>

On upland pastures bracken presented a serious problem to farmers and it was described as the worst weed found on many sheep farms. Unfortunately for farmers the bracken tended to occupy the best hill-land as it required good well-drained sub soil to grow and this type of soil on the mountain sheep farms had a significant value for the wintering of sheep. Therefore bracken reduced the grazing value and stock carrying capacity.<sup>399</sup> These losses to farmers influenced experiments at the college farm at the University of Wales. Routinely farmers would cut the bracken two or three times for about three to five years but this method proved unsatisfactory as it was costly and time consuming.<sup>400</sup> Agricultural scientists carried out experiments with chemical sprays in an attempt to eradicate bracken and during the summers of 1930 and 1931 they sprayed various strengths of copper sulphate, potassium chlorate, sodium carbonate and sodium chlorate with the latter proving to be the most effective.<sup>401</sup> However the scientists did appreciate that for farmers to adopt these chemical methods they had to be cheap, the compound had to be dissolvable in cold water enabling it to be used with the nearest water supply, be easily handled by the farm hands without risk and be harmless to livestock. Trials with sodium chlorate satisfied all these requirements and large scale experiments

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<sup>398</sup> Moses Griffith, ‘Pasture Improvement and the Eradication of Bracken and Rushes’, *WJA*, Vol. XIV, 1938, pp.176-77.

<sup>399</sup> Moses Griffith, William Evans and E. E. Williams, ‘The Eradication of Bracken’, *WJA*, Vol. VIII, 1932, p.229.

<sup>400</sup> *Ibid.*, pp.229-30.

<sup>401</sup> *Ibid.*, p.230; Moses Griffith, ‘Pasture Improvement and the Eradication of Bracken and Rushes’, *op.cit.*, p.177.

showed that the bracken withered and died within a few days of spraying and by the end of the summer the land was showing good quality green grass.<sup>402</sup>

Although chemical methods were helpful to farmers the absence of any available water supply made this method difficult or impossible and in such cases cutting was the only way of destroying the bracken. The Pugh Bracken Cutter, a machine invented by a farmer from Aberangell, was capable of cutting eight to ten acres a day, could be used on very steep hill-sides and it was said that ‘...where a horse can walk, a Pugh Bracken Cutter will work’.<sup>403</sup> Other machines such as the Holt Breaker, the Brenton and Aitkenhead were shown at bracken eradication demonstrations at Brimaston Hall, Wolfscastle and organised by the Pembrokeshire Agricultural Education Committee for Pembrokeshire farmers to see the machines in action.<sup>404</sup>

## **5.5 Improvement of Grass Nutrition**

When the trade for three year old wether sheep diminished, farmers found that the old rough herbage which had been sufficient for older sheep was not suitable for the growing lambs. Bringing lambs down to the lowlands in October therefore put a premium on the lowland areas. Agricultural scientists questioned that if farmers could keep their store cattle during the winter months with one feed of concentrate a day and the rest rough fodder then why couldn't sheep farmers grow a crop of winter hardy grass for one feed a day and then feed them for the rest of the day on the upland pasture or other rough pasture.<sup>405</sup>

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<sup>402</sup> Moses Griffith, William Evans and E. E. Williams, op.cit., pp.230-31.

<sup>403</sup> Ibid., p.232.

<sup>404</sup> PA, PCC/SE/71/56, correspondence of W. E. D. Jones, Pembrokeshire Agricultural Organiser.

<sup>405</sup> Moses Griffith and Martin Jones, 'Italian Rye-Grass for Winter Keep', *WJA*, Vol. VIII, 1932, pp.139-40.

Experiments and trials showed that if farmers grew Italian rye-grass on fields adjacent to upland pastures they could winter ewe lambs at home and save money on out-wintering while at the same time improving the rough pasture, especially if small areas could be enclosed. Large tracts of mountain pasture covered with bent and fine-leaved fescue, which make fair growth in the summer but when dried in the autumn is deficient in protein and minerals, could be used for roughage provided some nutritious food is supplied with it. It was shown that lambs rationed to one feed of rye-grass a day appeared to thrive better and if the sward was good then forty Welsh lambs could be grazed for two hours a day on three acres. The Italian rye-grass sward also gave a good quality of 'early bite', an important factor on sheep farms as the early spring grazing extended the grazing season.<sup>406</sup>

In addition to the high water content, typically eighty to eighty-five per cent, grass also contains proteins, carbohydrates and fibre. Scientists studying nutrition in the 1920s showed that the main factors that influenced the nutritive value of grasslands were: more judicious grazing which gave better development of the leaf which has a higher nutritive value than the stem; nitrogenous manuring which benefitted yield and chemical composition; phosphoric manuring which encouraged growth of clover which added to the mineral content; and the use of indigenous varieties of grass in preference to commercial as the indigenous were more leafy.<sup>407</sup>

Research at Aberystwyth revealed that some species and strains of grass became richer in essential chemical constituents than others even if they were grown on the same soil. This was attributed to the difference in the way the grasses abstracted and efficiently used the available constituents of the soil available. For example: perennial rye-grass and

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<sup>406</sup> Moses Griffith and Martin Jones, *op.cit.*, pp.143-44; Professor R. G. Stapledon and Rhoda Jones, 'Seed Mixtures for Temporary Grass', *WJA*, Vol.1, 1925, p.69, this grass has the ability to develop abundant root leaves and leaf shoots during the autumn and winter which renders it valuable for providing winter and early spring grazing.

<sup>407</sup> T. W. Fagan, 'The Nutritive Value of Pasture Grass as Influenced by Management', *WJA*, Vol. V, 1929, pp.99-109.

cocksfoot were found to contain high percentages of nitrogen, phosphoric acid and lime and in the same soil meadow foxtail contained a higher percentage of nitrogen but a lower percentage of phosphoric acid and lime; tall oat grass contained a higher percentage of phosphoric acid; red fescue was the richest in lime but poor in nitrogen and phosphoric acid; and clovers contained a higher percentage of nitrogen and lime. It was also found that not only were there nutritive differences between grass types, there were also differences between strains of a particular grass type.<sup>408</sup>

## **5.6 Science and the Production and Utilisation of Grass Seeds and Strains**

Intensive scientific studies in the 1920s showed that better management and utilization of grassland products were essential to Britain in giving a degree of production far in excess of old pasture. However it was also recognised that high-class temporary leys were not always economically profitable. Grass science and economics, grassland management and the value of better strains and seeds was the basis of the research conducted at Aberystwyth since 1920.<sup>409</sup> The value of grass depended on six main factors; yield, feeding value, palatability, persistency, winter greenness and earliness. It was common in the 1920s for prescriptions of grass and clover mixtures for sowing to contain about twenty species but by the 1940s farmers used their scientific knowledge of the habits and qualities of the grasses and clovers in order to narrow down the number of species used and therefore compile a simpler seeds mixture.<sup>410</sup>

The importance of suitably blended seed mixtures for permanent pastures was studied at the WPBS and although the evidence from research experiments were shared with farmers there were still large numbers who allowed price to influence their choice of

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<sup>408</sup> T. W. Fagan et.al., 'The Influence of Liming on the Herbage of Acidic Soils in Merionethshire', *WJA*, Vol. XVI, 1940, p.145.

<sup>409</sup> William Davies, 'Seeds Mixture Problems: Sowing and After- Management', *WJA*, Vol. V, 1929, p.133.

<sup>410</sup> H. I. Moore, *Grassland Husbandry*, op.cit., p.41.

seed. To assist farmers, scientists at the WPBS designed experiments to compare pedigree and indigenous strains with commercial mixtures. In the spring of 1928 they sowed one-tenth acre strips in the same fields as the farmers' mixtures on farms in Pembroke, Carmarthen, Cardigan, Brecon, Merioneth and Montgomery. The fields were managed by the occupant farmers and the results showed that the experimental plots were superior; the pedigree and indigenous strains filled the ground better and suppressed weeds better than the farmers' mixture.<sup>411</sup>

Scientists found that commercial mixtures were poor and as farmers were sowing small amounts of several species per acre, the swards were also poor. They found that meadow fescue in competition with rye grasses had no value and recommended that the farmers' money was better spent by increasing the species that do well and exclude those that do not. Scientists also commented that farmers were using too much Italian ryegrass as although it was useful for providing spring keep in the first year the species did not contribute in subsequent years. Experiments comparing the strains of seeds allowed scientists to recommend to Welsh farmers the types of seeds mixtures to be used where fields were put down to grass for three years or longer and would provide hay for one or two years and pasture for some years subsequently.<sup>412</sup>

Scientists at the WPBS published the feedback from farmers who had trialled the station-bred types of grasses and the commercially available seeds. Farmers commented on the persistency qualities, the palatability of the different strains and the after management of the sown pastures. Using this information, County Agricultural Organisers

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<sup>411</sup> M. T. Thomas, 'Simple Seeds Mixtures Containing Pedigree and Indigenous Strains Compared with Ordinary Commercial Mixtures for Permanent Grass', *WJA*, Vol. VII, 1931, pp.182-84.

<sup>412</sup> *Ibid.*, pp.182-86.



were able to advise other farmers how to apply this new knowledge with proven results in local conditions.<sup>413</sup>

Following the failing of seeding at Blaenffos Farm, Boncath, the County Agricultural Organiser advised that the best seed mixture to use should include rye grasses, Cocksfoot and varieties of clovers known to suit North Pembrokeshire soil and encouraged the farmer to use pedigree strains that had been proven to give a better and sustainable crop by agricultural scientists.<sup>414</sup>

The mixing and choice of seeds mixtures was described as an art which required considerable knowledge of the agronomic behaviour and qualities of species of strains.<sup>415</sup> Scientists recommended using the minimum of species for the specific purpose: rye grass for bulk and long seasonal growth; meadow grass for a dense sward; and clover for rich mineral food. Soil type also influenced the types of seeds used: perennial rye grass and meadow fescue for highly fertilised soils; and cocksfoot and fine-leaved fescue on poor soils. Farmers were encouraged to use scientifically balanced mixtures of seeds for successful swards for good pasture management.<sup>416</sup>

The WPBS carried out numerous experiments using different combinations of strains of grasses and clovers with the aim of finding mixtures that could form a good permanent sward in the shortest possible time.<sup>417</sup> Experiments on twenty-five farms in Cardiganshire involved comparing the WPBS seeds mixtures with the farmers' usual mixtures and in the third harvest year farmers thought that the experimental plots were significantly better showing more clover, fewer weeds and more palatable herbage with

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<sup>413</sup> M. T. Thomas, A.G. Davis and William Davies, 'Field Trials with Pedigree (Station-Bred) and Indigenous Strains of Grasses – Data Collected 1938', *WJA*, Vol. XV, 1939, pp.202-15.

<sup>414</sup> PA, PCC/SE/71/56, correspondence 19 April 1938.

<sup>415</sup> William Davies, 'Seeds Mixture Problems: Sowing and After- Management', *WJA*, Vol. V, 1929, p.135.

<sup>416</sup> *Ibid.*, pp.135-36.

<sup>417</sup> Ll. Iorwerth Jones, 'A Seeds Mixture Experiment in Mid-Cardiganshire', *WJA*, Vol. X, 1934, p.268.

one farmer complaining that ‘his mowing machine could not cope with the dense, leafy hay of the experimental plot’.<sup>418</sup>

Pedigree strains at the WPBS were trialled on fields with wide ranges of soil and climatic conditions and were compared with commercial strains with the management of the experiments completely in the hands of farmers. The trials from 1928 to 1931 showed that pedigree and indigenous strains were more persistent, leafier, and produced more hay than the commercial strains.<sup>419</sup> Trials of any one component of a seeds mixture affecting any of the other components were studied at Stanrach, Llanfynydd and at the Pibwrlwyd Institute and the results showed that rye grasses suppressed meadow fescue when sown together and that Italian rye grass may act as a check on weeds.<sup>420</sup> Other experiments and trials were carried out to determine if the inclusion of wild white clover in seeds mixtures increased the meat production and stock carrying capacity of the pasture. Results showed that the live weight increase per acre per annum on the farm was 593lbs and 437lbs on two plots.<sup>421</sup>

Stapledon believed that until grassland farming was more intensified and specialised, the plant breeder’s duty was to be ‘sparing in his dispensation of benefits, lest in his endeavour to serve local interests he engenders a state of confusion’. He stipulated that:

Ultimately it should be possible to organize the seed production of herbage plants on a more localized basis, but until the seed trade and the farmer have gained sufficient experience with pedigree grasses and clovers it would we believe be a

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<sup>418</sup> Ibid., pp.267-78.

<sup>419</sup> M. T. Thomas, ‘Field Trials with Pedigree and Indigenous Strains of Grasses’, *WJA*, Vol. XI, 1935, pp.147-57.

<sup>420</sup> William Davies and A. D. Thomas ‘Seeds Mixture Studies: Some Carmarthenshire Results’, *WJA*, Vol. III, 1927, p.149-51.

<sup>421</sup> E. J. Roberts, ‘The Effect of Sowing Wild White Clover on the Meat Producing Capacity of a Temporary Pasture’, *WJA*, Vol. VII, 1931, pp.187-94. The author notes that although there was substantial increase in production by the inclusion of wild white clover the control pasture without the clover was itself of a high order of productivity.

mistake for either a research station or a progressive seed house to release or to distribute more than quite a limited number of strains of any particular species.<sup>422</sup>

Perennial rye grass, Britain's preferred species, had been seeded for pasture since the seventeenth century and was capable of very high production.<sup>423</sup> The Aberystwyth strain S.23 was selected for leafiness, disease resistance and long life under grazing and was considered a major factor in the successful reclamation of hill land in Wales.<sup>424</sup> Pembrokeshire farmers<sup>425</sup> were called on to help with S23 seed production and were asked to grow two or three acres, preferably after root crops, and were remunerated one shilling a pound for the clean seed.<sup>426</sup> By 1937 the WPBS had organised 250 trials of seed mixtures throughout Wales and twenty-two trials in England arranged with the Royal Agricultural Society and the work of the WPBS under Stapledon's direction had world-wide recognition and were foremost amongst those who helped give farmers an entirely new picture of the value of his grassland.<sup>427</sup>

## 5.7 The Conservation and Preservation of Grass

The preservation of grass for winter feed was essential to most farmers and adequate provision of winter fodder was made by preserving a proportion of the summer grass. The focus of science was directed towards the preservation of grass as silage but the scientific principles behind haymaking and grass drying were also significant. Haymaking was considered the longest established method of conserving grass; a process where the moisture content of grass was reduced from about eighty to about fifteen to twenty per cent

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<sup>422</sup> R. G. Stapledon, 'Trials with Strains of Cocksfoot and Observations on the Policy of the Station in Relation to their Distribution and Use', *WJA*, Vol. X, 1934, pp.222-23.

<sup>423</sup> William R. Kneebone, *op.cit.*, p.307.

<sup>424</sup> Ll. Iorwerth Jones, *Studies on Hill Land in Wales*, *op.cit.*, p.81.

<sup>425</sup> Mr J. Jones, Slebech, Mr Harris, Newton, Mr J Belton, Gelliswick, Mr J Morris, Somerton.

<sup>426</sup> PA, PCC/SE/71/55.

<sup>427</sup> PP 1937-38 (Cmd.5768) Report of the Agricultural Research Council October 1935 – September 1937, p.88 and p.92.

enabling it to be stored as hay without deterioration. Scientific methods of curing and storing minimised the loss of nutrients and the farmers' aim was to have hay with a good colour, no mould, a pleasant smell and with a high chemical nutrient content. Loss in nutrient value could be caused by a number of reasons: cutting the crop too late; by having a less than optimum composition of the sward; or by carting the crop too soon before the moisture was sufficiently reduced. Weather also played a part; heavy rain caused soluble nutrients to be washed out and scorching sun bleached the crop leading to the loss of carotene.<sup>428</sup>

Difficulties of securing a hay crop in uncertain climates led to a focus of alternative methods of conservation which were not so weather dependent. As one farmer commented:

A study of the weather conditions had convinced me of the truth of an opinion I heard from one of the old inhabitants, to the effect that good hay could be made in Pembrokeshire only in one year in ten.<sup>429</sup>

The government accepted that farmers experienced considerable difficulty in storing grass and was concerned about the cost for purchasing concentrated animal foods and looked to the Agricultural Research Council and the Agricultural Departments for solutions.<sup>430</sup>

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<sup>428</sup> H. I. Moore, *The Science and Practice of Grassland Farming*, (London: Thomas Nelson, 1951), pp.100-01

<sup>429</sup> John E. Bennion, *op.cit.*, p.56.

<sup>430</sup> TNA CAB/24/269/22 Memorandum by the Minister of Agriculture, Cabinet paper 'Increasing the Productivity of the Soil', April 1937.



**Figure 6. The Harvest at Penysgwarne 1905**

*Source: Private Photograph Collection, courtesy of Edward Perkins*

Much of the hill lands were covered in Molina grass, also known as purple moor grass or flying bent but very few hill farmers in Wales made Molina hay as it required hand cutting. The *Farmers Weekly* reported that in 1921 three men cut fifty-six acres of Molina grass by scythe, cutting it before ‘the dew arose’ in the morning and they had it carted by night. This Molina hay, made in a day, had a protein content of eighteen per cent and was reportedly ‘quite palatable’ but as a winter keep it couldn’t be utilised because the Molina grass could not be cut by mower.<sup>431</sup>

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<sup>431</sup> *Farmers Weekly*, 3 September 1948.



**Figure 7. Haymaking at Trefin Swyn y Don c.1910**

*Source: Pembrokeshire Archives, HDX/1531/22*

In 1926 the research work of Professor T .B. Wood and Dr H. E. Woodman emphasised the high value of young, short grass and their scientific investigations explored the chemical composition and nutritive value of young leafy grass cut at intervals in the grazing season. Artificial drying was found to conserve nutrients and was also convenient to handle and agricultural scientists found that the more often a grass is cut the richer the conservation of the crude protein. Also its dried state compared well with many concentrated foods and could be used in the rations of dairy cows and when ground into a fine state it was suitable for pigs and poultry. Experiments in the 1930s showed a close correlation between the protein content of dried grass and the carotene content of the freshly cut herbage.<sup>432</sup> Carotene is a valuable source of Vitamin A and gave milk a rich

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<sup>432</sup> T. W. Fagan and W. M. Ashton, 'The Effect of Partial Field-Drying and Artificial Drying on the Chemical Composition of Grass', *WJA*, Vol. XIV, 1938, pp.160-76; E. J. Roberts, 'Grassland, Conservation of Young

creamy colour so consumers did not complain when cows were fed dried grass. The carotene content also gave dried grass a high commercial value.<sup>433</sup>

By the end of 1936 there were fifty dryers of various types used on estates, farms and aerodromes throughout the United Kingdom but there was a general attitude amongst farmers of a 'wait and see'. They appreciated the value of dried grass but the cost of the necessary equipment was prohibitive, the whole process being one which was theoretically sound but needed further development to make it a practical success.<sup>434</sup> The grass-drier shown in Figure 8 was installed by the Agricultural Executive Committee to produce good feed from grass but proved to be too expensive when the war-time programme of 'food production at any price' was abandoned after the war and the plant was subsequently dismantled.<sup>435</sup>

At Stackpole, it was found that the feeding value of dried grass was equal to that of the concentrates in cattle cake and money was invested in an I.C.I. Mark 3 dryer to produce tons of high protein food to solve their winter keep problems and was producing enough to sell a small quantity.<sup>436</sup> This type of drier was a batch type with four trays in parallel enabling grass to be dried on one pair while the other was cleared and recharged. I.C.I. claimed that this drier gave farmers grass that was evenly dried and required less skilled labour and less capital investment.<sup>437</sup>

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Grass', in J. A. Hanley, Ed. *Progressive Farming, Vol. II*, (London: Claxton, 1951), p.79; S. W. Cheveley, *Grass Drying*, (London: Ivor Nicholson & Watson, 1937), p.11.

<sup>433</sup> E. J. Roberts, 'Grassland, Conservation of Young Grass', in J. A. Hanley, Ed. *Progressive Farming, Vol. II*, (London: Claxton, 1951), p.80.

<sup>434</sup> S. W. Cheveley, *op.cit.*, p.16.

<sup>435</sup> NLW, Geoff Charles Collection.

<sup>436</sup> John E. Bennion, *op.cit.*, pp.56-57.

<sup>437</sup> E. J. Roberts, 'Grassland, Conservation of Young Grass', *op.cit.*, p.80; *Farmers Weekly*, 13 August 1948, 'Report on A.I.V. silage' by Moses Griffith.



**Figure 8. Grass-drying plant at Penrhos Aerodrome, Pwllheli, 1948**

*Source: Geoff Charles Collection with permission of National Library of Wales*

Harvesting, preserving and feeding forage crops as silage was practised in the USA from the late nineteenth century and although agricultural statistics show that there were silos present in England and Wales from 1884 it was not adopted in Britain as routine practice until the inter-war years.<sup>438</sup> Very little silage was made in Wales before the Second World War but the scarcity of imported feeding stuffs and the Government's National Silage Campaign, started in 1941, influenced some farmers to start making it. This campaign was disappointing and was described as being disastrous to the future of silage making as the instructors and lecturers had very little knowledge of practical silage making. It was said that following the campaign, it was ill-advised to mention silage to many farmers due to results and heavy losses in fodder material. However, propaganda, better demonstrations, an example as shown in Figure 9, and necessity swayed some farmers and within a few years the process of silage making was considered to fit well with

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<sup>438</sup> Paul Brassley, 'Silage in Britain, 1880-1990: The Delayed Adoption of an Innovation', *AHR*, 44(1), 1996, p.63 and p.70. The author notes that the first silo was built in the USA in 1873 and by the 1890s most dairy farmers used silage.



other farm work.<sup>439</sup> Although there were some farms making silage in Pembrokeshire in the 1930s, the quantity made by the start of the Second World War was still low and was only produced on a few farms. With the help of the County Agricultural Officers and more quality information production increased each year reaching 25,000 tons in 1950.<sup>440</sup>

The farm accounts for Orielton Farm showed that silage from eleven acres of three year leys yielded 115 cubic yards, the equivalent of about 57.5 tons, which was higher than hay which yielded 9.8 tons from 7.5 acres of three year leys and dried grass which yielded just less than fifty tons from nearly thirty-six acres.<sup>441</sup> Experiments in silage production at the college farm at Bangor University started in the 1920s to investigate feeding of silage to cattle under North Wales conditions and was proved to be a success where a large head of cattle, including forty dairy cows had to be wintered.<sup>442</sup> The processes of making silage varied and scientists investigated protein yields, types of containers, use of molasses and temperature in order for farmers to provide high protein winter food. Scientists had investigated the level of nutrients in the silage process and in low temperature and A.I.V. silage<sup>443</sup> the proportion of carotene preserved was shown to be the same as dried grass.<sup>444</sup> This A.I.V. method was advocated as a scientific and fool proof method of producing

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<sup>439</sup> R. O. Davies and W. M. Ashton, 'The Making and Feeding of Silage in Mid-Wales', *WJA*, Vol. XVII, 1943, p.91; W. J. Thomas, 'Silage Costs on Welsh Farms', *WJA*, Vol. XVII, 1943, p.15; see also Keith A.H. Murray, *Agriculture*, London: HMSO, 1955, p.271. The author notes that thousands of concrete and steel silos were unsold to farmers which resulted in a loss of £125,000 and subsequent events in the post war years showed that if the originators of the silage campaign had advocated making silage in pits or clamps money and materials might have been saved. See also NFU Record, Vol. XXII, No.272, 1945, p.155 where it is noted that the shipping position and the limited stocks showed that the distribution of molasses largely depended on the number of containers available and the farmers were required to return empty drums as soon as possible to the suppliers.

<sup>440</sup> PA, PCC/SE/71/56; W. H. Jones, 'Farm Productivity in Pembrokeshire, Ten Years' Endeavour', *JMA*, Vol.60, 1954, p.374.

<sup>441</sup> PA, D/PR/278 Farm Accounts and Valuations for Orielton Farm, measurements for silage yields were quoted in cubic yards whereas hay and dried grass measurements were in tons. I am grateful for the advice of Martin Sykes for advising that although there were differences in percentages of materials used to make the silage it was generally accepted that one cubic yard was the equivalent of 0.5 ton.

<sup>442</sup> E. J. Roberts, 'Silage Investigations at Bangor', *WJA*, Vol II, 1926, p.168.

<sup>443</sup> For precise details see W.H. Peterson *et. al.*, 'The Preparation and Nutritive Value of A.I.V. Silage for Dairy Cows', *Journal of Dairy Science*, Vol. 18(1), 1935, pp.63-78, this method of preserving fodder was named after Professor A. I. Virtanen, a Finnish agricultural chemist, and A.I.V. was a patented process in which weak mineral acid was mixed with the grass at the time of filling to control fermentation.

<sup>444</sup> E. J. Roberts, 'Grassland Conservation of Young Grass', *op.cit.*, p.79.

silage that would give farmers little trouble and yield a good product free from the obnoxious, penetrating smell of ordinary molassed silage.<sup>445</sup> However, other scientists relied on compaction and the exclusion of air in the silos to produce a reliable product and disagreed with the use of preservatives and the A.I.V. acids.<sup>446</sup>

The main use of oats as a green forage crop was to make silage where they were mixed with leguminous plants and when properly balanced gave valuable stock feed.<sup>447</sup> An experienced farmer in Penwenallt, Newcastle Emlyn, advised farmers that a pea and oat crop intended for hay should be cut when the peas are in flower and a few days before the oats 'appear in head'; '*Pis yn eu blode, a'r cyrch yn eu hosan*'. He added that if the crops had been sown in the spring then the mowing should take place in July and the crop should not be carted for at least nine days. This farmer regarded the pea and oat hay as a valuable contribution for winter feed and milk production but cautioned the farmers that 'unless they had experience it was not as simple as it appears to be'.<sup>448</sup>

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<sup>445</sup> *Farmers Weekly*, 13 August 1948, 'Report on A.I.V. silage' by Moses Griffith. Molasses was added to the silo to provide sugar for the lactic fermentation and the Ministry of Agriculture advised farmers to only use the solutions for first-quality grass silage as the more mature grasses contained enough sugar.

<sup>446</sup> *Farmers Weekly*, 13 August 1948, letter to the editor by Professor Martin Jones, University of Durham, King's College, Newcastle-upon-Tyne

<sup>447</sup> G.D. H. Bell, *op.cit.*, p.84.

<sup>448</sup> NLW C43/35 Farm Topics, March and April, Vol.2, No.2, 1944, p.4-5.



**Figure 9. Silage demonstration by Captain W F N Leighton at Maesmawr Hall Caersws Jan 6<sup>th</sup> 1940**

*Source: Geoff Charles Collection courtesy of the National Library of Wales*

The economics of silage making was measured not only by costs per ton produced but also by costs on a protein basis. Scientists at Aberystwyth estimated that on Welsh farms five or six tons of high quality silage would replace one ton of balanced concentrate for milk production. They further calculated that the cost per cwt. of high level digestible crude protein in silage was a third less than producing dried grass and forty per cent less than hay.<sup>449</sup> Both hay and silage had advantages and disadvantages for farmers; silage was very useful for self-feeding but more difficult to handle while hay was easier to transport. What farmers decided depended on personal preference, the type of farming and what machinery they could afford.<sup>450</sup>

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<sup>449</sup> W. J. Thomas, 'Silage Costs on Welsh Farms, 1941', op.cit., p.21; *Farmers Weekly*, 9 July 1948.

<sup>450</sup> Roscoe Howells, *Farming in Wales*, (London: David Rendel, 1967), p.72.

This chapter has shown that the complexity of strains of grasses and seed varieties required a combination of science and practical farming to ensure the most productive grass swards. Scientists needed farmers to undertake tests and trials in local conditions and farmers needed scientists to produce pedigree strains bred for specific purposes. Through well executed experimental work improvements in grassland, hill land and conservation gave farmers an understanding of the relevance of agricultural science to the industry and how productivity could improve year on year.

## CHAPTER SIX: SCIENCE AND SOIL MANAGEMENT

The whole business of agriculture is founded upon the soil; for the soil the farmer pays rent, and upon his skill in making use of its inherent capacities depends the return he gets for his crops.<sup>451</sup>

### 6.1 Introduction

Successful farming depended on many factors; prices, wages, and economic factors all played a part but it was considered that success ultimately depended on the kind of soil the farmer had to deal with and the use that he made of it. Soil research was considered a fundamental application of science and experiments and investigations intensified at the beginning of the twentieth century. Most farmers would have been able to make a basic soil map of their holdings to provide a practical classification such as high, medium or low lime status and use this knowledge for subsequent treatment. However, a scientific soil map was more difficult as it took into account many different properties assessed in the field and in the laboratory. These included texture and mechanical composition, moisture holding capacity in relation to clay soil, organic-matter content, and the content of minerals and colloidal matter. Physical, chemical and biological processes all contributed to the classification of soil and scientific studies allowed farmers to understand the soil's constitution and its nutritional value to the plant, enabling corrections of any inferior qualities.<sup>452</sup>

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<sup>451</sup> A. D. Hall, *The Soil, an Introduction to the Scientific Study of the Growth of Crops*, (London: Murray, 1915), p.1.

<sup>452</sup> G. W. Robinson, 'Soils', in J. A. Hanley, ed. *Progressive Farming Volume I*, (London: Claxton, 1951), p.1; A. M. G.A. WinklerPrins and J. A. Sandor, 'Local Soil Knowledge: Insights, Applications, and Challenges', *Geoderma*, Vol.111, 2003, pp.165-6; C. P. Burnham, 'The Soils of England and Wales', *Field Studies*, Vol.5, 1980, p.358; G. W. Robinson, 'Some Considerations on Soil Classification', *Journal of Soil Science*, Vol.1, No.2, 1950, p.150; A. D. Hall, *The Soil, an Introduction to the Scientific Study of the Growth of Crops*, op.cit., p.2, p.140 and p.261. The chemical analysis of a soil determinations amounts of the nitrogen, phosphorous, potassium, calcium, and (of less importance) of sodium, magnesium, iron, aluminium, chlorine and sulphur.

## 6.2 Soil Fertility Improvement

The fertility of soil means nothing more than its capacity to produce crops and the purpose of fertilisers is to increase fertility enabling better crops and a more productive and profitable system of farming.<sup>453</sup> For many generations farmers were convinced that lime was important and could be applied in a variety of conditions to the advantage of the crop and the land. At the beginning of the twentieth century the correspondent of the *Welshman* gave the following observation about science and the farmer:

Science in its youth did not exactly forbid the use of lime, but told us to beware of overdoing it. It could not be gainsaid that a certain amount of lime was serviceable to very wet, coal or peaty land, but in some cases farmers were warned to be careful. Lime, said Science, merely stimulates the soil for the time being, and in the absence of rich manures soon leads to exhaustion. With the advance of bacteriology, and other young 'ologies, Science has now begun to perceive that the farmer who used to give his land a few hundredweight of lime per annum must have possessed some strange gift of knowledge which until very recently has been denied to the learned. We often hear of the stupid ways of the farmer, and no doubt he is often far from being as observant and progressive as he ought to be. But is it not passing strange that the Scientist – the professed experimenter, observer, and reasoner – should occasionally be found as stupid as the farmer? Science has always known, or ought to have known, that every crop removes a certain quantity of lime from the soil, and that lime in the soil has a natural tendency to sink into the subsoil, or the drains. Surely then common sense should have told Science that the lime in the soil ought to be renewed according as it is exhausted.<sup>454</sup>

The character of soil is generally governed by the geology and as geological formation corresponded to a soil type, geological maps also served as soil maps and in some parts of Britain, especially Wales, rock is not far from the surface. It was considered that farmers in Pembrokeshire favoured soils overlying the Old Red Sandstone and when sufficiently limed to increase fertility, produced quality grassland. By grouping areas

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<sup>453</sup> G. W. Cooke, 'Recent Developments in the Use of Fertilizers', *AP*, Vol. XXIX, 1954, pp.117-20.

<sup>454</sup> *Welshman*, 11 October 1901.

together in terms of soil type and climate it was possible to give general advice on manuring and soil treatments. Hall's early twentieth century studies demonstrated the importance of lime and chalk for improving soil and his studies were seen to be the earliest attempts to quantify lime requirements of soils defining that any soil containing less than one per cent calcium carbonate would benefit from the addition of lime. This quantification was acceptable at the beginning of the twentieth century but as the concepts of soil pH and soil-acidity complexes developed alongside methods of testing, the quantification of lime requirements was more accurate by the 1930s.<sup>455</sup>

Soil analysis was important to enable the intelligent use of manures and fertilisers as however experienced a farmer was, it was difficult to assess the need for lime. By basing liming policy on a soil analysis farmers could ensure that fields were brought up to an adequate lime status for crops and avoid the use of unnecessary dressings and associated expense. Routine soil analysis reports also gave information on organic matter content, phosphoric acid, potash and nitrogen content and County Agricultural Organisers would send soil samples to the advisory chemists at no cost to farmers.<sup>456</sup>

However soil fertility was not solely about chemistry as physical conditions which regulate the supply of air and water as well as bacterial life were just as important for a fertile soil as the nutrient material it contained. As a rule it was not the soil's chemical composition which suited the farm for a particular crop but its mechanical texture, water-

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<sup>455</sup> A. D. Hall, *The Soil, an Introduction to the Scientific Study of the Growth of Crops*, op.cit., p.263; G. W. Robinson, 'Soils', op.cit., p.1; Margaret F. Davies, op.cit., p.99; L. Dudley Stamp, *Fertility, Productivity and Classification of Land in Britain*, op.cit., p.11; T. W. Walker, 'The Estimation of the Lime Requirements of Soils', *Journal of Soil Science*, Vol.3, No.2, 1952, p.261.

<sup>456</sup> G. W. Robinson, 'Soils', op.cit., pp.36-7; A. D. Hall, *The Soil, an Introduction to the Scientific Study of the Growth of Crops*, op.cit., p.289; Richard J. Colyer. *Man's Proper Study, A History of Agricultural Science Education in Aberystwyth 1878-1978*, (Llandysul: Gomer, 1982), pp. 54-55, the author notes that by the mid-1930s farmers were sending several hundred samples to Professor Fagan the advisory chemist at Aberystwyth.

bearing capacity and drainage. It was relatively easy to adjust the soil by applying manure but unsatisfactory texture was hard to rectify.<sup>457</sup>

A wide range of materials were available for liming; burnt lime, hydrated lime, ground limestone of varying degrees of fineness and calcium content, ground chalk and the waste limes of industrial origin. Quick lime, slaked lime, limestone and chalk all fulfilled the same function in agriculture, namely that of supplying lime (calcium oxide) to the soil. However, equal weights of these substances did not provide equal quantities of calcium oxide and the Fertilisers and Feeding Stuffs Advisory Committee recommended that suppliers should not only state the percentage of purity of the article but also the pure lime equivalent so the purchaser could have a comparative value. Although scientists found that the differences in the forms of lime were unimportant, experiments revealed that blast-furnace slag and shell sand were slightly inferior and coarse ground limestone appeared to be equally as effective as finely ground limestone.<sup>458</sup>

In the first two decades of the twentieth century farmers were able to get advice on improving the soil by attending local lectures. An instructive lecture on the manuring of grassland was given by Mr F Shrivell of Golden Green, Tonbridge, to the North Pembrokeshire Farmers' Club in March 1910. The lecturer explained to farmers that farmyard manure was good and 'it never went on the wrong place and did everything required except that it was deficient in lime'. Farmers were also told that chemical fertilisers on pasture were very economical provided that the land was properly supplied with phosphates, lime and potash. Additional practical advice was also offered: nitrate of soda should be used judiciously in early spring and from one to two cwt. per acre gave a

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<sup>457</sup> A. D. Hall, *The Soil, an Introduction to the Scientific Study of the Growth of Crops*, op.cit., p.167 and pp.233-34.

<sup>458</sup> T. W. Walker, op.cit., pp.262-3; PP 1925 (Cmd.2470) Report of the Fertilisers and Feeding Stuffs Advisory Committee, p.19.



greatly increased bulk of herbage; phosphatic dressing should be used in the autumn or early winter; phosphates encouraged the growth of finer grasses and clovers; if Kainit was used, four cwt. per acre should be applied.<sup>459</sup>

Another lecture entitled 'Manures and how to utilise to the best advantages' was held at Brynamman in May 1918 and Carmarthenshire farmers and horticulturists were informed that nitrogen develops stems and foliage, whereas phosphate develops roots.<sup>460</sup> At a lecture entitled 'Artificial Manures' held in Carmarthen in May 1910, Mr Cowie, a representative of the Potash Syndicate, London, explained that lime helped the soil physically and 'it would bind together light soils and open heavy soils' and counteracted any acidity or sourness and therefore sweetened the soil. During this lecture Mr D.H. Thomas of Starling Park remarked on the decrease in lime used and it was disappointing to see the lime kilns disappearing. He thought this a great mistake because 'his cow would tell him that she preferred lime to anything else'.<sup>461</sup>

Some farmers were criticised for not applying the new agricultural science available to them and that they would be able to increase the yield of their land with better scientific assistance and education. Reports indicated that some farmers who were applying the best scientific methods were producing more than their neighbours on similar land. Having a greater understanding of the right crops to grow and the best manures to use meant that some farms doubled their production.<sup>462</sup> However some farmers stuck by the traditional methods that in their minds worked well and unfortunately this stubbornness hindered the realisation that different practices may also work and could even work better on their farms. It was the scientists' responsibility to communicate effectively what could

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<sup>459</sup> *County Echo, Fishguard and North Pembrokeshire Advertiser*, 31 March 1910. Kainit is a crude potash salt and was used as a cost effective fertiliser for grassland, forage crops and sugar beet.

<sup>460</sup> *Amman Valley Chronicle*, 16 May 1918.

<sup>461</sup> *Carmarthen Weekly Reporter*, 6 May 1910.

<sup>462</sup> *Carmarthen Weekly Reporter*, 24 October 1913.

help and often enlisted the help of the County Organisers to add local knowledge to scientific theory and to let the farmer know what advice was available. The correspondence files of the Agricultural Organiser for Pembrokeshire show numerous requests for soil analysis from farmers in the county. For example the soil sample from Roft Fach, Wolfscastle was analysed at Aberystwyth and the results reported back to the farmer showing levels of the potash, nitrogen and phosphoric acid and what the lime requirements were. The farmer was advised:

...the field is short of lime and also potash. The field needs 3 tons per acre of burnt lime and should have 2 cwts per acre of muriate of potash, or sulphate of potash by next March. Afterwards the field should have 1½ cwt of muriate of potash (or sulphate of potash) every time you use superphosphate (or slag).<sup>463</sup>

Soils on a single farm could also differ from field to field; the soils of Big Pennywen and Stone Park at Home Farm, Stackpole, showed that the lime requirement was ½ ton and ¾ ton per acre respectively, and the County Agricultural Organiser also gave the added advice:

8 cwts of burnt lime per acre for Stone Park and 6 cwts for Big Pennywen will be needed, or if you are to use ground limestone then 15 cwts and 10 cwts are needed. Big Pennywen is running low in potash. Stone Park is not as badly off as Big Pennywen for phosphate manure but is very badly off for potash manures. The nitrogen supplies in Stone Park are less than normal and are small for a grass field. Stone Park is in poor condition.<sup>464</sup>

It was estimated that ninety-nine per cent of Pembrokeshire land was deficient in lime due to the excessive leaching resultant from heavy rainfall and therefore farmers were not so much interested in whether the soil was deficient in lime but wanted to know how

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<sup>463</sup> PA, PCC/SE/71/55, letter from W .E. D. Jones to Mr J Nicholas, Wolfscastle, 26 August 1938. Loss on Ignition analysis is used to determine the percentage organic matter content.

<sup>464</sup> PA, PCC/SE/71/55, letter from W. E. D. Jones to Mr Bennion, Stackpole, 8<sup>th</sup> October 1938.

much to use.<sup>465</sup> One farmer who sent a sample for analysis found that his land only needed 15 cwts per acre of Carbonate of Lime but had been applying it at the rate of 30 cwts per acre and was so impressed with the analysis and the cost saving that he wanted all his fields tested.<sup>466</sup> Farmers were glad to have the exact amounts of lime recommended instead of having to make wild guesses and the County Agricultural Organiser acknowledged that:

It looks as though farmers who have had lime requirement tests are talking to their friends and already are sending up the number of applications by leaps and bounds. As I was going down one road three times this month for lime tests and as I had only been once on that road previously in 18 years I asked the first farmer who had had the test if he had told his neighbours. He told me that he had as he was so pleased to know from the test the exact amount of lime to apply instead of having to make a wild guess.<sup>467</sup>

To be effective liming must be carried out regularly but in times of low agricultural income it was often neglected and by the 1930s the Ministry of Agriculture recognised that there was a lime deficiency which needed to be addressed. As a result, the Agriculture Act 1937 included provision for a Land Fertility Scheme which provided farmers with contributions towards the cost of purchasing lime. Within a few weeks of the Scheme's inception, applications were being received at the rate of over one thousand a day and during the nine months September 1937 to May 1938 there were 207,000 applications from 140,000 farmers, who had used 1,395,000 tons of lime and 409,000 tons of basic slag. By the end of November 1938 there had been 300,000 applications which represented 2,160,000 tons of lime and 577,000 tons of basic slag. It was estimated that the quantity of

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<sup>465</sup> Margaret F Davies, *op.cit.*, p.123.

<sup>466</sup> PA, PCC/SE/71/55, letter from W. E. D. Jones to Professor Fagin, 9<sup>th</sup> November 1937.

<sup>467</sup> *Ibid.*

lime used on the land was four times greater than the previous season and the use of basic slag had increased by seventy per cent.<sup>468</sup>

Prior to the introduction of the subsidy the price of lime made it impossible for farmers to use sufficient lime on their farms. The consequence of this was seen in the investigation of the soils in Mid-Wales where two thousand soils were examined and ninety-four per cent were found to be acidic. Following liming the improved chemical properties of the soil influenced the chemical composition of the plant and in turn improved the quality of the food to the grazing animal.<sup>469</sup> The Pembrokeshire Agriculture Committee asked the Agricultural Organiser to advertise in the press that farmers could have advice on their soils under the Land Fertility Scheme. He was, however, reluctant to do so as he had already far more requests than he could handle and it was a stipulation of the Advisory Chemist at Aberystwyth that all samples must be representative of the field and a member of staff had to visit the farm and take the sample.<sup>470</sup>

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<sup>468</sup> *The Agricultural Register*, Oxford Agricultural Economics Research Institute, 1939, p.236; Joan Thirsk, Gen. Ed., *The Agrarian History of England and Wales, Vol. VIII, 1914-39*, op.cit., p.327, the author notes that even these levels of lime and basic slag was a token of what was required for the general shortage of minerals in the country's grassland

<sup>469</sup> T. W. Fagan et.al., 'The Influence of Liming on the Herbage of Acidic Soils in Merionethshire', op.cit., pp.144-45.

<sup>470</sup> PA, PCC/SE/77/56, 19 April 1938.



**Figure 10. Liming from a sledge at Llawr-y-glyn 1940**

*Source: Geoff Charles Collection courtesy of the National Library of Wales*

For farmers to increase production they were able to use the soil analysis reports to make the best use of the lime and fertiliser supplies available. It was recommended that fields intended for arable crops should have priority for lime. The advice given was: Phosphatic fertilisers should be used for sugar beet, potatoes, kale, cabbage, rape or grass and clover; full allocation of potash should be given for growing potatoes flax or fibre, beans and market garden crops; when lime, phosphate and potash requirements are good then nitrogenous fertilisers were to be used for hay, swedes, wheat, oats and barley and in higher amounts for potatoes, sugar beet, mangolds, cabbage and kale rape.<sup>471</sup>

A large number of field trials established that liming was a useful treatment of finger and toe (clubroot), a destructive plant-disease which attacks cabbages and turnips. However advice to farmers was diverse ranging from applying thirty five bushels of quick lime if the disease was slight and up to eight tons if the disease was prevalent, or using a

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<sup>471</sup> NLW C43/34 Farm Topics, Jan and Feb, Vol.2, No.1, 1944, p.4.

combination of superphosphate with basic slag. The lack of comparable data impeded the advisory work although the experiments did demonstrate that the disease favoured acidic soils and alkaline conditions partially or wholly inhibited it.<sup>472</sup>

Other field experiments compared the effects of sulphate of ammonia with nitro-chalk as nitrogenous fertilisers on yields of pastures and showed nitro-chalk to be superior.<sup>473</sup> However John Price, a Milk Marketing Board consultant in the 1940s, recalled that he recommended using sixteen per cent nitro-chalk to a Carmarthenshire farmer as it was granulated and easy to sow and if put on in February the cows should be out to grass by mid-March with consequent increase in milk yield and reduction in feeding cost. This ‘early bite’ was intended to extend the grazing season but the Carmarthenshire farmer was not really interested in increased yields and replied ‘no man eats two dinners’.<sup>474</sup>

Andre Voisin, a French biochemist and farmer, considered fertilisers to be the most important discovery of modern chemistry and when applied correctly could raise soil fertility, increase crop yields and improve the feeding value of agricultural produce. However, if these chemical or artificial mineral fertilisers were unwisely used they could become highly dangerous, destroy fertility, impair the feeding value of agricultural products and adversely affect both human and animal health.<sup>475</sup> Lord Northbourne agreed:

It has been truly said that the food we bought in this country for a hundred years past has been the dearest ever bought by any nation. It has in fact cost us our health and vitality. It may even have cost us our empire and our nationhood.<sup>476</sup>

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<sup>472</sup> T. Whitehead, ‘Experiments on the Use of Lime in Controlling Finger and Toe Disease of Brassicae’, op.cit., ; *Carmarthen Weekly Reporter*, 6 May 1910.

<sup>473</sup> T. Emlyn Jones, ‘Sulphate of Ammonia Compared with Nitro-chalk as a Nitrogenous Fertilizer on an Open Hill Molina Pasture’, *WJA*, Vol. IX, 1933, pp.191-95.

<sup>474</sup> Oral testimony, Mr John Price, Fishguard, 9 November, 2013.

<sup>475</sup> Andre Voisin, *Fertilizer Application*, (London: Crosby Lockwood, 1965), pp.1-2.

<sup>476</sup> Lord Northbourne, *Look to the Land*, (Hillsdale NY: Perennis, 2003, 2<sup>nd</sup> revised edition, original publication 1940), p.39.

### 6.3 Organic Farming

Farmers interviewed during the research for this thesis all commented that they could not afford to be organic farmers and the use of artificial fertilisers was necessary for the maximum yield of crops and quality grassland. However Newman Turner argued that his organic farm, which he converted in the early 1940s, was free of disease, had less capital outlay, a reduction in labour costs, and had a significant saving in the cost of manure and veterinary bills. Along with these savings he also experienced increased yields and advocated that fertility farming was within the reach of any farmer and considered the ‘get-rich-quick’ methods of commercialised science ‘a snare’.<sup>477</sup>

The organic agriculture movement was often criticised for its anti-scientific perspective and that the pioneers of the British organic movement were ignored and their ideas disregarded by its opponents. However, it was claimed by Conford that organic pioneers had ample opportunity to express their views which were thoroughly debated and the artificial fertiliser industry in particular took organic ideas very seriously as it was seen as a threat.<sup>478</sup> The term ‘organic farming’ was first coined by Lord Northbourne in his 1940 publication *Look to the Land*, and was the name given to ‘alternative agriculture’ described as being a philosophy as well as a non-polluting method of farming for a healthy fertile soil.<sup>479</sup> The development of organic farming began early in the twentieth century on the basis of the ideas of, amongst others, R Steiner’s agricultural course (1924) as the basis for Bio-dynamic agriculture, Sir Albert Howard’s *Agricultural Testament* (1943) and Lady Eve Balfour’s *Living Soil* (1943) that led to the foundation of the British Soil Association

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<sup>477</sup> Newman Turner, *Fertility Farming*, (London: Faber and Faber, 1952), pp.19-20.

<sup>478</sup> Philip Conford, ‘The myth of neglect: responses to the early organic movement, 1930-1950’, *AHR*, 50(1), 2002, pp.89-91; Philip Conford, ‘Science, organic husbandry and the work of Dr David Hodges’, *AHR*, 59(2), 2011, p.217.

<sup>479</sup> Margaret C. Merrill, ‘Eco-Agriculture: A Review of its History and Philosophy’, *Biological Agriculture & Horticulture*, Vol.1, Issue 3, 1983, pp.183-86, the terms organic and chemical have various meanings but chemical was used as the name for conventional agriculture because of its dependence on manufactured fertilizers and biocides.

which was regarded as the true beginning of an organised organic movement in Britain.<sup>480</sup> Lady Balfour had been conducting private trials concerning the use of fertilisers and natural farm residues on a farm at Haughley which she then gave to the Soil Association to continue the experimental and demonstration work. The Soil Association advocated that for science to be good science it must respect natural processes and ecology. As Howard commented ‘the crucial test of real scientific achievement is whether it recognises and respects the supremacy of Mother Earth’.<sup>481</sup>

Sir Albert Howard was a British agricultural scientist, and Rudolf Steiner, an Austrian mystic and philosopher. They independently created a farming system that relied on compost and avoided chemicals. Howard called his the Indore Process and Steiner’s became the basis of the Biodynamic Method.<sup>482</sup> The dominant themes for the early organic writers in the 1930s and 1940s was the ‘humus versus chemicals’ controversy, for agricultural research to be based on health rather than pathology, for soil and plant ecology rather than chemistry, and for legislation requiring fertilisers to be tested for their effects on soil population and fungal activity.<sup>483</sup>

Steiner commented that science needed ‘peasant wit’ ‘what the peasants and farmers thought about their things far wiser than what the scientists were thinking. He also considered that spiritual forces at work within the soil, plants and animals were as important as the physical components.’<sup>484</sup> Sir Albert Howard did not share Steiner’s

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<sup>480</sup>Rudolph Steiner, *Agricultural Course, the Birth of the Biodynamic Method*, (Rudolph Steiner Press, reprinted 2011); E. B. Balfour, *Living Soil*, (London: Faber, 1943); Sir Albert Howard, *An Agricultural Testament*, (London: OUP, 1950).

<sup>481</sup> Erin Gill, ‘The impact of the early British organic movement’s anti-science bias and New Age religious beliefs on relations with agricultural scientists and policy makers’, *The Environmental Histories of Europe and Japan*, 2010, seminar proceedings of the Oxford-Nagoya Environmental History seminar, p.205

<sup>482</sup> Suzanne Peters, ‘Organic Farmers Celebrate Organic Research: A Sociology of Popular Science’, in Helga Nowotny and Hilary Rose, eds, *Counter-movements in the Sciences, Vol.III*, Boston: Reidel, 1979, p.252.

<sup>483</sup> Tracey Clunies-Ross, ‘Agricultural Change and the Politics of Organic Farming’, (unpublished PhD thesis, University of Bath, 1990), p.122; E. B. Balfour, *Living Soil*, op.cit., p.69 and p.185.

<sup>484</sup> Rudolph Steiner, op.cit., p.64; Tracey Clunies-Ross, op.cit., pp.125-26



mysticism labelling it ‘muck and mystery’ and as he was foremost a scientist did not support the secular concessions of Steiner’s movement. However, he was disillusioned with traditional research and believed that there was a wide chasm between science in the laboratory and practice in the field and suggested that unless the gap could be bridged then real progress could not be made to control plant disease.<sup>485</sup> He thought that agricultural chemistry was unsound and that inorganic fertilisers altered soil microbiology which resulted in the deterioration of soil quality and lowered disease resistance in crops.<sup>486</sup>

There were many who felt that agriculture should be dominated by biology and ecology rather than by chemistry and technology.<sup>487</sup> When Hyams first published *Soil and Civilization* he commented that ‘conservationists were called cranks, ecology was a word you would have had to look up in the dictionary, and the word “environmentalism” had yet to be coined’.<sup>488</sup> He also stated that the use of the word ‘scientific’ was confusing when used in connection with farming and that the expression ‘scientific farming’ had assumed the significance of ‘good farming’. He further commented:

Science in agriculture is good when the approach of the scientific specialists to the subject is controlled by an ecologist, or by an ecological point of view; when it is biological rather than mechanical; when the scientist’s respect for husbandry is profound; his education humane and philosophical; his methods controlled by empirical trials.<sup>489</sup>

He thought scientific farming in the early twentieth century was poor farming practice and he chose to redefine the term ‘scientific’ in that he used the term ‘scientific agriculture’ to mean the proper application of biologically biased knowledge to soil problems and ‘industrial agriculture’ for what he considered the old scientific agriculture

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<sup>485</sup> Sir Albert Howard, *The Soil and Health: A Study of Organic Agriculture*, (Oxford City Press, reprinted 2011), p.4-5.

<sup>486</sup> Erin Gill, op.cit., p.201.

<sup>487</sup> Margaret C. Merrill, op.cit.,p.193.

<sup>488</sup> Edward Hyams, *Soil and Civilization*, (London: Murray, 1976), p.v.

<sup>489</sup> Ibid., p.127.

and abuse of the soil. He accused the agricultural industrialist of regarding the soil as an inexhaustible source of wealth and using machines and chemicals to make money, views which he considered arose from the sophisticated urban community and not the countryside.<sup>490</sup>

Balfour stated that ‘...health, whether of soil, plant, animal or man, is one and indivisible’ and that any study concerning health must be qualitative and not quantitative.<sup>491</sup> She suggested that only the true peasant, ‘the man who, despite all modern agricultural science, still has a truer understanding of the soil than any theorist’ and was not taken in.<sup>492</sup> As expressed in Adrian Bell’s *Men of the Fields*:

If people ate more of what’s grown with muck, there’d not be half the illness about. People say what’s grown with artificial manure does you as much good as what’s grown with muck. But I know that’s wrong. What’s grown with chemicals may look all right, but it ain’t got the stay in it.<sup>493</sup>

Balfour thought Liebig’s mineral theory was naïve and that intuitive method had been replaced with scientific procedures helped by the volume of ammonia and synthetic fertilisers made available from the manufacturers of explosives after World War One. Howard and his supporters argued for farmers to adopt composting at a time when farmers were also being urged by this emerging agri-chemical industry to apply inorganic fertilisers based on nitrogen, phosphorus and potassium (NPK). Inorganic fertilisers were promoted as the modern, scientific and easy to use solution for farmers’ needs to maximise crop yields and the NPK fertilisers generally produced rapid and noticeable effects increasing

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<sup>490</sup> Ibid., p.128.

<sup>491</sup> E. B. Balfour, *The Living Soil and The Haughley Experiment*, (New York: Universe Books, 1975), pp.11-12.

<sup>492</sup> E. B. Balfour, *Living Soil*, op.cit., p.48.

<sup>493</sup> Adrian Bell, *Men and the Fields*, (Stanbridge: Little Toller Books, 2009), p.148.

crop yields and plant growth and was scornfully referred to as the ‘NKP mentality’ based on experiments at Rothamsted.<sup>494</sup>

Howard questioned the relevance of the scientific trials at Rothamsted suggesting there were major mistakes with the experiment designs: the size of the plots did not represent British farming; the small strips of land were not kept weed free; the plots were not isolated to prevent burrowing animals; and the manurial scheme influenced the soil and not the plant and therefore disregarded one of the most important factors of the trial – the wheat plant itself.<sup>495</sup>

It was suggested that the role of scientific research was to provide farmers with a clearer understanding of the biological processes. From the eco-agriculture point of view this scientific and holistic approach to farming should be controlled by the farmer’s own common sense drawing on accumulated knowledge and experience as well as details of modern science such as balancing minerals, rebuilding nutrient cycles and managing soil organic matter and humus. Merrill advocated that agriculture was a creative process as it was a biological and living system rather than a technological and industrial one.<sup>496</sup> Lord Northbourne suggested that a real farmer had a feeling for true fertility, which is health; but some farmers had been led or forced into accepting a commercial outlook which degraded farming to the status of a manufacturing industry.<sup>497</sup>

While many thought the use of artificial fertilisers harmful to human health and soil the majority of agricultural scientists remained convinced their proper use was necessary for improved productivity and therefore only a minority of farmers changed practices. Padel’s study of the conversion to organic farming argues that there was a slow diffusion

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<sup>494</sup> E. B. Balfour, *Living Soil*, op.cit., pp.48-49; Erin Gill, op.cit., p.201; Lord Northbourne, op.cit., p.96

<sup>495</sup> Sir Albert Howard, *The Soil and Health: A Study of Organic Agriculture*, op.cit., pp.74-76.

<sup>496</sup> Margaret C. Merrill, op.cit., pp.186-205.

<sup>497</sup> Lord Northbourne, op.cit., p.55.

rate rather than an outright rejection of the adoption of the organic movement because it was a complex system change which challenged common agricultural practices and values and therefore implied high risk with low profit, a consequence not well accepted by farmers in West Wales.<sup>498</sup> Brynlllys Farm near Aberystwyth had been farmed according to organic principles since the 1940s and in 1952 became the first dairy farm to be certified as organic by the Soil Association.<sup>499</sup> Conversion to organic farming was difficult in Wales because of the older methods and attitudes of generations of family involvement that were resistant to change.<sup>500</sup> Here, as mentioned earlier, was another example of the traditional methods that were working well and therefore hindered change.

This chapter has shown how farmers used knowledge of the chemistry of fertilisers to improve their soil fertility. The period saw the commencement of balanced fertilisers being used and the scientist, the County Agricultural Organiser and the farmers working together to optimize the quality and utilisation of the soil. By attending lectures and requesting soil analyses it is acknowledged that farmers had an understanding of the problems poor soil would have on their productivity and looked for solutions from the scientist. The evidence shown here distinctly shows the importance of soil management and although this period saw the beginnings and growth of the organic movement, it was evident that organic farming was not a feature on the farms in West Wales in the decades of this study.

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<sup>498</sup> Susanne Padel, 'Conversion to Organic Farming: A Typical Example of the Diffusion of an Innovation?', *Sociologia Ruralis*, Vol.41, Number 1, 2001, p.56.

<sup>499</sup> Selyf Lloyd Morgan, 'Developing the Welsh Organic Sector: Knowledge Generation and Learning', (unpublished PhD thesis, Cardiff University, 2007), p.99. Brynlllys farm was the basis of Rachel's Organic Dairy Ltd. The author also notes that the new wave of organic pioneers did not become established in West Wales until the 1970s.

<sup>500</sup> *Ibid.*, pp.128-29.

## CHAPTER SEVEN: THE DISSEMINATION OF INFORMATION

### 7.1 Introduction – The Diffusion and Adoption of New Methods

The dissemination of information to farmers in the decades of this study took on many forms and could be classed as both formal and informal or institutional and non-institutional. Universities, colleges and farm institutes provided the agricultural degrees and diplomas, County Councils provided local classes and lectures and societies, clubs and shows all had an educational element within their organisation. Personal contact between farmers assisted in the dissemination of information however, it was known that many farmers were reluctant to discuss their work with neighbours and the farmer next door would not ask because he didn't want to pry. Farmers were regarded as being discerning in choosing whose advice would influence their decision making. As Gwyn Jones commented, 'farmers undoubtedly acquire some knowledge by "talking over the hedge", but they are selective in choosing whose hedge it shall be.'<sup>501</sup>

In this study the diffusion of information suggests spreading the new practice in a social and geographical sense; the social diffusion of knowledge from the scientist, teacher or advisor to the farmer; and the geographical diffusion where the innovation spreads from earlier adopters or progressive farmers in the county.<sup>502</sup> This geographical diffusion was a challenge; contacts amongst farmers and labourers were important but as some did not travel far from home or even go to neighbouring market towns, contacts were severely limited, a factor that Colyer suggests had been responsible for Welsh agriculture being 'in

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<sup>501</sup> PP 1908 (Cd.4207) Departmental Committee on Agricultural Education in England and Wales, p.514; Gwyn E. Jones, 'Sources of Information and Advice Available to United Kingdom Farmers: Description and Appraisal', *Sociologia Ruralis*, Vol.3, Issue 1, 1963, p.57.

<sup>502</sup> Gwyn E. Jones, 'The Diffusion of Agricultural Innovations', *Journal of Agricultural Economics*, Vol.15, No.3, 1963, pp.387-88.

a state of almost medieval simplicity throughout much of the nineteenth century'.<sup>503</sup>

Although there was an allusion that Welsh farmers were clinging to obsolete farming methods there was also a defiant opinion that Welsh farmers were far ahead of the English farmers in ploughing and thatching and the 'lads of Wales could plough as well as anybody'.<sup>504</sup>

When a farmer did not adopt a technique that was commonly used, and generally recommended, it was often attributed to a resistance to change. However, this characteristic of resistance was often observed from the standpoint of the scientist or technical expert with the farmer's opinion of the suitability of the technique not always being given acknowledgment or full consideration.<sup>505</sup> Contradictions surrounded Welsh farmers; some considered the Pembrokeshire farmers lacked initiative while others described them as ready to embrace any new method that resulted in profit. Although farmers were said to regard science as unpractical, they also acknowledged that agriculture could not be practical unless it was scientific and based on verified facts.<sup>506</sup>

Farmers would have been more likely to adopt an innovation if it offered them a better way to do something, could be tried out before adoption, had observable benefits preferably under conditions similar to their own and was well communicated. This process is well documented and generally the elements agree. Rogers describes the innovation-decision process in five steps - knowledge, persuasion, decision, implementation and confirmation, and the result of the process would lead either to adoption or rejection.

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<sup>503</sup> Stuart Macdonald, 'The Diffusion of Knowledge among Northumberland Farmers, 1780-1815', *AHR*, 27(1), 1979, p.33; James Caird. *English Agriculture in 1850-51*, (London: Cass, 1968), p.xxxii; Gwyn E Jones. 'The Nature and Consequences of Technical Change in Farming', *Folk Life*, No.3, 1965, p.83; James Morris. 'Welshness in Wales', *Wales*, No.32, 1958, pp.15-16; Richard J. Colyer, *Man's Proper Study*, op.cit., p.154.

<sup>504</sup> *Welsh Gazette and West Wales Advertiser*, 19 December 1907.

<sup>505</sup> C. V. Dadd and L. W. Osborne, 'Factors Influencing the Choice of Cereal Varieties', *Outlook on Agriculture*, Vol.2, 1958, p.3; D. Sheppard, 'Farmers' Reasons for not Adopting Controversial Techniques in Grassland Farming', *Grass and Forage Science*, Vol.16, Issue 1, 1961, p.6.

<sup>506</sup> *Haverford and Milford Haven Telegraph*, 8 April 1914; *Welsh Gazette and West Wales Advertiser*, 19 December 1907.

Jones' model describes the process as - awareness, interest, evaluation and trial and adoption. Similarly, Schlebecker's model is - accumulated knowledge, evident need, economic possibility and cultural and social acceptability.<sup>507</sup>

Although this study shows strong evidence that acknowledges the many ways that Welsh farmers changed and adopted agricultural science and technology it also acknowledges that some failed to adopt new methods for cultural and social reasons and a reluctance to deviate from traditional methods that worked well. Some farmers had no enthusiasm for new methods or disliked change and some Welsh monoglot nonconformist tenant farmers had little in common with their often English speaking Church of England landlords.<sup>508</sup>

This chapter shows how agricultural education evolved in the first half of the twentieth century and the diverse ways that education was disseminated within the farming community.

## 7.2 Agricultural Education

There was an opinion that most farmers frowned upon formal education and that in agriculture, more than any other trade, the present generation has been educated by the last and was engaged in the education of the next. Many thought that experience and not scientific knowledge or literature led to successful farming.<sup>509</sup> It was also argued that agricultural education only begins on the farm and never finishes and even the oldest and

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<sup>507</sup> Everett M. Rogers, *Diffusion of Innovations*, (New York: Free Press, 1995), pp.10-11, p. 21 and p.355. The theories discussed by the author are applicable to almost any field and refers to on-farm and experimental demonstrations.; Gwyn E. Jones. 'The Diffusion of Agricultural Innovations', op. cit., p.388 fn; John T Schlebecker. 'Farmers and Bureaucrats: Reflections on Technological Innovation in Agriculture', *AH*, Vol. 51, No.4, 1977, p.650.

<sup>508</sup> Stuart Macdonald. 'The Diffusion of Knowledge among Northumberland Farmers, 1780-1815' op. cit., pp.35-36; R. J. Colyer. 'Early Agricultural Societies in South Wales', op.cit., p. 574; A.G. Street, *The Farmers Weekly*, 16 January 1948, p.35.

<sup>509</sup> J Chalmers Morton, 'Agricultural Education', *JRASE*, Vol. 1, 2<sup>nd</sup> series, 1865, p.442; John Martin, *The Development of Modern Agriculture*, (Basingstoke: Macmillan Press, 2000), p.23; *Haverfordwest and Milford Haven Telegraph*, 8 April 1914.

most enlightened farmer of his generation is a learner to the end of his days.<sup>510</sup> A south Pembrokeshire farmer commented that a good stockman or farmer cares for his animals so eagerly he knows each one's individual needs and knows each by name. Even when the animals moved to other farms, a year later the farmer could still recognise each one when he saw them. He postulated that 'colleges can't teach you that! You can't train that!'<sup>511</sup>

Research studies have shown that better-educated farmers were known to make greater use of information, advice, and training. However there were many successful farmers who were proud to have left school at fourteen years of age and not attended college. John Davies, a North Pembrokeshire farmer, received a basic elementary education until the age of fourteen and was never offered short courses or further education. Although he had not had formal technical training he took a great interest in agricultural activities in the area, was a committee member of the Royal Welsh Agricultural Show and went on to be the president of the Pembrokeshire branch of the NFU.<sup>512</sup> Studies have shown that fewer than ten per cent of farmers who were born before the First World War had formal agricultural qualifications and for those born in the inter-war years three studies showed that only between ten percent and thirty percent of farmers gained formal qualifications and the numbers were lower in Wales as compared to England and Scotland.<sup>513</sup>

Agricultural education was defined as:

...the bringing up, training and instruction of adults of both sexes in the sciences and their application to agriculture, the art and practice of cultivating the land for the production of crops and as including stock, poultry, dairy husbandry, horticulture, the various manual processes connected with the art and craft of

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<sup>510</sup> *The Times*, 1 December 1930.

<sup>511</sup> Oral testimony of George Mathias, Somerton Farm.

<sup>512</sup> John Davies, 'Oes o Ffermio yng Ngogledd Penfro', *JRWAS*, Vol. XXVIII, 1959, p.42.

<sup>513</sup> Ruth Gasson, 'Educational Qualifications of UK Farmers: A Review', *Journal of Rural Studies*, Vol.14, No.4, 1998, pp.487-93.



farming, the care and use of agricultural implements and machinery, the establishment of advisory services in relation to matters arising in the agricultural industry, the provision of lectures and demonstrations and the establishments of discussion groups and clubs.<sup>514</sup>

Agricultural education in the nineteenth century was directed by privately endowed institutions such as the Royal Agricultural College, Cirencester, and the Rothamsted Experimental Station and it was only in the 1880s that the government provided financial support. The Local Taxation (Customs and Excise) Act of 1890 gave the newly created county councils an unexpected source of funding for technical and agricultural education and over £1,000,000 of whisky money was made available to be used to create agricultural colleges, university chairs and county extension schemes at the turn of the century. The newly formed Board of Agriculture also disbursed a grant of £5000 towards agriculture and dairy schools.<sup>515</sup>

Formal or institutional education began with the foundation of the university departments of agriculture; Bangor was the first in 1889, followed by Leeds in 1890, Newcastle and Aberystwyth in 1891, Nottingham in 1892 and Reading and Wye in 1894.<sup>516</sup> Both Aberystwyth and Bangor offered extension lectures in all aspects of agriculture covering livestock, dairying, soils, manures and disease.<sup>517</sup> Attendance at the Aberystwyth lectures was very poor and described as ‘too chemical and not basic

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<sup>514</sup> PP 1942-43 (Cmd.6433) Report of the Committee on Post-War Agricultural Education in England and Wales, p.6.

<sup>515</sup> Paul Brassley, ‘Agricultural Science and Education’, in Joan Thirsk, Gen. Ed., *The Agrarian History of England and Wales, Volume VII, Part 1*, op.cit., pp.625-26; Charles Lawrence, ‘The Royal Agricultural College of Cirencester’, *JRASE*, Vol.1, 2<sup>nd</sup> series, 1865, pp.1-9, for detailed history of the foundation and funding Paul Brassley, ‘Agricultural Science and Education’, op.cit., p.629; P. R. Sharp, ‘Whiskey Money and the Development of Technical and Secondary Education in the 1890s’, *Journal of Educational Administration and History*, 4(1), 1971, p.31.; Susan Foreman, *Loaves and Fishes, an illustrated History of the Ministry of Agriculture, Fisheries and Food, 1889-1989*, (London: HMSO, 1989), p.7; R. J. Colyer, ‘Early Agricultural Societies in South Wales’, op.cit., p.577, the Welsh counties concentrated their efforts to improve local methods of butter and cheese-making to counteract an increasing public taste for Danish and American imports.

<sup>516</sup> Paul Brassley, ‘Agricultural Research in Britain, 1850-1914: Failure, Success and Development’, *Annals of Science*, 52(5), 1995, p.469; PP 1896 (C.8221) Report of the Royal Commission on Land in Wales and Monmouthshire, pp.801-06.

<sup>517</sup> PP 1896 (C.8221) op.cit., pp.804-07.

enough'.<sup>518</sup> Similarly Mr J. E. Jones, honorary secretary to the Tregaron Farmers' Club found that the lectures were too advanced for the people they were intended for and if they were to be of any use they must be entirely in Welsh and be very simple.<sup>519</sup> When dairy lectures were not well attended, the Royal Commissioners assumed that farmers' wives were slow to adopt the new methods and not that they knew how to make butter better than the lecturer could.<sup>520</sup> However, there were observed improvements of butter and these improvements were thought to be because of the lectures. A leading butter merchant in Caernarvonshire commented that the dairy demonstrations and lectures had opened the eyes of farmers, their wives and daughters which resulted in a marked improvement of butter and recommended more lectures throughout Wales to benefit the country.<sup>521</sup>

Some of the classes were not well attended because either they were too distant from the farm or were not well advertised. However, the Royal Commissioners considered the extension lectures and dairy schools to have been appreciated: Mr Owen Brigstocke, landowner and former Chairman of Carmarthen County Council thought the lectures by Professor Parry were intelligible and beneficial; Mr John Morgan Davies of Froodvale, Carmarthen, a land agent and surveyor, thought it would be a good thing to educate the farm children more in science and that Professor Parry 'manages to use the Welsh language for scientific purposes better than anyone I ever heard'; and Mr Hugh Hughes,

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<sup>518</sup> PP 1895 (C.7661) Royal Commission on Land in Wales and Monmouthshire, Minutes of Evidence, Vol. III, evidence of Dr Richard Harding, p.996 q.54373-54387, p.997 q.54397.

<sup>519</sup> Ibid. p.566, q.46654.

<sup>520</sup> PP 1894 (C.7439) 1894, Royal Commission on Land in Wales and Monmouthshire, Minutes of Evidence, Vol. II, p.860, q.35746-8.

<sup>521</sup> PP.1896 (C.8222) Royal Commission on Land in Wales and Monmouthshire, Minutes of Evidence, Vol. V p.450, q77365, evidence of Mr T Winter, lecturer in agriculture University College of North Wales, Bangor

Penrhewl Farm, Tregeiriog, thought the farmers of the district took great interest and ‘eagerly availed themselves’ to hear them.<sup>522</sup>

By the beginning of the twentieth century both Aberystwyth and Bangor had established degree courses, diploma courses and several short courses. The short courses were geared towards farmers’ children who were needed on the farm and could not attend the longer diploma courses. These courses were said to strengthen the link between the agricultural departments of the colleges with the rural population.<sup>523</sup> There was a criticism that the teaching of agriculture was not conducted on the same lines as other subjects and that the ladies teaching dairy classes were not recognised by Aberystwyth College as belonging to the college staff and that the department was ‘a side-show run on quasi-independent lines’.<sup>524</sup>

There were numerous short courses at Aberystwyth and included Mendelian genetics and horse breeding, theoretical chemistry, dairy chemistry, veterinary science, and entomology. As well as scientific agriculture courses there were also courses covering the laws of property, the rights of creditors and the law of mortgages.<sup>525</sup> These courses were considered successful with students receiving distinctions and high commendations and the Reay Committee expressing that ‘there is nothing in Welsh agriculture of today so full of promise as the remarkable awakening that has taken place in connection with these classes’.<sup>526</sup> It was suggested that young men who studied the short courses were likely to make better farmers than those who stayed at home and the seven or eight weeks they had

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<sup>522</sup> PP 1896 (C.8221) *op.cit.*, p.812; PP 1895 (C.7661) *op. cit.*, p.962, q53482-7, p.396 q43336-7, p.45 q37559-37564; PP 1895 (C.7757) Royal Commission on Land in Wales and Monmouthshire, Minutes of Evidence, Vol. IV, p.23 q.55539.

<sup>523</sup> Paul Brassley. ‘Agricultural Science and Education’, *op. cit.*, p.634; Richard J. Colyer, *Man’s Proper Study*, *op.cit.*, p.58.

<sup>524</sup> *Western Mail* 16 April 1900; *Western Mail* 3 September 1900.

<sup>525</sup> NLW C1988/7 and C1988/25, 2-19 T J Jenkin Papers, Lecture Notes 1908-9, Extension courses at University College Wales, Aberystwyth.

<sup>526</sup> PP 1908 (Cd.4207) *op.cit.*, p.304.

at Aberystwyth influenced their farming and gave them more advanced views than those at home.<sup>527</sup>

However, there was criticism that the curricula in agricultural colleges were not efficient and in many 'the man teaching your son economic zoology is also the lecturer on economic biology and botany and probably teaching mathematics, mechanical engineering and bee-keeping as well'. It was further suggested that teachers were very often not more than a page in advance of the student.<sup>528</sup> The Committee considered the attitudes of farmers were changing and did not consider that farmers were against innovations because of fear or a distrust of theory and change but because they did not trust the teacher's information and wanted clearer and more accurate information.<sup>529</sup> They found that the current generation of farmers had a far greater interest in lectures and literature than their fathers who distrusted scientists and book farmers and were confident that a college education gave the practical farmer a great advantage.<sup>530</sup> However, agricultural education was still not directly affecting the majority of farmers and it was estimated that the colleges were not teaching more than five per cent of British farmers and were not addressing the attitudes and sentiments of those who still had no faith in scientific teachers, especially those who had no farming experience.<sup>531</sup>

To address some of the criticism the committee recommended that Farm Institutes should be established with a farm laid out to be typical of the district in order to provide the best way to encourage and promote improvements in cultivation. Examples of such improvements included profitable methods of manuring local soils, utilising the best varieties of crops, and recommending the best methods for rearing and feeding livestock

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<sup>527</sup> Ibid., p.313.

<sup>528</sup> Ibid., p.185 .

<sup>529</sup> PP 1908 (Cd.4206) Departmental Committee on Agricultural Education in England and Wales, pp.11-12 and pp.26-27.

<sup>530</sup> PP 1908 (Cd.4207) op.cit., p.206, p.344, p.348.

<sup>531</sup> PP 1908 (Cd.4206), op.cit., p.12; PP 1908 (Cd.4207), op.cit., p.184.

and for keeping poultry.<sup>532</sup> In accordance with the recommendations of the Reay Committee, the Board of Agriculture made grants to local authorities through the Development Fund to cover seventy-five per cent of the cost of building new farm institutes. The Madryn Castle Farm School in Caernarvonshire, which opened in 1913, was the first to benefit from this funding.<sup>533</sup>

By 1914 a basic framework for agricultural education was in place: there were universities and their agricultural departments to train the future research, advisory and education officers who needed a degree for their work; there were agricultural colleges for teaching diploma courses suited to the needs of those who intended to farm on a large scale; and Farm Institutes established by the County Councils which were concerned with courses lasting for one year and intended to meet the needs of the future smallholder and the farmers and farm workers who would take responsible posts on farms.<sup>534</sup>

Writing in 1915, C. Bryner Jones the Agricultural Commissioner for Wales considered that:

Want of education is unquestionably responsible for a great many of the farmer's problems. But, to do him justice, he is not to blame for his educational deficiencies. In far too many cases no means of education have been offered to him, and the surprising thing is that he holds his own as well as he does...the farmer of the future must be an educated man, who will be prepared to take full advantage of the services of science, and of the most modern methods of managing his farm as a business concern.<sup>535</sup>

His report to the Board of Agriculture and Fisheries in 1916 contained optimistic messages. He felt that because of the Board's grants to the agricultural departments of colleges and the Local Education Authorities in Wales, the progress was substantial and 'in some ways remarkable' and was a good example of how State aid could stimulate local

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<sup>532</sup> PP 1908 (Cd.4206), op.cit., p.25.

<sup>533</sup> PP 1942-43 (Cmd.6433), op.cit., p.17.

<sup>534</sup> Paul Brassley, 'Agricultural Education', op.cit., p.649; Ronald Ede, op.cit., p.250.

<sup>535</sup> C. Bryner Jones, 'Welsh Agriculture', *Welsh Outlook*, Vol.2, No.5, 1915 p.187.

agricultural development. He stressed that in order for this to be continued, agricultural education was a priority for the agricultural community and that education was essential for progressing methods to improve the agricultural produce in Wales.<sup>536</sup>

During the inter-war years agricultural education in Aberystwyth consisted of lectures on agriculture and veterinary hygiene, courses of instruction in dairying, the management of poultry, maintenance of the college farm, and demonstrations and field experiments.<sup>537</sup> However, in spite of the various formats of agricultural education courses it was still considered that farm workers were scarcely touched by any part of the education system.<sup>538</sup> It was further argued that farmers themselves were responsible for training farm labourers but the reality was that the boy who came to work on the farm was usually kept busy with the more mechanical jobs without any thought for his future education and the technical training was often neglected.<sup>539</sup> There were also financial constraints with agricultural labourers beginning to earn wages at the earliest possible moment and any continuing education would be financially hard for the family. The education courses available were deemed to be for farmers' sons and even the scholarships awarded by county councils tenable at agricultural institutions were not taken up by farm workers and were not generous enough to allow attendance at the farm institute.<sup>540</sup>

These scholarships were described as being not competitive and the only qualification necessary was a reasonable indication that the candidate was likely to benefit

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<sup>536</sup> PP 1916 (Cd.8222), *op.cit.*, p.39.

<sup>537</sup> C. Bryner Jones, 'The University College of Wales and Agricultural Education', in John Ballinger, Ed., *National Union of Teachers Souvenir of Aberystwyth Conference 1911*, London: The National Union of Teachers, 1911, pp.224-25.

<sup>538</sup> W. R. Smith, 'The Education of the Farm Worker', *JMA*, Vol. XXVIII, No.5, August 1921, pp.393-94.

<sup>539</sup> A. D. Hall, 'The Development of Agricultural Education in England and Wales', *JRASE*, Vol.83, 1922, p.34.

<sup>540</sup> Sir Thomas Dyke-Acland, 'The Education of the Labourer', in Charles Bathurst and John C. Medd, Eds, *Report of the Conference on Agricultural Education held at Gloucester, October 15<sup>th</sup> 1904*, Published by the Gloucestershire Education Committee, p.126; W. R. Smith, *op.cit.*, p.394.

by the course.<sup>541</sup> Scholarships awarded for students in West Wales are shown in Table 10 and gives a clear indication that the number of scholarships for short courses varied according to whether an institute or its equivalent was established in the County and provides evidence that the institutes set up on a county basis were not able to induce adjoining Authorities to provide funds to substantial numbers of students.<sup>542</sup>

**Table 10. Scholarships granted by West Wales Counties 1938**

County	Agriculture		Dairying		Poultry Keeping	Veterinary Science	Misc.Short Courses	Total No.	Expenditure
	Deg	Dip	Deg	Dip	Dip	Deg			
Pembroke	4	1			3	4	5	17	£618.2.0
Carmarthen	2	2		2			51	57	£585.10.0
Cardigan	2	2		2			19	25	£340.0.0

*Source: TNA, MAF 33/397*

Agricultural scholarships in Pembrokeshire were open to:

...sons and daughters of agricultural workmen or of working bailiffs, smallholders and other rural workers whose means and method of livelihood were comparable with those of agricultural workmen, and to persons who are themselves bona-fide workers in agriculture.<sup>543</sup>

The value of the awards meant that neither the recipient nor the parents were required to make a contribution towards the cost of training.<sup>544</sup> In 1921 scholarships were awarded to four girls to attend short courses in dairying and house management at Aberystwyth in the summer months. Another was awarded to Mr Davies of Templeton to attend a short course in agriculture and one was also awarded to Muriel Phillips to study for a diploma course in dairying.<sup>545</sup> A scholarship was also awarded to Mr J.M. Harries of Llanrheithan Farm, Pembrokeshire when he was seventeen years old. He was the first

<sup>541</sup> TNA, MAF 33/397 Agricultural Education in England and Wales Inspector Reports 1938

<sup>542</sup> Ibid.

<sup>543</sup> PA, PCC/ED/2/619 Agricultural Scholarships.

<sup>544</sup> Ibid.

<sup>545</sup> PA, PACR year ended March 31<sup>st</sup> 1921.

person in generations of a farming family to attend university and enrolled at Aberystwyth to study for a degree in agriculture. This scholarship proved to be of benefit for the County as on graduating he took a keen interest in the education of farmers and worked with the advisors and the County Agricultural Organiser in giving evening lectures on choices of seeds, new fertilisers and feed stuffs.<sup>546</sup>

By the time of the Second World War Aberystwyth and Bangor universities were offering a range of degree and diploma course as can be seen in Appendix 1 and 2. One third of degree students were from outside of Wales but all the diploma students were from the Principality and were farmers' sons.<sup>547</sup> One year courses were also offered at the four Farm Institutes in Wales: Madryn Castle Farm School, Llysfasi Farm Institute, Monmouthshire Institute of Agriculture and Pibwrlwyd Farm Institute and the number of students attending can be seen in Appendix 3. Brassley's study showed that in comparison with the million or more people engaged in agriculture, the number of students attending universities and colleges remained small and that the course contents had not changed in twenty-five years.<sup>548</sup> However, the Luxmoore Committee reported that it was a very different situation with the non-institutional education that included day courses, evening classes, lectures and demonstrations as they attracted thousands of part-time students. In 1938/9 there were 3,940 students in organised day courses and 13,101 students enrolled in evening classes as can be seen in Appendix 4.<sup>549</sup> These non-institutional courses also involved the advisory services and are discussed further in chapter eight.

In the decade following the Second World War emphasis was placed on part-time education of farm workers at farm institutes and the government urged local authorities to

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<sup>546</sup> Oral testimony of Mrs Glenys Harries, Fishguard; PA, PACR year ended March 31<sup>st</sup> 1936.

<sup>547</sup> TNA, MAF 33/397 Agricultural Education in England and Wales Inspector Reports 1938.

<sup>548</sup> Paul Brassley, 'Agricultural Education, Training and Advice in the UK, 1850-2000', in Nadine Vivier, ed., *The State and Rural Societies, Policy and Education in Europe, 1750-2000*, (Turnhout: Brepols, 2008), p.264

<sup>549</sup> PP 1943 (Cmd.6433), op.cit., p.28.



set up committees to organise part-time programmes making use of the Young Farmers' Clubs (YFC) and the National Agricultural Advisory Service (NAAS). They emphasised the need for general courses for apprentices and boys and girls aged between fifteen and eighteen.<sup>550</sup> The government perceived that the full advantage of technical progress could only be adopted by farmers and farm workers who understood the scientific principles of agriculture and its application to their farms. They believed that the best farms, farmers and farm workers were unsurpassed anywhere in the world and wanted this high standard throughout Britain.<sup>551</sup>

Farm institutes were charged with providing basic courses in general agriculture and acknowledged that in Welsh institutes there were a proportion of students who could only gain maximum benefit if instructed in Welsh.<sup>552</sup> The Welsh language was recognised as a difficulty associated with agricultural education; although it was thought that bilingualism in the rural areas accounted for seventy to eighty per cent of population, in practice the farming community spoke their first language, Welsh. The Inspectors' Reports did not suggest that all the agricultural education should have been taught in Welsh but that the language should have been used sufficiently to ensure that students understood enough to give a full appreciation of the agricultural education to pass on the knowledge gained. It was also recognised that there would be monoglot English students attending the same classes.<sup>553</sup>

### **7.3 Societies, Clubs and Shows**

It was thought that farmers were more receptive to informal educational approaches such as the Young Farmers Clubs, farm walks, agricultural shows and reading *Farmers Weekly*

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<sup>550</sup> PP 1958 (Cmnd. 614), op.cit., p.4.

<sup>551</sup> Ibid., p.6.

<sup>552</sup> Ibid., p.27.

<sup>553</sup> TNA, MAF 33/397.

and *Farmer and Stockbreeder*. As John Martin states, ‘folklore and rule of thumb wisdom inherited from previous generations, and not scientific knowledge, were commonly regarded as the route to becoming successful farmers’.<sup>554</sup> There was an opinion that only a very small number of young people interested in employment in agriculture had the opportunity to attend agricultural colleges or farm institutes and the rural schools were not providing the agricultural education required.<sup>555</sup> Following successes in the United States and Canada, Young Farmers’ Clubs started in Britain in 1921 with the first one being a calf club sponsored by United Dairies Limited. The *Daily Mail* was one of the first promoters of clubs for boys and girls and the NFU and groups of farmers worked together to form new local clubs.<sup>556</sup> As the clubs were a voluntary organisation there was concern that well-intentioned organisers would make the Clubs look amateurish and unimportant. However experienced farmers took an interest and they were soon recognised as an integral and important part of agricultural education.<sup>557</sup>

By 1924 the Ministry of Agriculture took over the supervision of club work and although it helped the movement to become a national venture it was eventually handed over to the community councils to supervise the club work and by 1929 the National Association of Young Farmers’ Clubs (NAYFC) was formed under the auspices of the National Council.<sup>558</sup> By 1939 there were 412 Clubs formed with a total membership of 15,000 and the Local Education Authorities saw the potential of the YFCs stimulating interest in agriculture which led to a growth of clubs in schools.<sup>559</sup>

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<sup>554</sup> John Martin, *The Development of Modern Agriculture*, op.cit., p.23.

<sup>555</sup> Professor J. A. S. Watson, ‘Young Farmers’ Clubs’, *AP*, Vol. VII, 1930, p.119.

<sup>556</sup> J. M. Steadman, *Foreign Agricultural Extension Activities*, 1930, p.2.

<sup>557</sup> Professor J. A. S. Watson, ‘Young Farmers’ Clubs’, op.cit., pp.118-19.

<sup>558</sup> J. M. Steadman, op.cit., p.2.

<sup>559</sup> Lynne Thompson, ‘Agricultural Education in the Inter-war Years’, in Brassley, Paul, Burchardt, Jeremy and Thompson, Lynne, eds, *The English Countryside Between the Wars*, (Woodbridge; Boydell Press, 2006), p.61.

The YFC movement was popular throughout Wales and was seen to give young people not only a considerable agricultural education but also a confidence in preparing for careers in agriculture by attending weekly meetings over the winter months as well as attending the county rallies. The importance and focus of agricultural science within the YFC movement was evident; a Pembrokeshire rally meeting featured the importance of a scientific approach to farming.<sup>560</sup> The Department of Agricultural Economics and the NAYFC held a weekend school for Club Leaders at the University College Aberystwyth and the lectures included 'the Human Purposes of the Study of Agriculture', 'Programmes for Young Farmers' Clubs: Projects and Methods' and 'The Organisation and Activities of the Blaenporth, Cardigan, Young Farmers' Club'.<sup>561</sup> The interests of the YFCs were numerous and all the farmers interviewed for this study commented that they owed a lot to the YFC movement for giving them a foundation of training and knowledge and they continued to help out at meetings long after they became full time farmers.<sup>562</sup>

The activities within the YFC meetings at Croes Goch included calf and lamb rearing to show at the annual agricultural show, butter making, crop growing, rural crafts and learning how to truss a chicken. There were many interesting geographical films shown and agricultural quiz nights and evening events were often shared with the Methodist Chapel. Visiting lecturers came from the agricultural colleges to cover all aspects of agriculture and there were many practical talks given by local farmers.<sup>563</sup>

Activities at Pembroke YFC included a lecture by a veterinary surgeon on dairy, general farming education by local farmers, poultry trussing demonstrations and lectures by the

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<sup>560</sup> Caroline Wendy Marmara, 'The Influence of Two World Wars on Agriculture in South Pembrokeshire', (unpublished MA Dissertation, University of Wales Trinity Saint David, 2011), p.50; Jane Davies, 'The Young Farmers of Wales, 1904-54', *The Transactions of the Royal Welsh Agricultural Society*, 1954, p.86.

<sup>561</sup> PA, PCC/ED/2/619 Week-End School for Club Leaders, University College of Wales.

<sup>562</sup> Oral testimony of George Mathias, former member of Pembroke and Tenby YFC and Charles Tamplin founder member of Lisvane YFC.

<sup>563</sup> Oral testimony of George Mathias, Martin Sykes and Glenys Harries. Mrs Harries was a founder member of the St Nicholas Young Farmers Club in 1933 and a member of the Croes Goch Young Farmers' Club from 1939.

Livestock Officer, Mr Edward Davies. There was a rule that politics were not to be discussed at YFC meetings and when an invitation for an inter-club debate “That this house believes Wales should have Home Rule” was received by Pembroke YFC from St Nicholas YFC, it was declined.<sup>564</sup>

The growth of the YFC in Wales was rapid; from just eight in 1935 to 293 by 1947. Increases in membership were thought to have been facilitated by the appointment of Area Organisers of the Federation who not only encouraged recruitment but also actively encouraged members to take part in inter-club, inter-county and international visits and competitions. The YFC were also seen to take an active part in the Royal Welsh Show: they helped in the preparations and took part in the competitions; they inspected the research and experimental plots on show; and visited and studied the Education Avenue exhibitions of the Rural Industries Bureau and Women’s Institute.<sup>565</sup>

Bryner Jones had advocated that the purpose of agricultural shows was not just about competitions but that the educational element was to give farmers the opportunity to see what scientific research ‘can do to throw light on treatment of land, breeding and feeding animals, improving pasture and all other aspects of farm work’.<sup>566</sup> Figure 11 shows the judging of Welsh Cattle at the Royal Welsh Show and Robert Jones, a livestock farmer at Caerbellan, commented that he believed the best sign of the Black Cattle’s development and success was seeing new breeders crowned and winning main prizes at the show.<sup>567</sup>

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<sup>564</sup> PA, D/YFC/1 Minutes of Pembroke Young Farmers Club.

<sup>565</sup> Jane Davies, *op.cit.*, pp.87-88.

<sup>566</sup> Quoted in David W. Howell, *Taking Stock*, (Cardiff: UWP, 2003), p.133.

<sup>567</sup> Robert Jones, *op.cit.*, p.25.



**Figure 11. Judging Welsh Black at Royal Welsh Show July 29 1939 Caernarfon**

*Source: Geoff Charles Collection courtesy of the National Library of Wales*

The National Welsh Agricultural Society, founded in 1904, gained its Royal Charter in 1922 and placed a high priority on the educational aspects within its show. Between 1910 and 1939 there was an increase in the scale of educational exhibits relating to progressive farming methods reflecting the application of science, both mechanical and chemical, to help farmers. Among the various institutions exhibiting were the English and Welsh departments of the Ministry of Agriculture and Fisheries, the Agricultural Committees and Education Authorities of the Welsh county councils, the Welsh Agricultural Organisation Society and the various departments of the University Colleges at Bangor and Aberystwyth.<sup>568</sup> Technical demonstrations and exhibits featured highly; there were crop-drying demonstrations, butter-making demonstrations, dairy bacteriology and exhibits of animal husbandry. There was also information about the North Wales Seed

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<sup>568</sup> David W. Howell, *Taking Stock*, op.cit., pp.79-80.

Potato Scheme and a soil survey of Wales in 1936 by the School of Agriculture at Bangor.<sup>569</sup> However, even though it was the Society's concern to bring scientific, technical and commercial knowledge to the Welsh countryside, it was considered impossible to measure how many farmers modernised their farming ways as a result of their visits to the show. Furthermore, in the inter-war years farmers were reluctant to invest their savings in innovations and improvements in depressed market conditions and were mainly looking for methods of reducing costs or increasing profit without having to invest capital.<sup>570</sup>

The Royal Welsh Show promoted and encouraged machinery demonstrations and competitions and embraced both the rural artisan and the large machinery producers. This reflected the diverse farm holdings in Wales as the size of the farm and the wealth of the farmer dictated the machinery used. Some devices and 'new-fangled notions' were thought to be the prerogative of a few pioneers while the majority of farmers were said to prefer 'to follow at a safe distance'.<sup>571</sup>

Agricultural shows were popular summer events in Wales and the Royal Welsh and other smaller county shows were well attended not only by the farming community but also attracted visitors from urban areas. The shows became so popular that in order to accommodate the large numbers of visitors to the Royal Welsh Agricultural Show at Haverfordwest in July 1935, the Great Western Railway arranged for one of its Irish steamers to be moored at Fishguard Harbour to offer sleeping accommodation for visitors who couldn't find hotels in the district.<sup>572</sup>

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<sup>569</sup> Ibid., pp.80-81.

<sup>570</sup> Ibid., p.84; R. J. Moore-Colyer, 'Farming in Depression: Wales between the Wars, 1919-1939', op.cit., p.196; 'The Diffusion of Science into Practice', in Joan Thirsk, Gen. Ed., *The Agrarian History of England and Wales, Volume VIII, 1914-39*, op.cit., p.283.

<sup>571</sup> Llywelyn Phillips, 'Machinery in Wales', *The Transactions of the Royal Welsh Agricultural Society*, 1954, p.91.

<sup>572</sup> *County Echo*, 20 June 1935.



**Figure 12. Butter making competition Royal Welsh Show, Caernarfon, 29 July 1939**

*Source: Geoff Charles Collection courtesy of the National Library of Wales*

Local shows tended to reflect the area and type of farming and livestock competitions were often the largest part of the show. Farmers would attend to view the latest tractors and agricultural machinery and to investigate the latest feed-stuffs and fertilisers. There would be demonstrations for example of sheep shearing, silage making and milking, and the shows were considered to be a social venue for the agricultural community. There was also an opportunity to share achievements and the Pembrokeshire Agricultural Society Show of 1934 highlighted the many achievements of farmers who had been successfully growing early potatoes. Mr Roger Thomas, an expert agriculturalist, encouraged farmers by saying that big profits were possible and that the cultivation of early potatoes ‘could be the salvation of the hard-hit Pembrokeshire farmer’.<sup>573</sup> The educational side of the Penrice Show included competitions for young farmers in stock

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<sup>573</sup> Derek Rees, op.cit., p.127.

judging and identification of pasture plants, as well as having demonstrations in fruit bottling, poultry trussing and the grafting and pruning of trees.<sup>574</sup>

Attendance at agricultural shows was a proficient way of informally educating farmers and farm workers as they got to know the outcomes of the trials and learnt of other farmers' experiences. They received help and advice from the Agricultural Organiser and acquired technical and economic information for producing and selling new crops on their farms.

#### **7.4 County Council Organised Education in Pembrokeshire**

Following the Local Taxation Act of 1890, the Technical Instruction Committee of Pembrokeshire County Council made preparations for a Dairy School, the conditions for which are shown in Figure 13.

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<sup>574</sup> West Glamorgan Archives D/D/GAS/18.



# Pembrokeshire County Council.

1893.

## DAIRY SCHOOL.

The TECHNICAL INSTRUCTION COMMITTEE of the Council are prepared to arrange for a Fortnight's Instruction at certain Centres on the following conditions : —

1.—That a Local Committee of seven be formed to be convened and presided over by the Councillor of the Division.

2.—The Local Committee shall provide a suitable room about 40 x 30 feet, with a good supply of Pure water, both Hot and Cold.

3.—Six gallons of Cream per day for Eleven days.

4.—Not more than Twelve pupils divided thus. Six pupils for the first five days, and then another batch of six pupils for the following five days ; fee 10s. each. Two from same family, 15s. The public may be admitted to certain demonstrations at 6d. or 3d. each.

5.—Advertize and attend to all details of Local arrangements.

6.—Receive all fees and pay all Local expenses for advertizing, room, waiting, &c., and enter a full account of the same in the Dairy School Register (supplied), and hand over the balance (if any) to the Technical Committee.

An examination will be held at close of each Course (if desired), and Certificates granted with an annual County Competition and Prizes.

The Local Councillor shall be the Correspondent with the Deputy Clerk of the Council.

**MR. WM. DAVIES GEORGE,**

SHIRE HALL, HAVERFORDWEST.

**Figure 13. Conditions for Pembrokeshire County Council Dairy School**

*Source: Pembrokeshire Archives, PCC/ED/16/2*

News of the funding resulted in a seventeen page memorial submitted to the Pembrokeshire Education Committee asking for support for practical and theoretical training in agriculture, which included: cheese and butter making; veterinary, chemical, botanical and entomological science; the breeding, selection, management and feeding of dairy cattle and other livestock and generally in the practical work of a farm largely

devoted to dairying purposes; and to provide competent resident and peripatetic lectures and experts to give instruction with special regards to dairy management.<sup>575</sup> The County Agricultural Organisers were considered key to the spread of scientific knowledge to farmers as they were in direct contact with the farming community. The organisers were provided by the county councils through their statutory agricultural or education committees.<sup>576</sup> One of the key roles of the County Agricultural Organiser<sup>577</sup> was the education and training of students and this section explores the training and education that took place in Pembrokeshire.

In 1916, lectures on general agricultural subjects were delivered in Welsh or English at twelve centres around the county with attendances between 26 and 65 farmers and A. E. Jones, the lecturer in agriculture at Aberystwyth, commented that the lectures were appreciated by farmers and that ‘farmers fully realise the need of education in agricultural pursuits’.<sup>578</sup> Farmers were looking for practical education, as one Pembrokeshire farmer said ‘in the past farmers have not been addicted to the literary lore, and high sounding phrases or technical terms never figured in our vocabulary’.<sup>579</sup> The success of dairy demonstrations in the county was thought to be because of their practical rather than theoretical base.<sup>580</sup>

In 1918 there were twenty-one extension lectures held around the county covering general agricultural subjects. The centres delivering the lectures were increasing their applications to hold further courses which signalled they were being appreciated by

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<sup>575</sup> PA, PCC/ED/16/7 Memorial of Landowners, farmers and others interested in Agriculture in Pembrokeshire. The Education Committee asking for support for an institution to give theoretical and practical training in agriculture.

<sup>576</sup> Report on Agricultural Research in Great Britain, Political and Economic Planning, 1938, p.60.

<sup>577</sup> The duties of the County Agricultural Organiser were four-fold; advisory work, research work, demonstration of research and training of students. The advisory and research roles are explored in chapter eight.

<sup>578</sup> PA, PACR the year ended March 31<sup>st</sup>, 1916.

<sup>579</sup> *Haverfordwest and Milford Haven Telegraph*, 8 April 1914.

<sup>580</sup> *Haverfordwest and Milford Haven Telegraph*, 8 April 1914.

farmers.<sup>581</sup> During the same year there was a high demand for the travelling dairy classes.

Miss Sara Jones who was responsible for these classes noted:

My aim has been to conduct these classes in such a manner that the pupils would find no difficulty in continuing the work on similar lines in their homes, where proper and convenient dairy appliances are not always available. It is very evident from the number of farmers' wives and daughters who attended these classes, and have since commenced cheese-making in their homes, that the industry is rapidly being revived in this county.<sup>582</sup>

Dairy classes were held in Templeton, St. Florence and Hendre Cross and the high number of pupils at the St. Florence class necessitated that the Pembrokeshire Agricultural Committee employed an assistant, Miss Elsie Jones, to take charge of the butter and cheese-making department. Lectures on poultry keeping were delivered at sixteen centres throughout the county and it was reported that the success of the lectures had contributed towards establishing pure-bred birds in place of the nondescript type.<sup>583</sup> The following year the number of dairy classes and demonstrations taking place in the county had increased and are shown in Table 11. The education report stated that the classes at Mathry had a lot of local interest and at the end of the class an application was forwarded to the Board of Agriculture for a co-operative cheese factory to be established.<sup>584</sup>

In 1920, Mr W.E.D. Jones, Agricultural Organiser for Pembrokeshire, set out a scheme for the agricultural education of the county which included: day courses from which the best students were encouraged, by means of scholarships, to go on to the Farm Institute, College, or diploma courses at Aberystwyth; evening tutorial classes where day classes were not suitable; demonstration plots and field experiments arranged with scientists at Aberystwyth; potato trials and grassland experiments arranged in accordance

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<sup>581</sup> PA, PACR year ended March 31<sup>st</sup> 1918.

<sup>582</sup> Ibid.

<sup>583</sup> Ibid.

<sup>584</sup> PA, PACR year ended March 31<sup>st</sup> 1919.

with the Ministry of Agriculture's schemes; lectures in dairy work in the winter months on clean milk production; milk testing and a travelling dairy school in the summer and early autumn; and lectures and short courses on marketing poultry and egg preservation.<sup>585</sup>

**Table 11. Dairy Classes in Pembrokeshire in 1919**

Centre	Attendance
Jordanston	9
St Ishmael's – two classes	20
Brimaston Hall Vestry	9
Mathry – two classes	21
Castlemartin	9
Lawrenny Demonstrations	25

*Source: Pembrokeshire Archives, Report on Agricultural Work for the year ended March 31<sup>st</sup> 1919, Pembrokeshire Agricultural Committee*

The Agricultural Organiser delivered lectures throughout the county on many subjects; fungi, foods, potatoes, manures, grassland and the 'Objects and Value of Experiments'. In connection with the Ministry's grassland campaign, Mr T. J. Jenkin lectured at Narberth, Fishguard, Letterston, Pembroke, Haverfordwest, Croesgoch and Maenclochog. There was also support from the dairy branch of the Ministry as Mr Hatfield gave a lecture on Co-operative Cheese Schools at Treffgarne Owen. Mr Whitehead from the Small Live Stock Department gave a lecture at Burton on goats to the ex-service men in training. Poultry keeping was gaining attention; there were twenty-eight lectures throughout the county and the numbers attending the lectures varied between 12 and 200.<sup>586</sup>

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<sup>585</sup> PA, PCC/ED/16/3 Pembrokeshire Education Authority, Memorandum by the Agricultural Organiser on a Suggested Scheme of Agricultural Education for County of Pembrokeshire, 1920.

<sup>586</sup> PA, PACR year ended March 31<sup>st</sup> 1921.

Education exhibits were displayed at Pembrokeshire agricultural shows; in 1921 exhibits were taken to the show at Haverfordwest and Fishguard and to the horticultural shows at Haverfordwest and St Davids. These exhibits included specimens of fungoid and insect pests with their remedies, common weeds and methods of eradication, specimens of grasses and clovers with their seeds, and specimens of all the cereal, root, clover and potato crops which were under experiment in the county. The exhibits also gave organisers an opportunity to advertise the educational facilities offered by the Committee and by the Ministry of Agriculture that were available to farmers and farm workers.<sup>587</sup>

During the winter of 1922-23 lectures were given on manures, cereals, potatoes, grasses, seeds, foods and feeding and agricultural experiments. Attendances at lectures and classes were increasing and the average attendance at these lectures had increased from 22.3 per lecture in the previous year to 37.4. The largest classes were seen at Marloes with one hundred and fifty people attending and Castlemartin with one hundred attending.<sup>588</sup> The number of farmers and farm workers interested in agricultural education was seen to increase each year and by 1925 there were lectures at seventeen centres across the county with an attendance of over six hundred. There was also support from the university: Dr R. Stenhouse-Williams gave a lecture on 'Clean Milk' at St Davids; Professor R. G. Stapledon gave a lecture on 'Grassland Improvements' at Haverfordwest; and D. D. Williams gave a lecture on 'Livestock Improvement' at New Hedges. All the lectures were followed by visits to farms in the county.<sup>589</sup>

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<sup>587</sup> PA, PACR year ended March 31<sup>st</sup> 1922.

<sup>588</sup> PA, PACR year ended March 31<sup>st</sup> 1923.

<sup>589</sup> PA, PACR year ended March 31<sup>st</sup> 1925.



**Figure 14. Butter making and poultry dressing competition held at Trenewydd Farm, Pencaer, 1930**

*Source: Private Photograph Collection courtesy of Edward Perkins*

There were several dairy classes, clean milk competitions and butter making competitions in Pembrokeshire during 1928. The enthusiasm and interest in the district was high and culminated in winning first, second and third prizes of ‘champion milkers’ for Wales and Monmouthshire at the Royal Welsh Show at Swansea. As shown in Figure 15, from left to right, the first prize was won by Miss Mabel Morris of Wolfscastle, 2<sup>nd</sup> prize won by Mrs Morris of Somerton and 3<sup>rd</sup> prize won by Miss M Phillips of Letterston. On the right is Miss Luned Francis, Treifa, Penycwm who was 2<sup>nd</sup> in butter making for open class in Wales and Monmouth.<sup>590</sup>

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<sup>590</sup> PA, PACR year ended March 31<sup>st</sup> 1928.



**Figure 15. Winners of the milking competition at the Royal Welsh Show, Swansea, Champions for Wales and Monmouthshire.<sup>591</sup>**

*Source: Pembrokeshire Archives, Report of the Agricultural Work in Pembrokeshire for the year ended March 31<sup>st</sup> 1928*

In 1927, Mr Morgan Jones of the Agricultural Economics Department, University College of Wales, Aberystwyth, delivered a series of six lectures on the ‘Business Side of Farming’ to the Llantood Agricultural Study Circle. Of the twenty-six students enrolled, there were nine farmers, nine farmers’ sons, five agricultural labourers, one co-operative manager and one school teacher. Lectures were given in Welsh and English and there was reportedly a ‘live interest in an abstruse study to a class previously absolutely uninitiated in economics’. One lecture that aroused interest was ‘Pig Marketing in Wales and Co-operation’. There were also visiting lecturers; Mr W. S. Jones from the Welsh Department Ministry of Agriculture spoke on ‘What Farming Owes to Science’ and Mr A. W. Ashby spoke on ‘Benefits of Co-operation’.<sup>592</sup>

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<sup>591</sup> Ibid., from left to right 1<sup>st</sup> prize – Miss Mabel Morros, Wolfscastle, 2<sup>nd</sup> prize – Mrs Morris, Somerton, 3<sup>rd</sup> prize – Miss M Phillips, Letterston. On the right is Miss Luned Francis, Treifa, Penycwm who was 2<sup>nd</sup> in buttermaking for open class in Wales and Monmouth.

<sup>592</sup> PA, PACR year ended March 31<sup>st</sup> 1927.

By 1930 an Association of Dairy Students was formed in Pembrokeshire with the primary aims to keep the students of the county in touch with the County Agricultural staff and to help form a Butter Producers' Association to get better prices for the best quality butter and to raise the overall standard of butter and cheese. It also had an educational agenda; the association encouraged the reading of dairy literature and organised an educational trip to places of dairying interest each summer.<sup>593</sup>

The Ministry of Agriculture invited and welcomed the involvement of the NFU in improving and extending agricultural education and special agricultural lectures by leading authorities were offered to branches of the union to support county directives. The Education Committee of the NFU considered the extension of agricultural education one of the measures required to deal with the agricultural depression in the 1920s and visits to farms and other places of interest to farmers would be of value for the dissemination of practical knowledge of good agricultural practice.<sup>594</sup> In 1928 over forty members of the North Pembrokeshire Farmers' Club visited the Agricultural Department at the University of Wales, Aberystwyth where they received lectures on: 'The Improvement and Management of Pastures in the Light of Recent Developments in Grass Land Science' by Professor R. G. Stapledon; 'The Nutritive Value of Pasture Grass as Influenced by Management' by T. W. Fagan; 'The intensive management of Grassland' by R. Lindsay Robb the Chief Grassland Advisor at Nitram Limited; 'A purveyor of Grassland' by S. M. Bligh, Esq, Cilmery Park, Builth Wells; 'The sheep and its pasture' by Martin G. Jones, Esq; and 'Factors determining the success of Seeds Mixtures' by William Davies.<sup>595</sup> The report of the day's visit highlighted:

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<sup>593</sup> *County Echo* 13 February 1930.

<sup>594</sup> *The Year Book of the National Farmers' Union for 1924*, pp.210-11.

<sup>595</sup> *The County Echo*, 1 March 1928.



....they could not help realising that they had at their disposal all the scientific knowledge emanating from the University at Aberystwyth as well as the facilities provided by experts in agriculture and horticulture in their own county. As farmers, they did not make sufficient use of the services placed at their disposal in this direction. It would be well however if the lecturers realised the feelings of the farmers on the matter. They would find that farmers would take more interest than they did in agricultural education if they were shown practical results in their own neighbourhood. It might also be of greater advantage if the lecturers went about visiting the different areas and advising the farmers without waiting to be written to by those who were seeking knowledge on some particular matter. In that way farmers might be encouraged to take more advanced views on agriculture.<sup>596</sup>

Agriculture economics classes were organised at Croesgoch in 1936 under the auspices of the Workers' Educational Association. The Agricultural Organiser gave an address on 'The Value of Agricultural Education'.<sup>597</sup> By 1939 lectures and classes in Pembrokeshire Districts were aided by the use of educational films: the Rations Sound Films and Milk Publicity Sound Films were shown to one hundred and fifty attendees in Eglwysrwrw and to thirty-five attendees in Dinas; and Basic Slag Films were shown at Maenclochog, Dinas, Kilgetty and Crymych. Extension lectures were also given on 'Attestation' and 'Land Fertility'.<sup>598</sup>

The County Organiser also organised visits to Rothamsted and Harper Adams for farmers to see experiments and trials first hand.<sup>599</sup> Figure 16 shows a visit of Pembrokeshire's Dairy School on a visit to Harper Adams Agricultural College for the students to see first-hand the experiments taking place.

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<sup>596</sup> *The County Echo*, 1 March 1928.

<sup>597</sup> PA, PACR year ended March 31<sup>st</sup> 1936.

<sup>598</sup> PA, PACR year ended March 31<sup>st</sup> 1939.

<sup>599</sup> PA, PCC/SE/71/55.



**Figure 16. Pembroke Dairymen's School on a visit to Harper Adams, 1937**

*Source: Private Collection courtesy of Merrill Mabey*

This study has shown the diverse ways of disseminating information to farmers. For those not able or not wishing to attend formal education there were sufficient alternatives for informal access to information. The question of whether formal agricultural education was perceived as successful is complex, as even though student numbers were small in the time period the universities were influential in diffusing knowledge and skills not only within their course structure but through their research and county experts. Agriculturalists considered that agriculture was rich in scientists and technologists but poor in education and educators and for this reason agricultural research outperformed agricultural education.<sup>600</sup>

This study found strong evidence from the county agricultural education reports that there was a high level of interest from farmers and farm workers for learning. Records of local class attendance provided confirmatory evidence that they were relevant and appealing to them and that the new science was significant to their industry. The

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<sup>600</sup> W. R. Dunlop, 'Education for Management', *AP*, Vol. XI, 1934, p.49; Viscount Astor and Seebohm B. Rowntree, *British Agriculture, the Principle of Future Policy*, op.cit., p.419.

collaboration between farmers and scientists has not only been shown to have been facilitated by the County Organiser but that scientists were also talking to them directly and acknowledged that the application of agricultural science required local conditions and local knowledge. It has been demonstrated that West-Walian farmers were choosing how they acquire their scientific and technical knowledge to use on their farms and not as Calder's perception that they had a distrust of education and were ignoring the advances of science.<sup>601</sup>

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<sup>601</sup> Angus Calder, *The People's War, Britain 1939-1945*, (London: Pimlico, 2008), p.419.

## CHAPTER EIGHT: AGRICULTURAL ADVISORY SERVICES AND COUNTY ORGANISED SUPPORT

### 8.1 The Development Commission and the Formation of the Advisory Services

Sir John Winnifrith<sup>602</sup> emphasised that worldwide farming would benefit by providing farmers with an advisory service to enable them to be educated about scientific discoveries. However, it was acknowledged that farmers who were receptive to such advice would by this time be in the process of change before calling in the advisory officer having already had their own ideas of how to improve productivity and profitability.<sup>603</sup> The Development and Road Improvements Funds was an integral part of the social reform vision of David Lloyd George and Winston Churchill and the resultant Development Commission was fundamental to the institutional support for agriculture. There was little organised agricultural research before 1909 and Lloyd George thought that the government should be ashamed how little money was given for the encouragement of agriculture compared to other countries and the small sums of money given to be 'short-sighted' with 'niggardly parsimony'.<sup>604</sup> The Commission was considered a pioneer body that had scientific agricultural research prominent in the plans for rural development.<sup>605</sup> It was also described

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<sup>602</sup> Sir John Winnifrith was a senior civil servant at the Ministry of Agriculture and became Permanent Secretary of the Ministry in 1957 and knighted in 1959

<sup>603</sup> Sir John Winnifrith, 'The Advisory Services of the Ministry of Agriculture in England and Wales', *Agricultural Administration*, Vol.1, 1974, pp.1-2; W. J. Thomas, 'Advisory Services and the Agricultural Community', in J. Ashton and R. F. Lord, Eds, *Research, Education and Extension in Agriculture*, Edinburgh: Oliver & Boyd, 1969, p.117

<sup>604</sup> Sir E. John Russell, *A History of Agricultural Science in Great Britain*, *op.cit.*, p.268; Bentley Brinkerhoff Gilbert, 'David Lloyd George: Land, The Budget, and Social Reform', *The American Historical Review*, Vol.81, No.5, 1976 p.1065; Sir Francis L. C. Floud, *The Ministry of Agriculture and Fisheries*, London: Putnam, 1927, p.34; Robert Olby, 'Social Imperialism and State Support for Agricultural Research in Edwardian Britain', *Annals of Science*, 48, 1991, pp.514-15; Hansard 29 April 1909, Vol.4 c493

<sup>605</sup> The Development and Road Improvement Funds Act was passed on 3 December 1909, the Development Commissioners were appointed 12 May 1910, and the first Development Commission Meeting was held 25 May 1910. PP 1911 (199), Development Commission, first report of the proceedings of the Development Commissioners for the period 12 May 1910 to the 31 March 1911, p.37; TNA, CAB 24/212 Report of Agricultural Research Organisation Committee of the Economic Advisory Council, p.3; Timothy DeJager, *op.cit.*, p.131; Keith Vernon, 'Science for the Farmer? Agricultural Research in England 1909-36', *Twentieth Century British History*, Vol.8, No.3, 1997, p.310; Roy MacLeod, 'Science for Imperial Efficiency and Social Change: Reflections on the British Science Guild, 190-1936', *Public Understanding of Science*, Vol.3,

as a ‘constitutional curiosity, a Department with neither a Minister nor a Parliamentary Vote’.<sup>606</sup>

The Development Commission thought the research institutes and the advisory service were so closely related that in order to accelerate the application of agricultural science scientists needed to leave the laboratories and spend time with farmers on their land.<sup>607</sup> Following the Commission appointment a review of the state of agricultural research and education in England, Scotland and Wales was carried out and a programme was developed to meet the needs of the country.<sup>608</sup> The appointed Commissioners<sup>609</sup> outlined three objectives: to increase the amount and quality of the product of agriculture by assisting the extension of scientific research and education; to increase the variety of production by placing the cultivator in a position to know whether he can add certain new crops; and to improve the methods applied in the business of agriculture by promoting the organisation of co-operation.<sup>610</sup>

Opinions of the Development Commission were mixed amongst historians and economists with some calling it innovative and a turning point in the history of agricultural science and others considering it unsuccessful and failed to promote economic development.<sup>611</sup> However, regardless of these opinions there was at last money available

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1994, p.165, the British Science Guild argued for the inclusion of agricultural research in the Development Act.

<sup>606</sup> Margaret Brasnett, *Voluntary Social Action, A History of the National Council of Social Service 1919-1969*, (London: National Council of Social Service, 1969), p.34.

<sup>607</sup> PP 1920 (230 ) Development Commission, Tenth Report, p. 96.

<sup>608</sup> TNA CAB/24/212 Cabinet paper, Report of Agricultural Research Organisation Committee of the Economic Advisory Council, 13 May 1930.

<sup>609</sup> Alan Roger, *The Most Revolutionary Measure, A History of the Rural Development Commission 1909-1999*, (Rural Development Commission, 1999), p. 11; Paolo Palladino, ‘The Political Economy of Applied Research: Plant Breeding in Great Britain, 1910-1940, *Minerva*, Vol.28, No.4, 1990, p.448.

The eight Commissioners, a small group of scientists and scientifically minded civil servants were Lord Richard Cavendish, Sir Francis Hopwood, Saint-Hill Eardley-Wilmot, Henry Jones Davies, Michael Andrew Ennis, William Stowell Haldane, Alfred Daniel Hall and Sidney James Webb.

<sup>610</sup> PP 1913 (273) Development Commission. Third report, p.5.

<sup>611</sup> Sir E. John Russell. *A History of Agricultural Science in Great Britain*, op.cit., p. 268; Avner Offer. *Property and Politics 1870-1914*, (Cambridge: CUP, 2010), p. 360; J. C. F. Fryer, ‘Plant Protection’ in *Agriculture in the Twentieth Century*, (New York: Libraries Press, 1939, reprinted 1969), p.292; Jose Harris,

for the Board of Agriculture to help pay for provision for the advisory scheme extensions to help farmers with practical, technical advice and to promote scientific research and practice within the agricultural community. The Commission also sanctioned schemes such as agricultural co-operation, gave capital expenditure to the WPBS, paid for land for other Research Institutes, and supported the development of the poultry and livestock industry.<sup>612</sup> The grants and loans made available from the Development Commission are shown in Table 12 and can be seen to have increased from just over £220,000 in 1912 to over £576,000 in 1939. These grants were considered generous when compared to the aid given to other industries at the time. However the money awarded was only a small percentage of the value of the agricultural industry to the national income. For example in 1925 the grant awarded was £433,709 which amounts to just 0.18 per cent of the agricultural income of £233,520,000.<sup>613</sup> The figures showed a higher investment in 1930 with grants being the equivalent of 0.23 per cent of the value of agricultural income of £202,660,000.<sup>614</sup>

The next five years saw an increase in agricultural output of fourteen per cent and this was attributed to improvements made by farmers on their land. They were making more effective use of fertilisers, choosing better crop varieties, improving their pasture

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*Unemployment and Politics, a Study in English Social Policy 1886-1914*, (Oxford: Clarendon, 1972), pp. 357-58; G. R. Searle. *Corruption in British Politics 1895-1930*, (Oxford: Clarendon, 1987), p. 233; R. C. K. Ensor, *England 1870-1914*, (Oxford: Clarendon, 1936), p. 413-14.

<sup>612</sup> PP 1911 (199) op.cit., p.6 and p.14; PP 1912 (305) Development Commission. Second report of the Development Commissioners being the report for the year ended the 31<sup>st</sup> March 1912; PP 1923 (129) Development Commission, thirteenth report of the Development Commissioners for the year ended the 31<sup>st</sup> March 1923, p. 1.

<sup>613</sup> PP 1934 (Cmd.4605) The Agricultural Output of England and Wales 1930-1931; PP1924-5 (147) Development Commission, fifteenth report of the Development Commissioners for the year ended 31<sup>st</sup> March 1925.

<sup>614</sup> PP 1929-30 (157) Development Commission, Twentieth report of the Development Commissioners for the year ended 31<sup>st</sup> March 1930. The thirteen per cent decrease in the total agricultural output between 1925 and 1930 was reported as the result in changes in quantity and average selling price, see PP 1934 (Cmd.4605) op.cit., pp.39-41.

management, using better feedstuffs for livestock, controlling diseases in both livestock and plants and using improved machines and implements.<sup>615</sup>

If the expansion of agricultural research was to succeed there had to be an effective means of taking this new knowledge to farms and the Development Commission organised and funded twelve advisory provinces, each centred around a college, with each having an advisory council with representation of the Board of Agriculture, the county councils in the province and the college.<sup>616</sup> There were three advisory centres established in Wales: the Department of Agriculture at the University College of Wales, Aberystwyth, established 1913-14 which was responsible for Mid Wales – Brecknockshire, Cardiganshire, Carmarthenshire, Merionethshire, Montgomeryshire and Pembrokeshire; the Department of Agriculture at the University College of North Wales, Bangor, established 1913-14 which was responsible for North Wales – Anglesey, Caernarvonshire, Denbighshire and Flintshire; and the Agricultural Advisory Department at the University College of South Wales & Monmouthshire, Cardiff which was established in 1922-23 and was responsible for South Wales – Glamorganshire and Monmouthshire.<sup>617</sup>

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<sup>615</sup> PP 1935-36 (148) Development Commission, Twenty-Sixth Report of the Development Commissioners for the year ended 31<sup>st</sup> March 1936, pp.9-10.

<sup>616</sup> H. E. Dale, *op.cit.*, p.91; PP 1913 (273) *op.cit.*, p.8; Colin J Holmes, *op.cit.*, p.78, The twelve advisory 'provinces' that were selected to cover England and Wales were; Cambridge University, Bristol University, Reading University College, Harper-Adams Agricultural College, University College of North Wales Bangor, University College of Wales Aberystwyth, the Armstrong College Newcastle, Leeds University, the Midland Agricultural College, the South-Eastern Agricultural College, the Seale Hayne College, and Manchester University in association with Holmes Chapel Agricultural College. However, by the beginning of the First World War only nine out of the twelve colleges selected had acquired staff for this purpose and the £12,000 allocated by the Development Commission had not been used.

<sup>617</sup> Colin J Holmes, *op.cit.*, p.78.

**Table 12. Development Commission Grants 1912-1939**

For the year ending March 31st...	Agricultural Rural Industries	
	Grant	Loan
1912	221,156	
1913	227,600	
1914	469,293	3500
1915	287,738	
1916	147,037	
1917	139,348	125,000
1918	153,665	5125
1919	249,997	40,000
1920	189,429	49,568
1921	316,655	49,607
1923	421,667	16,500
1924	387,219	
1925	433,709	500
1926	485,956	
1927	329,705	1400
1928	338,794	250
1929	345,819	930
1930	473,943	28,000
1931	484,825	
1932	426,773	
1933	365,094	
1934	326,597	
1935	401,059	1800
1936	555,201	
1937	551,538	
1938	606,611	
1939	576,332	3148

*Source: Development Commission Reports 1912 to 1939. 1911 is excluded as it was not a full year and the 1922 report was unavailable. Individual Commission Reports are referenced in the Bibliography*

The relationship between provincial advisors and county advisors was complex. The policies of the county agricultural committees had a different scientific outlook from the research and provincial advisors, and some provincial advisors complained that the county organiser would not consult them due to an unwillingness to admit a lack of



agricultural knowledge.<sup>618</sup> There was a lack of coordination and communication and although the provincial officers were supposed to deal with referred cases from the advisory staff of the county services, in practice the provincial centres often responded to requests for advice directly from farmers.<sup>619</sup>

The advisory work in Pembrokeshire increased considerably by 1918 and was accounted for largely by the orders served on farmers by the Agricultural Executive Committee to bring more of their land under cultivation. The bulk of the work was dealt with by correspondence but in many instances requests were received to visit farms for examination and advice. One prominent feature of the enquiries received was the desire among farmers in the County to obtain fuller information concerning the different varieties of cereal crops and their suitability for different soils and climate. A large percentage of farmers in Pembrokeshire had little or no knowledge of the different varieties of oats with the exception of the *Black Tartarian* and *Ceirch Du Bach*.<sup>620</sup>

Much has been written about Sir George Stapledon and his pioneering work that gave him world-wide recognition. His enthusiastic approach to agricultural science and his personality gained him the title 'British Farming's Mr Chips' as he persuaded even the most obstinate farmer to put new ideas into practice and it was said that those who followed his advice profited from it financially.<sup>621</sup> He first came to Wales in 1912 when he was appointed Adviser in Agricultural Botany at the University of Wales, Aberystwyth; a role that he considered as 'sufficiently alarming' and stated that:

It was somewhat ironical that during my years as Adviser I had no reliable doctrine of my own but for the most part talked through the mouth of outworn textbooks.

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<sup>618</sup> Report on Agricultural Research in Great Britain, Political and Economic Planning, 1938, p.61.

<sup>619</sup> Colin J Holmes, op.cit., p.81.

<sup>620</sup> PA. PACR year ended March 31<sup>st</sup>, 1918.

<sup>621</sup> A. G. Street, 'British Farming's Mr Chips', *The Listener*, 7 October 1943; For the work and life of Sir George Stapledon see Robert Waller, *Prophet of the New Age, The Life and Thought of Sir George Stapledon*, London: Faber & Faber, 1962.

This, however, did not matter a great deal, for the farmers did not pay nearly as much attention to the word of science as they do today: at the worst I was only substituting one set of errors for another: and at least I was able to dispense some valuable home truths with respect to seeds.<sup>622</sup>

Stapledon was described by Moore-Colyer as ‘a conundrum’:

‘As a scientist of the first rank, he was bored by the ordered regimentation of inductive science; as an implacable opponent of the Welsh language, he was held in deep affection by the Welsh rural community; and as a professor he rarely turned up to lectures, but when he did so he offered contributions of memorable brilliance...’<sup>623</sup>

Initially his work involved preparing a botanical survey of the Aberystwyth district and advising farmers in the college area.<sup>624</sup> He produced a report on the state of the seed trade in the region and found that most of the seeds on the market were unreliable because they were adulterated and not suitable for the local ecological conditions.<sup>625</sup> Stapledon was also critical of the institute at Cambridge for failing to produce seed varieties that were appropriate for the conditions in which Welsh farmers worked.<sup>626</sup> In 1913 he was concerned about the condition of the seed trade in the district and appealed to farmers to send seed samples for analysis at the college. The farmers responded readily and sent 380 samples.<sup>627</sup> The following year there were 103 applications to the advisory department mainly for advice related to the purity and germination of seeds which resulted in twenty-five personal visits to farms.<sup>628</sup> There was also a special investigation into the infertility of

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<sup>622</sup> Robert Waller, *op.cit.*, p. 55.

<sup>623</sup> R. J. Moore-Colyer, ‘Science, Education and the Rural Tripper: Sir George Stapledon (1882-1960) at Ponterwyd, ca. 1913’, *Journal of the University of Wales Agricultural Society*, Vol.80, 2000, p.2.

<sup>624</sup> PP 1914 (Cd. 7450) Board of Agriculture and Fisheries, Annual Report of the Education Branch on the Distribution of Grants for Agricultural Education and Research 1913-14, p. 46.

<sup>625</sup> Paolo Palladino, ‘The Political Economy of Applied Research: Plant Breeding in Great Britain, 1910-1940’, *op.cit.*, p.456.

<sup>626</sup> *Ibid.*, p.457.

<sup>627</sup> PP 1914 (Cd. 7450), *op.cit.*, p. 47.

<sup>628</sup> 1914-16 (Cd.8066), Board of Agriculture and Fisheries, Annual Report of the Education Branch on the Distribution of Grants for Agricultural Education and Research 1914-1915, p. 41.

3000 acres in North Cardiganshire caused by drainage from the lead mines in the district.<sup>629</sup>

The Advisory Chemist at Aberystwyth, T. W. Fagan, and his assistant R. O. Davies, were responsible for the research associated with advisory duties and this included studying the effects of manures on pastures, the chemical aspects of silage making, the nutritional value of grains and roots and the nutritive value of pastures. The advisory centre also analysed soil, manure and fertilisers for the farmers and the County Agricultural Organisers and although in the beginning the farmers had been reluctant to make use of the analytical service due in part to their suspicion of science, farmers were sending up to 500 samples to Fagan's laboratory by the mid-1930s, an indication that there was a growing awareness for advice concerning the nutrition of plants and animals.<sup>630</sup>

The advisory work at Bangor commenced in October 1912 and the Development Fund gave a grant of £1,100 for alterations in the chemical and botanical laboratories including additional equipment.<sup>631</sup> In 1913-14 the advisory work included: visits to four farms in Caernarvonshire and three in Flintshire to advise on selection of grass seeds and improvement of permanent pasture; analysing 64 samples of seeds from farmers; identification and eradication of weeds; and gave advice on infertility in soils and selection of manures.<sup>632</sup> The following year the advisory work included: turnip disease; experiments on the eradication of bracken; studies of reclamation schemes; and field experiments for long grass rotation.<sup>633</sup>

From 1920 there were Advisory Officers in chemistry, entomology and mycology at Aberystwyth and Bangor and in entomology and mycology at Cardiff to support Welsh

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<sup>629</sup> Ibid., p. 42.

<sup>630</sup> Richard J. Colyer. *Man's Proper Study*, op.cit., pp.54-55.

<sup>631</sup> PP 1913 (273), op.cit., p. 9; 1914 (Cd.7450) op. cit., pp. 49-50.

<sup>632</sup> PP 1914 (Cd.7450), op. cit., p.50.

<sup>633</sup> PP 1914-16 (Cd.8066), op.cit., p. 44.

agriculture. For veterinary purposes Wales was divided into north and south with specialist Advisory Officers at Bangor and Cardiff and Advisory Dairy Bacteriologists were appointed in Aberystwyth in 1925 and Bangor in 1926.<sup>634</sup> The appointment of Mr Trefor Thomas as Advisor in Grassland for Wales in 1930 was considered an important development because the position was attached to the WPBS and not to the Agricultural Department, thus having no provincial or regional boundaries.<sup>635</sup>

At the beginning of the century farming costs were composed largely of overheads with few ways of performing particular tasks or of producing particular products. When agricultural scientists discovered new ranges of inputs for farmers to use, often for the same or similar process, the cost of each new input had to be weighed against benefits. Farmers had to decide whether to use and how much to use and consequently the science of economics grew in importance to farmers and the advisory worker.<sup>636</sup> The financial information from the farm was said to provide the means of diagnosing weaknesses which then formed the basis of the scientific advice offered. Therefore it allowed the farmer to use the agricultural science profitably in practical farming.<sup>637</sup> The partnership of economics with science was important to Welsh farmers and led to the appointment of Professor A. W. Ashby<sup>638</sup> as Advisor in Agricultural Economics, not just for the Aberystwyth Province but for the whole of Wales and was the first advisory position that traversed provinces.<sup>639</sup> Professor Ashby wanted to raise the incomes and standards in Welsh farming and emphasised that improvements would need to be made to create a stronger demand for the produce of Welsh farms. He expected farmers to use their

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<sup>634</sup> A. W. Ashby and I. L. Evans, *op. cit.*, p.147-48.

<sup>635</sup> Sir George Stapledon. *The Way of the Land*, (London: Faber and Faber, 1943), pp. 210-11.

<sup>636</sup> W. J. Thomas, 'Advisory Services and the Agricultural Community', *op.cit.*, pp.109-10.

<sup>637</sup> E. P. Weller, 'The Basis of Agricultural Advisory Work', *AP*, Vol. V, 1928, pp.102-06.

<sup>638</sup> Arthur Wilfred Ashby (1886-1953) was a prominent agricultural economist who also took a great interest in the education of rural workers, was a supporter of the Welsh Agricultural Organisation Society, and the establishment of the Milk Marketing Board.

<sup>639</sup> Sir George Stapledon. *The Way of the Land*, *op.cit.*, pp.210-11.

initiative and use the technical information available to improve their farming processes in order to improve quality. Although he believed there would be laggards who refused to make changes he thought that on the whole Welsh farmers would rise to the occasion to make changes in grassland quality, selection of the best livestock and feeding products as well as improving farm organization. The key functions of Professor Ashby's Economics Department were helping farmers to develop methods for livestock marketing, better utilisation of milk on stock-raising farms, the improvement in the preparation of butter and organisation for sale and the development of methods of marketing wool.<sup>640</sup> When asked by the travel writer H. V. Morton what he thought of the Welsh farmer Professor Ashby thought carefully before replying:

That varies with my moods...and with the manifestations of his varied characteristics from day to day. At times it would not be fit for publication! But on the whole I have found him a wonderful man to work with. He is always cautious and, like all small farmers, tends to be conservative. What Welsh farmers need is good leadership from within their own class. One good technical and social leader who is a farmer will leaven a mass of rank and file farmers.<sup>641</sup>

In Wales the expansion of the Provincial Advisory Services in the inter-war years was supported by the increases in the funding from the Development Commission and this rose from £1500 in 1919 to over £20,000 in 1939 as is shown in Table 13.<sup>642</sup> The Departmental Committee on the Home Production of Food asserted that farmers were waiting for leadership and were willing to modify methods, not primarily for profit, but to secure the maximum output from their land. They believed that there were many farmers who, from patriotic motives, were willing to produce more food provided that the agricultural policy was a sound one and although there were many farmers distrustful of

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<sup>640</sup> PP 1930-31 (126) Development Commission, Twenty-first report of the Development Commission of the year ended 31<sup>st</sup> March 1931, pp.169-70.

<sup>641</sup> H. V. Morton, *In Search of Wales*, London: Methuen, 2008, (first published in 1932), pp.204-07.

<sup>642</sup> A. W. Ashby and I. L. Evans, *op. cit.*, p.148.

agricultural education, there would be many that would welcome practical advice from men who were knowledgeable about local conditions.<sup>643</sup>

Although the advisory service grew in the inter-war years by offering advice in six branches of science – chemistry, dairy, bacteriology, economics, entomology, mycology, and veterinary science, the range of specialisations did not cover the whole range of agricultural science.<sup>644</sup> Animal feeding, crop nutrition and agricultural engineering problems were referred directly to the appropriate research institute.<sup>645</sup> There was severe understaffing of the service; in the 1930s the ratio of advisory officer to farmer was 1:3647 and even when county organisers were appointed the service was only able to maintain contact with a small proportion of farmers.<sup>646</sup> By 1936 there were four times as many Advisory officers and assistants as were originally contemplated by the Commissioners in 1911 and the annual provision made from the Fund had increased seven-fold.<sup>647</sup>

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<sup>643</sup> PP 1914-16 (Cd.8095), Departmental Committee on the Home Production of Food. (England and Wales) Final Report of the departmental committee appointed by the president of the Board of Agriculture and Fisheries to consider the production of food in England and Wales, p.9.

<sup>644</sup> H. E. Dale, *op. cit.*, p.93; Colin J. Holmes, *op. cit.*, p.80.

<sup>645</sup> Colin J. Holmes, *op. cit.*, p.80.

<sup>646</sup> *Ibid.*, pp.81-82, the author comments that in a social survey in 1944 only 17 per cent of the 1968 farmers questioned said that they had consulted their County Organiser, 68 per cent said they had not and 9 per cent claimed not to have known of his existence.

<sup>647</sup> PP 1935-36 (148), *op.cit.*, p. 62.

**Table 13. Grants from the Development Fund to Advisory Centres in Wales**

<b>Academic Year</b>	<b>Aberystwyth</b>	<b>Bangor</b>	<b>Cardiff</b>	<b>Total</b>
1919	430	1,055	-	1,485
1920	1,490	1,805	-	3,295
1921	1,238	3,144	-	4,382
1922	1,090	2,590	-	3,680
1923	2,100	2,650	1,500	6,250
1924	1,950	3,380	1,500	6,830
1925	3,490	3,960	1,500	8,950
1926	4,350	5,035	2,400	11,785
1927	5,240	5,190	2,470	12,900
1928	5,150	5,170	2,450	12,770
1929	5,190	5,240	2,570	13,000
1930	6,430	5,410	2,680	14,520
1931	6,895	5,520	2,750	15,165
1932	6,700	5,350	2,660	14,710
1933	6,830	5,420	2,710	14,960
1934	7,010	5,510	2,770	15,290
1935	7,520	5,840	2,670	16,030
1936	8,366	6,000	2,900	17,266
1937	8,990	5,950	2,970	17,910
1938	9,685	6,095	3,010	18,790
1939	10,475	6,790	3,205	20,470

*Source: A.W. Ashby and I. L. Evans, The Agriculture of Wales and Monmouthshire, (Cardiff: UWP, 1944), p.201*

Holmes considered that despite staff shortages and a lack of financial resources, the advisory service available to farmers had improved considerably by 1939 and although there were deficiencies in the relationship between agricultural advisers and farmers, the advisers' achievements were substantive and their work was appreciated by a growing number of farmers.<sup>648</sup> Although it was considered that the Advisory Service was not a substitute for agricultural education but a means of keeping farmers up to date with the

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<sup>648</sup> Colin J. Holmes, op.cit., p.86.

latest research, it was suggested that this advisory work would induce an appreciation of the need for education for future generations.<sup>649</sup>

## 8.2 The County Advisory Service in Pembrokeshire

As mentioned in the previous chapter, the Agricultural Organiser had many roles; in addition to the teaching of farmers and students, he was responsible for advisory work, research work and for demonstrating the results of the research work. It was considered that the most important function of the advisory work was passing the research results in a form that farmers could both understand and adopt in order to promote best practice from farm to farm. The organiser connected the agricultural research scientist to the practical farmer and following the First World War, it was believed that farmers thought more favourably of the adviser and looked for valuable help.<sup>650</sup>

The Agricultural Organiser for Pembrokeshire commented that by 1921 the advisory side of his work had rapidly increased on account of the fact that lectures and experiments acted as an introduction to advisory work. Large numbers of enquiries in connection with seed mixtures, potatoes, artificial manures and samples of oats and barley were received alongside several applications for soil analyses. University advisors were active in the county: Mr Fagan, the Chemistry Advisor, visited eight farms that year; Mr T. J. Jenkin had examined a large number of plants; and nearly 1500 advisory leaflets were sent to the farmers of the county.<sup>651</sup>

The Agricultural Education report for the year ending March 1925 showed that 213 applications for advice were requested, 127 of them being dealt with by correspondence

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<sup>649</sup> R. S. Hudson, opening address at the luncheon of the Jubilee of the Agricultural Education Association, 13 December 1944, *AP*, Vol. XIX, 1944, p.35; T. S. Dymond, 'The British Association Meeting, Dundee, 1939', *AP*, Vol. XVI, 1939, p.236.

<sup>650</sup> D. B. Johnstone-Wallace, *op.cit.*, pp.99-101.

<sup>651</sup> PA, PACR year ended March 31<sup>st</sup> 1921.



and 86 by farm visits. Most enquiries were about soils, manures and seed mixtures. Of the questions relating to weeds, Charlock, Cornmarigold, Spurrey and Ferns were most commonly mentioned in correspondence. Cornmarigold (in North Pembrokeshire called 'Gold') was responsible for serious losses. Although there were many lectures and visits to farms from the agricultural advisors throughout the year the County Organiser commented:

...if it were generally known amongst farmers that these advisors are prepared to assist willingly and promptly to solve difficulties, much time and money could be saved. In some cases farmers do not worry about them until any pest has become a serious epidemic.<sup>652</sup>

The Advisory Scheme in Pembrokeshire was brought more prominently to farmers as a result of the Exhibition and Public Meeting held in connection with Education Week. Approximately five hundred farmers attended the meeting at Shire Hall, Haverfordwest, to listen to Sir John Russell of Rothamsted and Sir Ernest Gray of the National Union of Teachers and then attended exhibits staged by the Ministry of Agriculture, The Rothamsted Experimental Station, The Welsh Plant Breeding Station, The University College of Wales Advisory Staff, the National Institute for Research in Dairying, The National Farmers' Union and the Pembrokeshire Agricultural Committee. The Pembrokeshire advisors also had marquees of educational exhibits at the agricultural shows at Pembroke, Haverfordwest, Fishguard, Crymych, Narberth and Kilgetty in order to advise farmers in aspects of agriculture, horticulture, dairying, poultry keeping and fruit and vegetable preservation.<sup>653</sup>

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<sup>652</sup> PA, PACR year ended 31<sup>st</sup> March 1925.

<sup>653</sup> PA, PACR year ended 31<sup>st</sup> March 1926.



**Figure 17. The Agricultural Advisors' Exhibits at Local Agricultural Shows 1926**

*Source: Pembrokeshire Archives, Report on the Agricultural Educational Work done in Pembrokeshire during the year ended 31<sup>st</sup> March 1926, Pembrokeshire Agricultural Committee*

By 1930 there had been an increase in the number of requests for advice on a number of aspects of agriculture as shown in Table 14. This was the first year that sugar beet was grown on a commercial scale in Pembrokeshire and the farmers had many questions for the advisory service. A demonstration and lecture on the cultivation of sugar beet was held at Eastington, near Pembroke and was attended by forty farmers. Later in the year twenty farmers from the county inspected the sugar manufacture process at Allscott Beet Sugar Factory near Shrewsbury.<sup>654</sup>

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<sup>654</sup> PA, PACR year ended 31<sup>st</sup> March 1930.

**Table 14. Requests for Advice on Agriculture in Pembrokeshire 1930**

	Visits	By Correspondence	Total
Fungus Diseases	-	9	9
Crops (other than sugar beet)	3	13	16
Sugar Beet	9	85	94
Insect Pests	2	8	10
Weeds	2	11	13
Seeds Mixtures	3	9	12
Rations	1	12	13
Manures	3	17	20
Soil Samples	10	-	10
Graded Milk and Clean Milk Competition	22	-	22
Rat Destruction	11	-	11
Miscellaneous	1	15	16
<b>Total</b>	<b>67</b>	<b>179</b>	<b>246</b>

*Source: Pembrokeshire Archives, Report on the Agricultural Educational Work done in Pembrokeshire during the year ended 31<sup>st</sup> March 1930, Pembrokeshire Agricultural Committee*

A few years later approximately 250 farmers from all parts of the county attended a lecture given by Mr Howard of the Lincolnshire Beet Sugar Co. on the cultivation of sugar beet. Following this meeting there was a growing demand for the erection of a sugar beet factory in Pembrokeshire supported by the County Council and the County Branch of the NFU. Mr W. E. D. Jones canvassed the support of 270 farmers within the county and they committed to grow between one and one hundred acres of sugar beet to support building of the factory.<sup>655</sup>

Pembrokeshire farmers were interested in the work at experimental and research stations and in May 1932 the Pembrokeshire Farmers' Educational Tour was organised for farmers to visit the Rothamsted Experimental Station and the Imperial Chemical Industries

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<sup>655</sup> PA, D/ROC/MISC/15/11 Correspondence of Pembrokeshire Agricultural Education Committee; PA, PACR year ended 31<sup>st</sup> March 1933.

Research Station at Jealott's Hill.<sup>656</sup> In the same month the University College of Wales Agricultural Society selected Pembrokeshire for their annual tour. The places that were chosen reflected the adoption of scientific and technical improvements in the county:

Cilrhue, Boncath (Grade A, T.T. Farm)  
Caerelwyn, Clynderwen (Model Cowshed)  
The Model Egg Depot and Creamery at Clynderwen  
The Haverfordwest Churn Works (manufacture of churns and poultry houses)  
The Dingle Poultry Farm (Intensive Grassland and Egg Laying Trials)  
Glanafon (Grade A milk production)  
Castell Farm (Grassland treatment and seed mixture experiments)<sup>657</sup>

Questions from farmers were wide-ranging and covered subjects such as what manure to use, how to eradicate weeds, how to deal with rabbit and rat infestations and milk grading. The number of requests in 1935-36 is shown in Table 15 and the numbers show that there was less advisory work undertaken by visits and over thirty percent more dealt with by correspondence than in 1930. There were many questions addressed at lectures and fairs, when visiting experimental and demonstration plots in the county, or when taking samples for analysis under the Fertiliser and Feeding Stuffs Act. The twenty seven enquiries in connection with the Milk Drinks and Milk Bars were received following the Royal Welsh Show in Haverfordwest and they not only came from Pembrokeshire but also from Cardiganshire, Carmarthenshire, Glamorganshire and even London. The Milk Bar was the idea of the Pembrokeshire Agricultural Organiser and it was recorded as a great success not only for encouraging visitors to the show to drink more milk but also as milk propaganda outside the show yard. In order to give the maximum publicity to the new milk drinks, Mr Jones also convinced the Show Committee to have milk and milk cocktails for the toast of 'The Royal Welsh Agricultural Society' at the President's luncheon on the first day of the Show. The novelty of seeing farmers drink a toast in milk

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<sup>656</sup> PA, PACR year ended 31<sup>st</sup> March 1933.

<sup>657</sup> Ibid.

or milk cocktails at an agricultural show placed the Milk Bar in the headlines of newspapers and broadcast news.<sup>658</sup>

**Table 15. Advisory Work undertaken in 1935-36**

<b>Subject</b>	<b>By visits</b>	<b>By correspondence</b>	<b>Total</b>
Manures	10	32	42
Soils	7	13	20
Seeds Mixtures	4	9	13
Accredited and Attested Milk	4	15	19
Milk Drinks and Milk Bars	1	26	27
Potatoes (Earlies)	7	13	20
Potatoes (Main Crop)	2	6	8
Other Crops	0	16	16
Plants for Identification	0	27	27
Weed Destruction	1	10	11
Rations	0	12	12
Animal Diseases	1	7	8
Insect and Fungus Pests	3	6	9
Rabbit Gassing	0	10	10
Rat Destruction	0	16	16
Miscellaneous	1	25	26
<b>Total</b>	<b>41</b>	<b>243</b>	<b>284</b>

*Source: Pembrokeshire Archives, Report on the Agricultural Educational Work done in Pembrokeshire during the year ended 31<sup>st</sup> March 1936*

By 1939 the number of requests farmers made to the advisory service had doubled as shown in Table 16. Soils, manures and lime accounted for nearly half of the requests for advice and reflected the impact of the Land Fertility Scheme that occupied the advisory work for this year.<sup>659</sup>

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<sup>658</sup> PA, PACR year ended 31<sup>st</sup> March 1936.

<sup>659</sup> PA, PACR year ended 31<sup>st</sup> March 1939.

**Table 16. Requests for advice on Agriculture in Pembrokeshire, 1939**

	Visits	By Correspondence	Total
Soils	78	162	240
Manures	5	46	51
Lime	3	16	19
Grass Seeds Mixtures	11	20	31
Early Potatoes	5	26	31
Other Crops	8	33	41
Stock	-	10	10
Weeds	11	33	44
Rations	2	28	30
Milk Improvement	1	20	21
Plant Diseases	-	19	19
Insect Pests	2	11	13
Miscellaneous	15	73	88
<b>Total</b>	<b>141</b>	<b>497</b>	<b>638</b>

*Source: Pembrokeshire Archives, Report on the Agricultural Educational Work done in Pembrokeshire during the year ended 31<sup>st</sup> March 1939*

Although this study has shown significant improvement in the dissemination of scientific information from scientists to farmers via the County Organiser, there were concerns that the majority of farmers were not helped. *The Report on Agricultural Research in Great Britain* indicated that the State-supported agricultural research and advisory services and the farming community were out of touch with one another and that the majority of farmers were unaware of the work of the research institutes and the advisory centres. The Report stated that the gap between the traditional conservatism of the farming community and the progressive outlook of the research services was the fundamental cause of the time-lag between the new scientific discoveries and the practical use of the farm.<sup>660</sup> However, Earl De La Warr disagreed and commented that it was largely due to the personalities and technical competence of the agricultural organisers that

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<sup>660</sup> Report on Agricultural Research in Great Britain, Political and Economic Planning, 1938, p.69.

farmers gained a respect for agricultural science and that farmers were open to scientific advice.<sup>661</sup>

*The Times* correspondent described the organisers as ‘a fine body of men, who understand farming psychology well enough not to try to pose as teachers, but rather to offer practical advice on particular problems when their assistance is invited’. Successful agricultural organisers approached their work in the spirit that farmers knew ninety-five per cent of their job and he may be able to help and tell them something about the remaining five per cent.<sup>662</sup> It was acknowledged that the Agricultural Organiser for Pembrokeshire, had good relationships with the farming community and the advisory staff at Aberystwyth. His correspondence files also show a good relationship with the Advisory Chemist; in January 1938 Mr W. E. D. Jones sent two sacks full of soil samples by rail and emphasising that the carriage was paid in advance, informed Professor Fagin that ‘if the GWR try to get you to pay carriage see that the carrier gets a lecture all to himself in the big lecture hall’. In another letter welcoming advisors to Pembrokeshire he asked to be let known which train they were arriving on so he could ‘send the band’ to welcome them.<sup>663</sup>

The advisory work in Wales was seen to make good progress and the numbers of requests doubled between 1941 and 1945 as can be seen in Table 17. The 10,875 soil samples related to 2,011 holdings and the decrease in number from the previous year was attributable to the disturbance caused by the reorganisation of the Advisory Service and formation of the National Agricultural Advisory Service as outlined in Chapter Ten. The large decrease in the number of milk samples was a result of the routine testing of milk fat

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<sup>661</sup> Right Hon. Earl De La Warr, ‘Presidential Address, The Relation of Agricultural Education and Research to the Development of British Agriculture’, *Journal of Proceedings of the Agricultural Economics Society*, Vol.5, Issue 3, 1938.

<sup>662</sup> *The Times*, 13 April 1931.

<sup>663</sup> PA PCC/SE/77/56, 27 January 1938.

that was taken over by the Milk Marketing Board.<sup>664</sup> In concluding his report the Advisory

Chemist, G. W. Robinson stated:

In presenting the report of my 34<sup>th</sup> and last year as Advisory Chemist I must resist the temptation to look back regretfully to the organisation that has now been superseded. As one of those first appointed under the old scheme, I have seen its growth from small beginnings, and I can only hope that equally impressive progress will be made in the years that lie ahead. The old service has provided good foundations.<sup>665</sup>

**Table 17. Number of Samples investigated by the Advisory Chemist at the University of North Wales for the year ended 30 September 1946**

	1941-2	1942-3	1943-4	1944-5	1945-6
Soils	6,243	4,868	8,901	11,845	10,875
Fertilisers	80	81	57	63	24
Milks	1,180	1,567	3,235	3,980	96
Fodders	73	70	53	97	109
Miscellaneous	6	-	-	5	1
<b>Total</b>	<b>7,582</b>	<b>7,586</b>	<b>12,246</b>	<b>15,990</b>	<b>11,105</b>

*Source: TNA MAF 33/395 Reports from Advisory Centres 1945-6*

At Aberystwyth there were 7546 samples analysed by the Advisory Chemist of which 2983 were soil samples and 1661 were feeding stuffs samples. The Advisory Chemist, R. O. Davies also concluded his report with a personal comment:

I also desire to acknowledge my indebtedness to my colleagues at Aberystwyth who have devoted themselves unsparingly to the Advisory work in Agricultural Chemistry, and to the Technical Advisers in the Counties and to many District Officers and farmers whose active interest greatly facilitated the field work of the Department.<sup>666</sup>

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<sup>664</sup> TNA MAF 33/395 Reports from Advisory Centres 1945-46.

<sup>665</sup> TNA MAF 33/395 op.cit., Report of Advisory Chemist for the year ended 30<sup>th</sup> September 1946, University College of North Wales, Bangor.

<sup>666</sup> TNA MAF 33/395 op.cit., Report of the Advisory Work in Agricultural Chemistry 1945-46, University College of Wales, Aberystwyth.



The Advisory Bacteriologists at Aberystwyth helped West Walian farmers by investigating the purity of their water supplies for dairy purposes. This was important because several types of water bacteria were known to produce gassiness, fishiness and bitterness in milk, rancidity and surface taint in butter and rancidity in condensed milk. In the interest of public health it was desirable that water supplies for dairy purposes should have purity at least equal to potable waters. The investigation of 3745 samples found that 75 per cent of the dairy farm supplies, 48 per cent of the dairy supplies and 42 per cent of the creamery supplies were unsatisfactory for the standard advocated by the Ministry of Health. In Pembroke, Montgomery and Carmarthen over 30 per cent of the holdings had used stream and canal water due to of seasonal shortage and the investigation showed ninety-seven per cent were unsatisfactory and nearly sixty per cent were very heavily polluted.<sup>667</sup> The advisors helped dairy farmers to eliminate bacteria by recommending better methods to clean and sterilise machinery and utensils and to improve their pasteurisation techniques 1,642 farms were visited in connection with milk producing problems.<sup>668</sup> In response to enquiries from dairy farms relating to machine milking, advisors at Aberystwyth suggested a two day refresher course for the County Dairying Instructresses so they could support dairy farms with further information on the theoretical and practical instruction of operating, cleaning and sterilisation of different types of milking machines.<sup>669</sup>

### **8.3 Commercial Advisory Services**

Agricultural research discoveries were often adopted by industrial and commercial companies and manufacturers, whose priority was profit, and did not always have the

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<sup>667</sup> TNA MAF 33/395 op.cit., Report of Advisory Bacteriologist for the year ending September 1946, University College of Wales, Aberystwyth, p.1.

<sup>668</sup> TNA MAF 33/395 op.cit., Report of Advisory Bacteriologist for the year ending September 1946, University College of Wales, Aberystwyth, p.2 and p.8.

<sup>669</sup> PA, PCC/SE/2/7 Meeting of the Agricultural Executive Sub-Committee 14 June 1941.

farmers' interest at heart. The salesmen and industrial scientific advisers of fertilisers and feeding stuff were more numerous and persistent than county advisors and would spread the scientific knowledge about their products, albeit in a biased way.<sup>670</sup> The quality of advisory work provided by some commercial firms was deemed to have been very high, benefitting not only the farmer recipients but by their example, the official advisory services as well.<sup>671</sup>

The Agricultural Education Inspectors' reports showed that in 1938 representatives of commercial concerns did most of the advisory work in many of the Welsh Counties. There was also a consideration that by the late 1930s farmers were receiving more information from the sales and technical staff of the large feed and fertiliser manufacturers than from the advisory services and although reputable companies provided reliable information based on genuine field trials, advice from less scrupulous firms was extremely unreliable.<sup>672</sup> However, there was an argument that the commercial firms had the advantage of producing 'user techniques' for the successful application of their products. This meant that they could advertise very broad recommendations on how to use their products and as farming conditions were so variable they could recommend a universal application to get the best from the product and would rely on farmers to optimise it in their local conditions.<sup>673</sup>

The purpose of the Fisons Advisory Service was to give farmers advice on matters concerning the use of fertilisers and other general problems connected with agriculture and horticulture and the company had Area Advisers throughout the country working in

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<sup>670</sup> Report on Agricultural Research in Great Britain, Political and Economic Planning, 1938, p.70.

<sup>671</sup> W. J. Thomas, 'Advisory Services and the Agricultural Community', *op.cit.*, p.113.

<sup>672</sup> TNA MAF 33/397 Agricultural Education in England and Wales Inspectors Reports 1938; Colin J. Holmes, *op.cit.*, p.83; For details of Fisons, ICI, Potash Ltd and other suppliers see the Report on the Supply of Chemical Fertilisers, The Monopolies Commission, (London: HMSO, 1959).

<sup>673</sup> The opinion of J. P. Johnson, Farm Advisory Service Manager of ICI in W. J. Thomas, 'Advisory Services and the Agricultural Community', *op.cit.*, p. 131.

collaboration with the local Fisons Sales Offices. Fisons operated a technical and advisory service to help farmers secure the best return for their investment in fertilisers. The service was organised on the same area basis as the fertiliser sales force and was free of charge with farmers' questions being answered by letter or if applicable by a personal visit.<sup>674</sup> Fisons sales representatives and advisors were so active in Pembrokeshire that the Fisons name became so ingrained in the minds of farmers that the name of the company became the name of the fertiliser and it was known for a farmer to ask another 'do you use Fisons' fisons or another company's fisons?'<sup>675</sup> Although the NFU considered that the fertiliser needs of its members were adequately met and that the advisory services of the leading suppliers such as ICI and Fisons were technically first rate there was evidence from farmers and smallholders associations that Fisons employed knowledgeable and qualified advisory staff but that the advisory service and the company's advertisements, had on occasion recommended excessive uneconomic fertiliser applications.<sup>676</sup>

The *Farmers Weekly* also offered a free advice service for farmers and all inquiries were answered by post or published in the newspaper. It also advertised commercial advisory services; Silcocks Advisory Service offered farmers advice on 'eeking (sic) out foddors and concentrates till the grass is really ready'.<sup>677</sup> As more and more farmers were converted to adding mineral supplements to animal feed for increased production and breeding, feed supply companies were also offering advisory services; Churn, the supplier

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<sup>674</sup> Report on the Supply of Chemical Fertilisers, The Monopolies Commission, op.cit., pp.72-73. At the time of the report it was noted that in order to extend Fisons' service to farmers and its own knowledge of soil variation 50,000 soil and crop samples were taken annually for routine analysis at Levington; Fisons Advisory Services were advertised in *Farmers Weekly*, see for example 2 January 1948.

<sup>675</sup> I am grateful to Martin Sykes, a retired Pembrokeshire farmer in Letterston for this quote.

<sup>676</sup> Report on the Supply of Chemical Fertilisers, The Monopolies Commission, op.cit., p.116 and p.120.

<sup>677</sup> *Farmers Weekly*, 18 April 1947, R Silcock & Sons Ltd., Liverpool.

of protective mineral supplements, had an advertisement slogan of ‘You won’t regret it. For about ten bob a head a year, you will get a better yield and fewer losses’.<sup>678</sup>

To fully utilise the capacity of ICI’s nitrogen plant in Billingham, Sir Alfred Mond<sup>679</sup> later Lord Melchett, decided that in 1928 sales would need to be boosted by active marketing, promotion and propaganda and decided to introduce an agricultural research station to back up the marketing drive with hard scientific knowledge. He recruited Professor Sir Frederick Keeble to devote himself to research and propaganda in fertilisers at ICI and used Nitram Ltd. and their experienced team of agricultural advisers for field consultancy work and produced brochures, sales leaflets and a journal entitled *Farm Notes on Profitable Farming*.<sup>680</sup> In 1927 Nitram Ltd bought three adjacent farms, Jealott’s Hill, Hawthorndale and Nuptown to serve as ICI’s centre for agricultural research and demonstration with an aim to popularise the use of nitrogen on grass and to encourage the adoption of an intensive system of grassland management which they claimed could substantially increase the numbers of livestock which could be supported by pastures. They also assisted farmers by giving local demonstrations and lectures in local conditions as can be seen in Figures 19 and 20. The team at Jealott’s Hill were encouraged to regard themselves as an advisory service but also stated its aim as for ‘the long-term prosperity of agriculture, irrespective of the immediate interests of the Company, since in the long run both are identical’ and published its results freely.<sup>681</sup>

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<sup>678</sup> *Farmers Weekly*, 16 January 1948.

<sup>679</sup> Sir Alfred Mond was a British industrialist, financier and politician.

<sup>680</sup> Carol Kennedy, *ICI The Company that Changed our Lives*, (London: Paul Chapman, 1993), pp.136-37.

<sup>681</sup> Carol Kennedy, *op.cit.*, pp.137-38; Report on the Supply of Chemical Fertilisers, The Monopolies Commission, *op.cit.*, p.53-54, at the time of this report ICI’s advisory service supported farmers with lectures, films, and farm demonstrations and maintained contact with the advisory services, universities and colleges.



**Figure 18. ICI Grassland and Silage demonstrations at Tai Hen Farm, Rhoscoch.**

*Source: Geoff Charles Collection courtesy of the National Library of Wales.*



**Figure 19. ICI Grassland and Silage demonstrations at Tai Hen Farm, Rhoscoch.**

*Source: Geoff Charles Collection courtesy of the National Library of Wales.*

This chapter has illustrated the influence of both the County and Provincial Advisory Services on agricultural improvement in West Wales, as well as highlighting the importance of the three –way relationship between the farmer, the County Organiser and the scientist. Individual leadership and influences have been shown to have had an impact on the ways farmers improved their productivity. The advisory work of both the County staff and the Advisory Bacteriologists has been seen here to be crucial in the hygienic standard of milk production and represented a significant example of how scientists and farmers work together. The evidence shown demonstrates positive farmers' attitudes and the volume and variety of questions and requests of scientists illustrate how farmers believed and recognised how science could contribute to their industry.

## CHAPTER NINE: AGRICULTURAL CO-OPERATION

### 9.1 Introduction

The co-operative movement dates from the formation of the Rochdale Equitable Pioneers in 1844, a movement that was described as ‘emphatically working class in origin and anti-capitalist in outlook’.<sup>682</sup> However, LeVay’s review of agricultural co-operative theory states that even though the conventional approach to defining co-operation is to list the Rochdale Principles, there were many departures resulting in no standard model other than the fact that the co-operative was an association of people who work together to achieve commercial objectives.<sup>683</sup>

Although agricultural co-operation was considered an economic side of the farmers’ business it is included within this thesis because of the way it changed how Welsh farmers worked. It considers how farmers adopted and applied the principles of Horace Plunkett’s triple doctrine *Better Farming, Better Business, Better Living* which disputed the gibe that ‘co-operation is merely farmers playing at shop’.<sup>684</sup> It was thought that the science of better farming and the plans for better living would fail if the foundation of better business was not ingrained in every part of farm life for improvement in efficiency for example within crop rotation, breeds of livestock, soil fertility and quality in the dairy. Farmers acting as businessmen adopted scientific farming methods for business reasons when they knew and appreciated that joining with neighbours equipped them with the ability to produce those products in quantity and quality for good returns. Agricultural co-operation allowed the farmer to buy in bulk and sell in bulk whilst preserving

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<sup>682</sup> A. J. Rayner and C. T. Ennew, ‘Agricultural Co-operation in the UK: A Historical Review’, *Agricultural, Administration & Extension*, Vol. 27, 1987, p.94.

<sup>683</sup> Clare LeVay, ‘Agricultural Co-operative Theory: A Review’, *Journal of Agricultural Economics*, Vol.34, Issue 1, 1983, p.3.

<sup>684</sup> *Better Farming, Better Business, Better Living* was the doctrine of Horace Plunkett who was the leading activist for the UK co-operative movement and who had established the Irish AOS in 1894; Dafydd Jenkins. *Clear the Harvest-Dawn*, James Publications, 1987, p.60.

independence and individual initiative.<sup>685</sup> However, at the beginning of the twentieth century farmers were described as being averse to co-operation because of habit and prejudice preferring to be independent and secret about their business:

...he is, by breeding, training and habit, conservative, reticent, and, above all, egotistical...his jealousy of his neighbour is almost as strong as his jealousy of foreign competitors. To combine with his neighbours for any purpose whatever is irksome, and to combine for business purposes is repugnant.<sup>686</sup>

Agricultural co-operation was seen as a constructive social and economic programme that addressed these personal traits. It was based on the fact that the farmer was highly skilled in what he does and that by being part of the co-operation movement gained the advantages of wholesale prices of raw materials, fertilisers, feeding stuffs and seeds. It was also seen as an intelligence service for scientific discovery and progress and allowed farmers to transport and sell in an economical and efficient way.<sup>687</sup> As co-operation began to be adopted there was still an undercurrent of suspicion amongst farming communities, as Babcock stated:

I regard a farmer-owned, farmer controlled co-operative as a legal, practical means by which a group of self-selected, selfish capitalists seek to improve their individual positions in a competitive society.<sup>688</sup>

The development of agricultural co-operatives had been slow relative to the development of industrial co-operation possibly because of farmers attitudes and the high degree of resistance by landlords. By the beginning of the twentieth century there was a

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<sup>685</sup> W. H. Warman. *Agricultural Co-operation in England and Wales*, (London: Williams & Norgate, 1922), pp.viii-x, preface by Leslie Scott, Chairman, Agricultural Organisation Society.

<sup>686</sup> Richard Henry Rew, *An Agricultural Faggot*, (Minster: King & Son, 1913), p.104-15; Joan Thirsk, *The Agrarian History of England and Wales, Vol.VIII, 1914-1939*, op.cit., pp.27-28.

<sup>687</sup> E. J. Coyne, 'Agricultural Co-operation', *The Irish Monthly*, Vol.73, No.864, 1945, pp.227-28.

<sup>688</sup> H. E. Babcock, 'Co-operatives the Pace-Setters in Agriculture', *Journal of Farm Economics*, Vol.17, No.1, 1935, p.153.



more favourable attitude to co-operation due to reduced tenant loyalty following the agricultural depression at the end of the nineteenth century.<sup>689</sup>

## 9.2 The Formation of the Agricultural Organisation Society

The first farmer's co-operative trade organisation was the British Agricultural Organisation Society established in 1900 which then merged with the National Agricultural Union in 1901 to form the Agricultural Organisation Society.<sup>690</sup> The Royal Commissioners supported the introduction and creation of co-operation associations similar to those in Europe recommending co-operation in the production of butter and cheese and that the Board of Agriculture, local authorities and landlords should support establishing factories. They considered the development of butter manufacture in Denmark an 'object lesson to every British farmer, which he ought to study, and also afford valuable indications as to one class of remedy for depression'.<sup>691</sup> The Commissioners further recommended that in order to improve co-operation in logistics the Welsh farmers would firstly need to address changes in dealing with the railways and other carriers, by combining packages to get reduced rates and secondly, to cut out the 'middlemen' to bringing the producer and consumer together as had been demonstrated by French agricultural syndicates.<sup>692</sup> They also recommended changes in co-operation for distribution in order to allow Welsh farmers to sell meat, dairy, eggs and poultry to the large towns of their district.<sup>693</sup>

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<sup>689</sup> A. J. Raynor and C. T. Ennew, *op.cit.*, pp.94-95.

<sup>690</sup> Joan Thirsk, Gen. Ed. *The Agrarian History of England and Wales, Vol.VII, 1850-1914*, *op.cit.*, p.979; Richard Henry Rew, *An Agricultural Faggot*, *op. cit.*, pp.115-128, In the nineteenth century there were three branches of co-operation; firstly co-operative production, for example the hiring of a farm by a number of labourers who shared the risks and profits; secondly, co-operative purchase where consumers combine to purchase large quantities of commodities, a movement started by the Rochdale pioneers in 1844; and thirdly, co-operative distribution and sale for a more profitable business for the producer.

<sup>691</sup> PP 1896 (C.8221), *op.cit.*, p.873 and p.956; D. Lleufer Thomas. *Welsh Land Commission*, *op.cit.*, p.459.

<sup>692</sup> PP 1896 (C.8221), *op.cit.*, pp.874-75.

<sup>693</sup> *Ibid.* p.956.

The first grant to the Agricultural Organisation Society from the Development Fund was £3000 in 1912 for the appointment of an assistant secretary and two ‘competent organisers’.<sup>694</sup> Prior to this the Society was supported by private donations and subscriptions and by contributions from affiliated societies. The grants received from the Small Holdings Account of the Board of Agriculture from 1908 were ear-marked for the development of small holdings and allotments.<sup>695</sup> In 1919 the Ministry of Agriculture and the Agricultural Organisation Society formed an arrangement that grants would be allocated on a diminishing scale for four years after which the Society would become self-supporting with no State assistance.<sup>696</sup> In 1924 the Society finished as the voluntary income from private subscriptions and affiliation fees were not enough to continue its work. The view taken was that co-operation was a farmers’ movement and the National Farmers Union was to accept responsibility for co-operative developments.<sup>697</sup>

As shown in Table 18 the majority of agricultural marketing societies were for dairy produce and the total number of societies had increased from thirty societies in 1914-15 to sixty-three in 1923-24, with an associated increase in turnover from £490,124 to £1,447,627.<sup>698</sup>

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<sup>694</sup> PP 1912 (305), *op.cit.*, p. 19.

<sup>695</sup> Report on Co-operative Marketing of Agricultural Produce in England and Wales, Ministry of Agriculture and Fisheries, Economic Series No.1, (London: HMSO, 1926), p.21.

<sup>696</sup> *Ibid.*, pp.23-24, the sums paid were £51,000, £28,000, £11,586 and in 1922-23 just £4,556.

<sup>697</sup> *Ibid.*, pp.26-27.

<sup>698</sup> *Ibid.*, p.33.

**Table 18. Agricultural Marketing Societies and Trading 1923-24**

<b>Commodity Handled</b>	<b>Number of Societies</b>	<b>Turnover* £</b>
Dairy Produce	63	1,447,627
Eggs and Poultry	43	349,262
Fruit and Vegetables	18	301,932
Livestock**	9	375,128
Auction Marts (Livestock)	18	1,081,953
Slaughterhouses	11	415,270
Bacon Factories	6	694,826***
Wool	13	200,000****
<b>Total</b>	<b>181</b>	<b>4,865,998</b>

\* Turnover in respect of produce handled and not necessarily total turnover of the society

\*\* Societies selling livestock other than through an auction mart

\*\*\* 1924 figures

\*\*\*\*Estimated value

*Source: Report on Co-operative Marketing of Agricultural Produce in England and Wales, Ministry of Agriculture and Fisheries, Economic Series, No.1, (London: HMSO, 1926), p.176.*

### **9.3 The Early Co-operative Movement in Wales**

Augustus Brigstocke, often referred to as the ‘Plunkett of Wales’, thought that the climate and size of holdings of Welsh farms and the temperament of Welsh farmers had a lot in common with those in Ireland. In 1902 he took a delegation of twenty-four farmers and landlords from West Wales to Waterford, Cork and Dublin to study the Agricultural Co-operative Movement in Ireland. They visited creameries and dairy societies, inspected the Irish Department of Agriculture and Technical Instruction exhibits, Horace Plunkett’s creation, and met with officers of the Irish Agricultural Organisation Society and the Irish Wholesale Society.<sup>699</sup> On their return their report was distributed to the parish councils

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<sup>699</sup> H. Jones-Davies, ‘The History of the Agricultural Cooperative Movement in Carmarthenshire, *The Carmarthenshire Antiquary*, Vol.1, Part 2, 1942; Dafydd Jenkins, *Clear the Harvest-Dawn*, op.cit., p.30.

and the contents emphasised the adaptability of co-operative creameries for the Welsh Counties and the advantages of agricultural societies that could benefit all Welsh farmers. To reach all in the farming community the report was translated into Welsh by D. Lleufer Thomas, who was considered a pioneer of co-operation and every other movement for the improvement of the countryside. The dissemination of the information brought back from Ireland influenced the adoption of the movement and as a result by the end of 1904 there were thirteen agricultural societies formed primarily for supplying farmers' requirements. As new farming methods required new products which small farmers could not buy economically, the solution was to combine orders so that large quantities of fertilisers or feeding stuff could be sent to a convenient communal location: the Carmarthen Society bought manure distributors to members; the Lledrod Society in Cardiganshire organised the buying of bulls; and some West Wales societies marketed members' butter. By 1914 there were twenty three agricultural co-operatives in West Wales with over 4,000 members, a movement described as 'an achievement amongst an independent and intensely individualistic class of people'.<sup>700</sup>

Pembrokeshire was described as being at the forefront of agricultural co-operation with the county having three requirement societies founded early in the twentieth century; Clynderwen in 1904, Crymych in 1908 and Haverfordwest in 1911. Clynderwen, the oldest society, expanded rapidly and in addition to its fertiliser and feeding stuffs supply developed a strong grocery business, an egg-packing station and a weaner pig group. The society's success was described as an example of good management and a forward-looking

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Augustus Brigstocke came from a landowning family which had long been active in agricultural improvement, his great-grandfather, William Owen Brigstocke, was one of the strongest supports of the Cardiganshire Agricultural Society founded in 1784. Augustus Brigstocke served on the Cardiganshire and Carmarthenshire County Councils because he had land in both, and supported the possibilities of co-operation as a means of improving the lot of the small farmers of his districts.

<sup>700</sup> H. Jones-Davies, 'The History of the Agricultural Cooperative Movement in Carmarthenshire, op.cit.; Alun Burge, 'Individual Problems Have Collective Solutions: Looking Back Towards a Welsh Co-operative Future?', *Journal of Co-operative Studies*, Vol.45(3), 2012, p.50; Dafydd Jenkins. *Clear the Harvest-Dawn*, op.cit., p.31.

attitude.<sup>701</sup> The Crymych Society was developed from a branch of the Vale of Tivy Society therefore the business had a committee already experienced in co-operative trade. The sale of farm requirements was their main business with feeding stuffs being the biggest item. The society also traded in seeds with the committee buying eighty bushels of seed barley from Berry Hill Farm, near Newport, at 3s.6d. per bushel and sold it to members at 3s.9d. In the first year of trading the Crymych Society had sales of £1,016 increasing to £60,746 in 1950.<sup>702</sup>

In the early part of the twentieth century the co-operative movement in rural Wales was helped by the Agricultural Organisation Society and district committees were formed in North Wales in 1910 and South Wales in 1914.<sup>703</sup> The requisite movement began at a time when farmers in Wales were becoming increasingly dependent on purchased manures and feeding stuffs and the requisite societies fitted in well with agricultural production.<sup>704</sup>

As the diary entries at Potterslade Farm, Llawhaden show:

*27 November 1919 – Dry, Clynderwen lorry brought 5 tons Basic. Jack went to plough but came home at 11 o'clock to help carry in the Basic.*

*1 December 1919 – Self in Board of Guardians. The Co-op lorry came today for 152 Bushels of oats. Jack ploughing in morning.*

*20 March 1921 – Austin and Jack in Narberth with lambs. Fetched 40 bushels seed...½ sack flour and a sack of bran from co-op.<sup>705</sup>*

It was suggested that the increase of produce societies in Wales was largely due to the encouragement officially given to the making of cheese during the First World War. Farmers also realised that societies helped commute price increases and were eager to join existing societies or form new ones to save money. By the end of the First World War

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<sup>701</sup> *Farmer Business in Wales*, Welsh Agricultural Organisation Society Ltd, Number 1, Spring 1966.

<sup>702</sup> Crymych and District Farmers' Association Ltd, Jubilee Souvenir, 1908-1958.

<sup>703</sup> A. W. Ashby and I. L. Evan, op. cit., p.125.

<sup>704</sup> J. Morgan Jones, 'A Review of Agricultural Co-operation in Wales', *WJA*, Vol.VI, 1930, pp.58-59; A. W. Ashby and I. L. Evans, op. cit., p.122.

<sup>705</sup> PA, HDX/610/1 Papers of the Lewis family of Potterslade Farm, Llawhaden.

there were 129 agricultural societies in Wales.<sup>706</sup> When the AOS was reorganised in 1918 it was decided that the special conditions of Wales merited its own council resulting in a Welsh Provincial Council of twenty-one members set up to supervise AOS activities. This continued until 1921 when a proposal was laid before the Governors of the AOS for Wales to have an independent society.<sup>707</sup>

#### **9.4 The Formation of the Welsh Agricultural Organisation Society**

The Welsh Agricultural Organisation Society (WAOS)<sup>708</sup> was separated from the Agricultural Organisation Society in 1922 and to support the organisation the Department of Agricultural Economics became responsible for the economic and business advisory work in agricultural co-operation by 1926.<sup>709</sup> The WAOS was supported by grants from the Development Commission and these grants were criticised on the grounds that the grants to the AOS were terminated at the end of the 1922-23 financial year. However this criticism was invalidated because the Commissioners stated that Wales showed better results than England and Welsh farmers were favourably disposed to co-operation.<sup>710</sup> Farm holdings in Wales were smaller than those in England and in the inter-war years sixty-four per cent of farms were fifty acres or less. Farms of this size were run almost entirely by the tenant or owner and his family and it was amongst farmers of this type and the character of Welsh farming that agricultural co-operation was most successful.<sup>711</sup>

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<sup>706</sup> A. W. Ashby and I. L. Evans, op. cit., p.123; Dafydd Jenkins. *Clear the Harvest Dawn*, op.cit., p.32.

<sup>707</sup> Hugh James, 'The Welsh Agricultural Organisation Society', *Welsh Outlook*, Vol.10, No.7, 1923, p.183.

<sup>708</sup> The new society took over the work on 1<sup>st</sup> April 1922 under the direction of a Provisional Committee consisting of W. J. Percy Player (Chairman), Clydach, Major-General Sandbach, Llanfyllin, Mr R. Williams Ellis, Chwilog, Mr Ben John, Clynderwen, Mr H. Jones Davies, Nantgaredig, Mr I. D. Thomas, Morryston, Mr G. E. Hemelryk, Dyserth, Rhyl, and Mr R. Davies, Dolgelly. The society was registered on the 26<sup>th</sup> October, 1922.

<sup>709</sup> A. W. Ashby and I. L. Evans, op. cit., p.125-6; WAOS Pamphlet, Report for 1938, p.8.

<sup>710</sup> PP 1929-30 (157), op.cit., pp.180-81, although the Commissioners were not committed to aid for subsequent years they did award similar grants every year.

<sup>711</sup> P. Redfern, ed. *South and West Wales*, Manchester: Co-operative Wholesale Society, 1935, p.73.

By 1923 there were three societies in Wales formed for the collection and sale of eggs. At this time the largest in Anglesey was dealing with over £20,000 a year and was testing and grading each egg keeping four motor-cars busy with collecting. One farmer member tried to 'palm off' pickled eggs on the society and was expelled for 'conduct detrimental to the welfare of the society'.<sup>712</sup> The establishment of the Clynderwen Egg Packing Station stimulated the poultry culture of Pembrokeshire and in 1928/29 the depot was handling 80,812 dozen eggs increasing to 117,848 by 1929/30. Collection centres were organised in Haverfordwest, Newport and Solva so that farmers throughout the county could send their eggs to a packing station.<sup>713</sup>

Between 1930 and 1939 the Welsh Society's field work extended and proved to be of valuable assistance to farmers and the process of co-operation. In 1937 the Society supported the registration of the South Caernarvonshire Creameries, supported egg-grading in mid-Cardiganshire, advised individual producers on pig-marketing; and assisted in a survey of the production of lime in Wales.<sup>714</sup> In June 1939 a short course for members of staff of agricultural co-operative societies was run at the Department of Agricultural Economics in conjunction with the Departments of Agriculture, Agricultural Chemistry and Agricultural Botany to introduce students to various aspects of the co-operative movement.<sup>715</sup>

By the start of the Second World War half the farmers of Wales were members of agricultural co-operative societies which had a cumulative annual cash turnover of over £2,000,000, representing an increase of 58% between 1933 and 1937. This was due primarily to the strong position of the requisite societies, although it was commented that

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<sup>712</sup> Hugh James, *op.cit.*, p.185.

<sup>713</sup> PA, PACR year ended 31<sup>st</sup> March 1930.

<sup>714</sup> PP 1939-40 (40), Development Commission, Twenty-ninth report, p.64.

<sup>715</sup> Welsh Agricultural Organisation Society, Limited, Report for 1938/39, p.28.

the service rendered by a co-operative society to the agricultural community in its trading area could not be measured by trading results or balance sheet as the important benefit of good advice was 'not amenable to measurement'.<sup>716</sup> The farm diaries of George Griffiths of Brynhill Farm show the many entries of trading with Clynderwen Co-operative stores as part of his routine days:

*Saturday 4 March 1944 – snow with northwind, snow cleared by noon and dry afterwards. Morning picking potatoes. Took ½ cwt swedes, ½ potatoes Clynderwen*

*Tuesday 25 April 1944 – Dry north west wind cooler. Went back to Clynderwen coop after cake 4 bags, 4¼ cwt balance rations.*

*Wednesday 3 May 1944 – Dry north west wind. Went up to Clynderwen with trap fetch 4 bushels barley 16/6 pr bush*

*Thursday 11 May 1944 – dry fine and warm. Went over see cattle in the morning. Bought 2 cwt potash from coop stores sowed ½ cwt on 12 drills mangolds rest to potatoes...<sup>717</sup>*

Co-operative buying or requisite societies were generally more successful than marketing societies and the sales of the twenty-five produce societies in Wales had decreased to twelve by 1926. The Anglesey Egg Collecting Depot which became the Anglesey Farmers' Society (1911 – 1934) survived the longest until the fall of prices in the 1930s and by the late 1930s the co-operative marketing of poultry produce was provided by two or three requisite societies.<sup>718</sup>

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<sup>716</sup> A. W. Ashby and I. L. Evans, op. cit., p.126; W. H. Jones, 'Agricultural Requisite Societies in Wales', *WJA*, Vol. XV, 1939, pp.54-55; J. Glynne Williams and Dorothy Davies, 'Agricultural Co-operative Societies in Wales: A Review of Three Years' Trading in Farm Requirements', *WJA*, Vol. X, 1934, p.38; W. H. Jones, 'Agricultural Co-operative Societies in Wales', *WJA*, Vol. XIII, 1937, p.116.

<sup>717</sup> PA, HDX/1706/1 Dairy of George Griffiths Brynhill Farm 1944.

<sup>718</sup> Joan Thirsk, Gen. Ed., *The Agrarian History of England and Wales, Vol.VIII, 1914-1939*, op.cit., p.152; A. W. Ashby and I. L. Evans, op.cit., pp.122-23.



**Table 19. Geographical Distribution of Requisite Societies in Wales, 1939**

<b>Region</b>	<b>Societies</b>	<b>Turnover £000s</b>	<b>Members</b>
North-West	13	256.5	5,050
North-East	5	88.3	1,187
Border	6	333.2	2,734
South-East	9	138.2	1,656
West	20	934.1	15,650
	<b>53</b>	<b>1,750.3</b>	<b>26,277</b>

*Source: A. W. Ashby and I. L. Evans. The Agriculture of Wales and Monmouthshire, (Cardiff: UWP, 1944), p.121*

West Wales was described as the classic home of agricultural co-operation and as Table 19 shows accounted for nearly sixty per cent of the membership and over fifty-three per cent of total sales in 1939.<sup>719</sup> Societies in West Wales were gaining good reputations: Dairy Societies making butter under the Milk Marketing Scheme were doing well; Crymych Seed Growers' Association was commercially successful; and an association had been formed for growing the WPBS's varieties of cereals on a commercial scale. The WAOS was also working with farmers to market their livestock and worked with the Welsh Dragon Mark Store Cattle Association arranging auction sales of quality cattle to eliminate the dealers.<sup>720</sup>

The WAOS supported education in farming and combined agricultural co-operation conferences with educational tours. A conference organised at Aberystwyth in 1939 had local arrangements organised by the WAOS. There were conference sessions in the morning and evening leaving the afternoons free for visits to the WPBS, the Cahn Hill

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<sup>719</sup> A. W. Ashby and I. L. Evans, op.cit., p.121.

<sup>720</sup> Dafydd Jenkins. *Clear the Harvest Dawn*, op.cit., pp.61-62.

Improvement scheme and the University College of Wales farm. Lectures included “crop drying in relation to the future supply of feed for livestock”.<sup>721</sup>

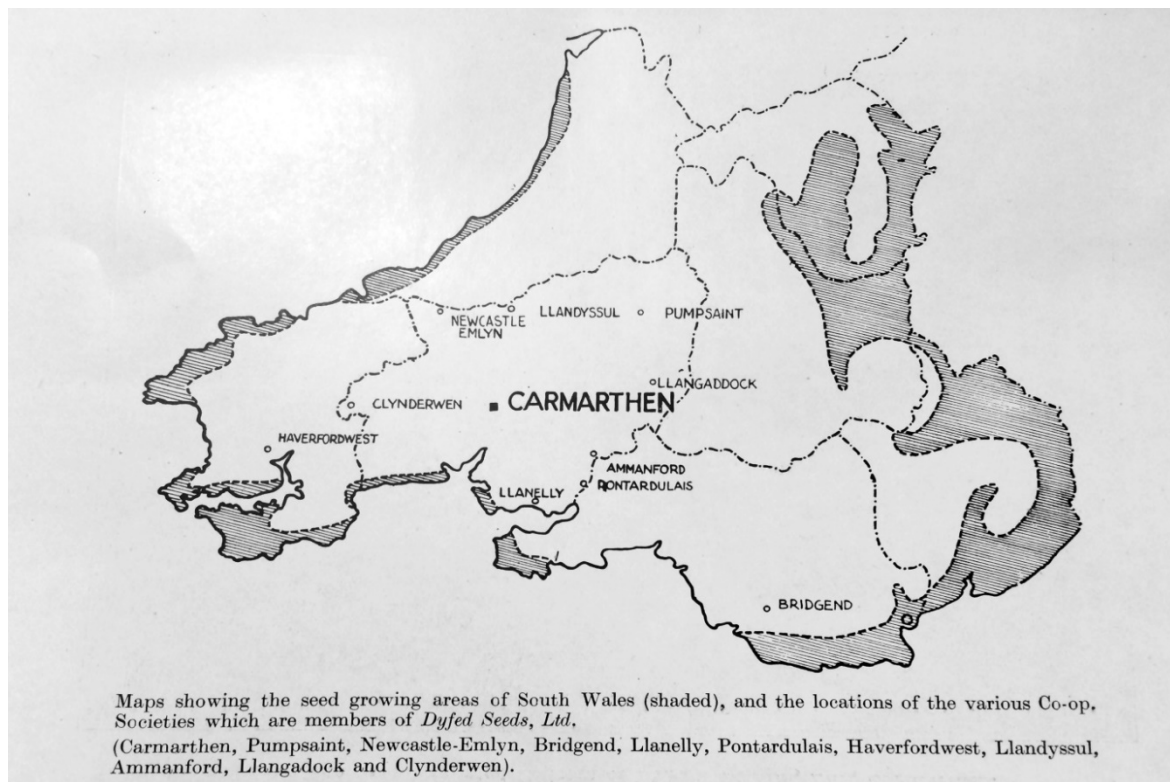
All through the Second World War the WAOS was asked to assist societies: there were increased demands for fertilisers to increase crop output; increased demands for cereal seed and seed potatoes to fulfil quotas; increased demands for ley acreage which meant a higher demand for grass and clover seed; and for farmers frustrated of waiting for machinery from the War Agricultural Executive Committee, machinery pools were successfully formed for harvesting in the parishes of Pembrokeshire.<sup>722</sup> By 1941 the impact of the plough-up campaigns resulted in diminished permanent grassland and farmers did not want to be faced again with the inferior grassland left post First World War. They wanted their farms to have better and more productive pastures and when the supplies of foreign seeds were cut off there was an impetus to produce the new Aberystwyth seeds in Wales to be used by Welsh farmers. New seed growers’ societies were formed in Pembroke, Carmarthen and Monmouth and the older societies in Cardigan, Brecon and Radnor turned their attention to grasses and clovers.<sup>723</sup> Figure 20 shows the areas in South Wales where seeds of grass strains were grown and harvested in good condition.

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<sup>721</sup> Ibid., p.59.

<sup>722</sup> Ibid., pp.69-73.

<sup>723</sup> PA, *Dyfed Seeds*, A study in Welsh Agricultural Co-operation. Written for the Opening Ceremony of the Seed Cleaning Factory of Dyfed Seeds Limited at Carmarthen on 14<sup>th</sup> November 1944.



**Figure 20. The seed growing areas of South Wales**

*Source: Pembrokeshire Archives, Dyfed Seeds, A study in Welsh Agricultural Co-operation. Written for the Opening Ceremony of the Seed Cleaning Factory of Dyfed Seeds Limited at Carmarthen on 14<sup>th</sup> November 1944, p.17*

The Cardiganshire coastal fringe was covered by the Clarach Seed Growers' Society which formally specialised in oats but by 1944 was growing ryegrass. Pembrokeshire's lengthy coastline lends itself to a specialist farming as discussed in previous chapters. The county was also fortunate to have a number of progressive farmers who adapted their farms to new crops and methods of farming. Both Pembrokeshire and Cardiganshire farmers preferred to grow ryegrass rather than cocksfoot or timothy.<sup>724</sup>

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<sup>724</sup> *Dyfed Seeds*, op.cit., p.8.



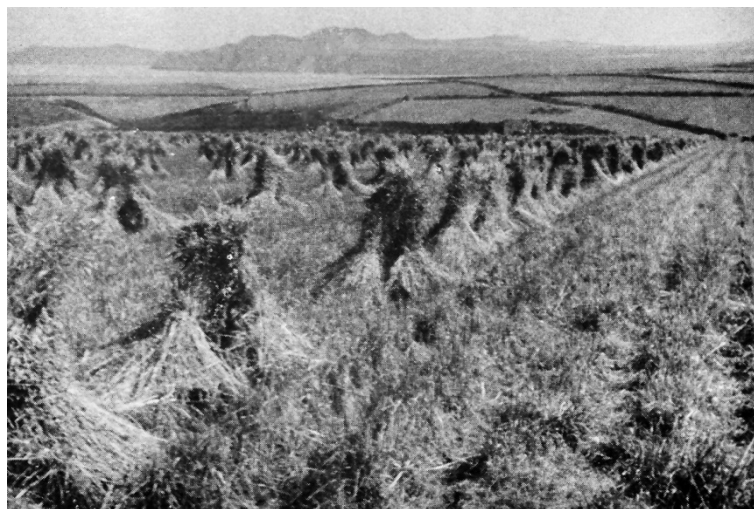
**Figure 21. S.23 Ryegrass in swath at the Home Farm Stackpole. Mr J. E. Bennion discusses the sample with the Seed Production Office of Pembrokeshire W.A.E.C**

*Source: Pembrokeshire Archives, Dyfed Seeds, A study in Welsh Agricultural Co-operation. Written for the Opening Ceremony of the Seed Cleaning Factory of Dyfed Seeds Limited at Carmarthen on 14<sup>th</sup> November 1944, p.9.*

However there were big farms in Pembrokeshire that managed to grow cocksfoot and Figure 23 shows a bumper crop of S.37 cocksfoot standing in stook on Trefelyn Farm, Mathry. The farmer, Mr Perkins, was said to prefer growing this crop as it was virtually immune from lodging and was only little more trouble to harvest than a crop of wheat.

The seed growers covering South Wales were:

- Clarach Seed Growers Ltd (Cardiganshire)
- Pembrokeshire Seed Growers Ltd (Pembrokeshire)
- Myrddin Seed Growers Ltd (Carmarthenshire)
- Glamorgan Seed Growers Ltd (Glamorgan)



**Figure 21. Crop of S.37 Cocksfoot standing in stook on Trefelyn Farm, Mathry, Pembrokeshire**

*Source: Pembrokeshire Archives, Dyfed Seeds, A study in Welsh Agricultural Co-operation. Written for the Opening Ceremony of the Seed Cleaning Factory of Dyfed Seeds Limited at Carmarthen on 14<sup>th</sup> November 1944*

The seed growers were aware that they needed a local facility built for cleaning Welsh-grown seeds of pedigree strains and the idea for Dyfed Seeds Ltd was considered at a conference of farmers in December 1942. Although it was often alleged that farmers were guilty of ignoring expert advice, it was acknowledged that in this case the representatives of the societies were eager to take the advice of Professor Ashby and T. J. Jenkin of Aberystwyth as they acquired the latest machinery and modern engineering science information available.<sup>726</sup>

The formation of Dyfed Seeds was acknowledged as being the idea of farmers themselves and was established by collaboration with scientists and economists. Both the

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<sup>725</sup> *Dyfed Seeds*, op.cit., p.10.

<sup>726</sup> *Ibid.*, p.13.

WPBS and the CAECs gave support and technical advice, the university's economic advisors helped with the business plans and the WAOS was considered the keystone bringing all the forces together.<sup>727</sup>

## 9.5 The West Wales Farmers' Dairy Society

There were many stories written about the success of co-operative societies but there was one case in Wales that came to a disastrous end and the memory of the West Wales Farmer's Dairy Society had a depressing effect on co-operative projects in Carmarthenshire and Pembrokeshire for a quarter of a century.<sup>728</sup>

The West Wales Farmers' Dairy Society was started in 1918 under the Ministry's war time scheme for the encouragement of co-operation milk depots and received a loan of £2,500 to establish two cheese factories at Haverfordwest and Carmarthen.<sup>729</sup> The Ministry appointed the Co-operative Wholesale Society in Cardiff to deal with the products of the society and there was a requirement to grade all cheese within six weeks of delivery and to make payment within three days after. During May to September 1919 there were delays with the Wholesale Society accepting the cheese which resulted in deterioration of cheese grade due to insufficient and unsuitable buildings and equipment for storage selected by representatives of the Ministry of Agriculture. By September the West Wales Farmers' Dairy Society held stocks of the value between £32,000 and £33,000 and repeated efforts were made to the Ministry of Food to remove the cheese. This resulted in a lengthy legal claim against the Board of Trade for compensation.<sup>730</sup> Although a sum of £8,000 was agreed only half was paid as the Ministry declared that the Wholesale Society

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<sup>727</sup> Ibid., p.18.

<sup>728</sup> Dafydd Jenkins. *Clear the Harvest Dawn*, op.cit., p.46.

<sup>729</sup> TNA MAF 60/136 British Cheese (Requisitions) Order 1918, West Wales Farmers Society Ltd. correspondence and settlement.

<sup>730</sup> Ibid., the basis for compensation was the difference in value between the A grade cheese and the C grade it deteriorated to.

was liable for the rest.<sup>731</sup> The Cardiff Society denied negligence and stated that the evidence showed the loss was wholly caused by the manufacture of curd instead of cheese throughout the flush season.<sup>732</sup>

Unfortunately for the Board of Trade the compensation claims were published in the *Western Mail* which led to other societies' claims.<sup>733</sup> The United Dairies wrote to the Rt. Hon. Stanley Baldwin stating that '...we all suffered through the grading of cheese, and had to hold it longer than we should have, so I take it that you will be prepared to treat the whole of the Trade alike'.<sup>734</sup> The Board of Trade were not sympathetic to the West Wales Farmers' Society's plight; Mr Coller of the Board of Trade commented:

..In the beginning the Society manufactured decent cheese and make good profits. This rather turned their heads; they bought cows at top prices and were consequently flooded with liquid milk, which they could not utilise; they manufactured bad cheese and made enormous losses. Thus in March 1919 they converted 35,000 gallons of milk into cheese 70% of which was graded "A". Later in the season their monthly rate of conversion increased to 150,000 gallons, of which only 16% was graded "A", the bulk being sold as "C" cheese for what it would fetch, which was very little, as at that time the neighbouring miners were rich and would only eat the best.<sup>735</sup>

The Secretary of the WAOS questioned why the Ministry of Food, on whose advice the society was started, did not offer any of the money that they had at the end of food control to help these farmers, especially as it was suggested that the task was too big for its

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<sup>731</sup> Ibid., Letter from Earl Ancaster, Ministry of Agriculture and Fisheries to Viscount Wolmer at the Board of Trade, 27 March 1923; Letter for Sir William Mitchell-Thomas, Board of Trade to Stokes & Stokes, legal representatives of the West Wales Farmers' Society, 16 May 1922.

<sup>732</sup> Ibid., Reply to Lord Ancaster from Viscount Wolmer.

<sup>733</sup> *The Western Mail* 15 and 16 February 1922.

<sup>734</sup> TNA MAF 60/136 op.cit., Letter from United Dairies (Wholesale) Ltd to Rt. Hon. Stanley Baldwin, President of the Board of Trade, 24 February 1922.

<sup>735</sup> Ibid., Minutes of Board of Trade 13 January 1923.

management committee and claimed that it was their misfortune rather than their fault that the society failed.<sup>736</sup>

Although this particular venture was unfortunate, this study has shown positive benefits of co-operation for West Walian farmers, and has provided evidence of productive and economic benefits that became part of the farmers' routine activities. As mentioned in the introduction to this chapter, co-operation is an economic feature of farming life but was included and merited a chapter because of the way it changed how farmers worked and how co-operation became ingrained in their daily routines. The process of co-operation shared best practice and the distribution of better products that not only had an economic advantage but has been proven to give a quality advantage also.

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<sup>736</sup> Dafydd Jenkins. *Clear the Harvest Dawn*, op.cit., p.60.



## CHAPTER TEN: SCIENTIFIC SUPPORT FOR FARMERS IN THE FIRST AND SECOND WORLD WARS

### 10.1 Agriculture and National Defence

Professor A. W. Ashby considered four methods of changing agricultural organisation for national defence; publicity or propaganda, education and advice, material inducement, and compulsion. The use of agricultural science in these policies lay primarily in the improvement of land, use of fertilisers and feedstuffs and safeguards against product deterioration. Improvements by land draining, liming and manuring in order to maintain or improve fertility were fundamental to the governments' policies and formed part of the Agricultural Acts. The organisation of agriculture for national defence was the ways and means of securing food supply which included storage, labour and supply of horses, equipment for extended arable production, reduction in some classes of livestock and directing the greatest amount of crops and grain for human consumption.<sup>737</sup>

Food supplies in the First World War were not problematic until 1916 when submarine warfare led to shortages. This was followed by rationing of sugar, fats and meat in 1918 which continued to 1920. Government policies were formed to use the successful experiences of food production of the First World War and by the end of the Second World War the agricultural ministers guaranteed producers of milk, fat cattle and sheep a four year guarantee, up to the summer of 1948, of an assured market and price levels of 1944. They also recommended that prices of fat cattle and sheep be adjusted for 1944/45 with a bias towards quality to give an average increase of two shillings per live cwt. for cattle and 1d per lb. for sheep in order to offset the rise in costs of production that occurred in 1942. This gave a cost to the Exchequer of approximately £2.4 million but the government

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<sup>737</sup> Professor A. W. Ashby. 'Agriculture and National Defence', *Journal of the Agricultural Economics Society*, Vol.5, Issue 3, 1938, pp.242-46.

considered this to be sufficient to provide the impetus to the recovery of pre-war production.<sup>738</sup>

## 10.2 Scientific Support in the First World War

During the First World War the Lloyd George government implemented a food production policy to produce more food by ploughing up grassland. Lloyd George wanted the country to get 'as near the point of self-sustenance' and wanted farmers to 'strike a blow for British agriculture'.<sup>739</sup> The scientific rationale behind this policy was considered sound as more food was to be produced for human consumption than for livestock and effective local control was provided by the county based War Agricultural Executive Committees (WAEC), colloquially known as the War Ags and made up of farmers and landowners. The policy was regarded as a success and provided the model for the policy of the Second World War.<sup>740</sup>

In 1914 farmers in the UK had nearly forty-seven million acres of cultivated land at their disposal for food production. The Food Production Department of the Board of Agriculture was responsible for organising the increase in food production during the First World War and the first task of the district committees was to visit every farm and classify them into three groups; those farmed well, those where production could be increased, and those that were in need of drastic reform.<sup>741</sup> The Committees had to deal with many facets

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<sup>738</sup> Juliet Gardiner, *Wartime Britain 1939-1945*, (London: Headline, 2004), p.139; TNA CAB/66/49/18, War Cabinet, 22 April 1944, Memorandum by the Minister of Agriculture and Fisheries, the Secretary of State for Scotland, the Secretary of State for the Home Department and the Minister of Food.

<sup>739</sup> Glamorgan Archives D/D/Z28/65 Speech by The Prime Minister, The Rt. Hon. D Lloyd George, MP, in reply to a delegation from farmers 9 October 1917 at Downing Street, a deputation consisting of representatives of the Advisory Committee of the Board of Agriculture, Farmers' Club, National Farmers Union, Federation of War Agricultural Committees and Emergency Committee of the Royal Agricultural Society of England.

<sup>740</sup> P. E. Dewey, *British Agriculture in the First World War*, (London: Routledge, 1989), pp.1-2; Keith A. H. Murray, *Agriculture*, pp.15-16; Gordon E Cherry and Alan Rogers, *Rural Change and Planning*, (London: E & FN Spon, 1996), pp.75-76.

<sup>741</sup> Thomas Hudson Middleton, *Food Production in War*, (Oxford: Clarendon Press, 1923), p.14; Joan Thirsk, Gen. Ed., *The Agrarian History of England and Wales, Vol VIII, 1914-1939*, op.cit., p.97.

of food production including the supply of seed potatoes, distribution of fertilisers, labour requirements, instructions for cleaner and more wholesome milk, supply of horses and tractors and the issuing of cropping orders. These Committees, both district and county, were considered to be the indispensable link between the farmer and Whitehall.<sup>742</sup> Lord Selborne, the then President of the Board of Agriculture, thought that a number of farms could be carried out as commercial enterprises but also considered that it would be a 'social calamity' if agriculture was industrialised commenting:

Farmers were a hard class, and they must adopt a new attitude in regard to the remuneration of labour, of education, and to the application of science to industry.<sup>743</sup>

Throughout the UK farmers were acknowledged for their patriotism and intelligence and for achieving the production plans. The agricultural returns for the first year of war showed twenty-five percent acreage increases for wheat, seven per cent for oats whilst maintaining the high levels of potatoes of the previous year. Cattle stock and sheep stock also increased.<sup>744</sup>

Experts in the scientific investigations of food values and the physiology of nutrition contributed to the fact that the country escaped formal bread rationing during the war.<sup>745</sup> Studies had shown that the calorific value of grain was much higher if eaten directly rather than fed to animals and eaten as meat. The Royal Society's committee on food supply calculated that an acre of land under wheat and potatoes could produce between three and four millions calories, ten times more than meat or milk converted from

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<sup>742</sup> Joan Thirsk, Gen. Ed., *The Agrarian History of England and Wales, Vol VIII, 1914-1939*, op.cit., pp.99-102; TNA CAB/24/50/33 Ministry of Food report 1 May 1918.

<sup>743</sup> *Llangollen Advertiser, Denbighshire, Merionethshire, and North Wales Journal*, 21 April 1916, Lord Selborne speaking as guest of the Agricultural Organisation Society.

<sup>744</sup> R. H. Rew, 'Farming and Food Supplies in Time of War', *Science*, New Series, Vol.42, No.1084, 8 October 1915,p.482. Address of the President to the Agricultural Section of the British Association for the Advancement of Science, Manchester, 1915.

<sup>745</sup> A. W. Flux, 'Our Food Supply Before and After the War', *Journal of the Royal Statistical Society*, Vol.93, No.4, 1930, pp.538-39.

grassland. In food value per person calculations showed that grazing would maintain two persons per acre, dairy farming nearly three persons, wheat growing would maintain eight, and potato growing fifteen persons per acre. Studies also showed that a mixed farm of two-thirds arable and one-third grass land producing milk and meat would fulfil the requirements of a self-supporting system of agriculture. Ploughing orders were therefore issued for acres on farms to be ploughed and sown.<sup>746</sup>

These official forms were issued as the Cultivation of Lands Order 1917 under the Regulation 2M of the Defence of the Realm Regulations and gave notice to cultivate corn, roots and potatoes for the 1918 harvest. For example the Pembrokeshire War Agricultural Executive Committee (PWAEC) issued orders for six acres on Maesyblodau Farm, Letterston, to be cultivated, seven acres on Meillion, Letterston, thirty and a half on Clover Farm, Letterston and one hundred and eight acres at Llambled, Castlemorris.<sup>747</sup>

Local Committees were persuasive in realising these orders and although the power to dispossess farm owners was the responsibility of the Board of Agriculture the PWAEC had the power to fine farmers who ignored them.<sup>748</sup> Lloyd George wanted the County Committees to secure their quotas by agreement and only introduced compulsory powers as ‘a weapon to be held in reserve for dealing with individual recalcitrants’.<sup>749</sup> In July 1919 the Board of Agriculture and Fisheries had proposals from the County Councils for the acquisition of 106,654 acres which included 11,359 acres which the Councils wanted to exercise compulsory powers. The Board also received notice of compulsory orders from

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<sup>746</sup> Christopher M. Reason, ‘Agriculture and Authority –Responses to the Food Production Campaign 1917-1918, (unpublished MA thesis, University of Birmingham, 1982), p.19; Joan Thirsk, Gen. Ed., *The Agrarian History of England and Wales, Vol. VIII, 1914-1939*, op.cit., pp.93-94; *Cambrian News and Merionethshire Standard*, 24 September 1915; Edward T. John, op.cit., p.186.

<sup>747</sup> PA, PCC/SE/71/20 PWAEC cultivation orders.

<sup>748</sup> Joan Thirsk, Gen. Ed., *The Agrarian History of England and Wales, Vol VIII, 1914-1939*, op.cit., p.92; *Haverfordwest and Milford Haven Telegraph*, 29 May 1918, a farmer in Mynachlogddu was fined £18 for failing to plough 60 acres.

<sup>749</sup> *War Memoirs of David Lloyd George Vol III*, (London: Ivor Nicholson & Watson, 1934), p.1309 and p.1282

Carmarthen County Council for the compulsory purchase of Pentowin Farm, comprising 199 acres and also Plassyforest Farm comprising 263 acres.<sup>750</sup>

Before the Cultivation Orders were issued, Pembrokeshire farmers were described as ‘having a complacency equal to Mark Tapley – they are happy under all circumstances’ and that ‘when not aroused they move in a groove like the buckets of a steam dredge and with the regularity of the planets’. When the Board of Agriculture was urging farmers to grow more wheat they were accused of paying more attention to prices than to production.<sup>751</sup> A similar perception was seen in Carmarthen:

I was down by the station on Saturday and I heard two farmers talking about the war. One said “I read very bad news in the paper this morning.” “What’s that?” asks Farmer No.2. “There is a report that the Kaiser is getting tired of the war and is going to offer peace”. “That is very bad news whatever” says farmer No.1 “I hope the Government won’t make no peace for three years; it would be cruel if we had to go back to the old prices soon.” The farmer is feathering their nests all right over this little scrap.<sup>752</sup>

The requests to grow more wheat were considered ill-advised, as one farmer commented:

The amateur guides to perfect farming very often know as much about the matter as a sucking pigeon...we are to ram all the wheat in that we can irrespective of the fact that we may be displacing something of equal importance; we are to break up all inferior pasture for wheat –sowing purposes although such land was laid away because it did not pay to grow wheat...and we are to bring all waste corners into cultivation and plant vegetables whether they will grow or not; all acorns, chestnuts, and beech mast are to be carefully raked up and fed to live-stock, whether they get acorn poisoning or not...I am quite sure that much of the advice tendered us is simply so much footle.<sup>753</sup>

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<sup>750</sup> TNA CAB/24/84/91 Board of Agriculture and Fisheries, report for week ended 13 July 1919.

<sup>751</sup> *Haverfordwest and Milford Haven Telegraph*, 27 January 1915.

<sup>752</sup> *Carmarthen Weekly Reporter*, 15 January 1915.

<sup>753</sup> *Amman Valley Chronicle*, 22 October 1914.

However, when the Cultivation Orders were issued Pembrokeshire farmers were acknowledged to cooperate and tribute was paid:

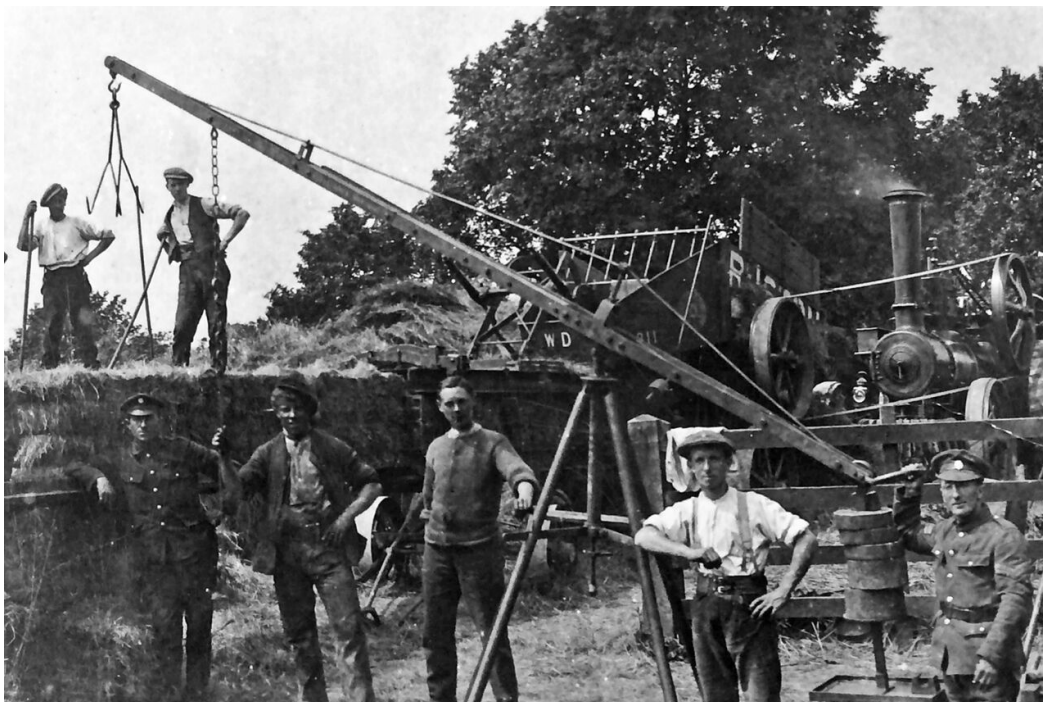
When we view the landscape from the highways and bye-ways of the countryside we can see at a glance that the Pembrokeshire farmer has settled down to his allotted task. Of course he grumbles, as was always his wont, perhaps it would be ominous if he didn't; but when he sets to work his growl dies away and is lost in the din and rattle of business activity. Bulldog like, he pursues his course in silence, and with that tenacity of purpose which has long since become traditional of his race.<sup>754</sup>

Although soldier labour was supplied to farmers as early as 1915 there were significant increases of soldier labour organised by the Home Defence troops by 1917 and camps of approximately one hundred men were set up in agricultural areas. Soldier labour was the largest source of replacement labour and those able to plough benefited from training courses organised by the Food Production Department. Within the UK, four thousand men were trained for horse ploughing, four thousand for tractor ploughing and two hundred men for steam ploughing.<sup>755</sup>

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<sup>754</sup> *Haverfordwest and Milford Haven Telegraph*, 27 March 1918.

<sup>755</sup> P. E. Dewey, 'Government Provision of Farm Labour in England and Wales, 1914-1918', *AHR*, Vol.27(2), 1979, pp.111-12.



**Figure 22. Farm workers and soldiers c.1917-18**

*Source: Pembrokeshire Archives, J/JEN/159*

The Labour Officer in Haverfordwest stated that there were about 250 soldiers employed in Pembrokeshire by 1918. They were mainly working in the Milford and Haverfordwest districts and very few were working in the north of the county. Skilled soldier ploughmen received fifteen shillings a week and farmers were expected to provide accommodation. The Education Officers in Haverfordwest also reported that children helping out on farms were exempt from school for two month periods and in April 1918 there were seventeen exemptions for agriculture work.<sup>756</sup>

Helping farmers with scientific and technical advice included supplying the farmers with subsidised fertilisers for liberal use for maximum food production. It was estimated that this assistance cost the State £1,600,000 in 1918.<sup>757</sup> Food campaigns were also supported by the supply of tractors and this gave the Agricultural Committees challenges.

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<sup>756</sup> NLW D2/6 Edgar Chappell Investigations.

<sup>757</sup> *Haverfordwest and Milford Haven Telegraph* 11 June 1919.

Competent farmers knew what could be achieved by horses and labour but the capabilities of the tractor were unknown as they frequently broke down because they were put onto the heaviest jobs and the men who could repair them were already in the army or the munitions factory. Additionally the number of different makes and models of tractors supplied in 1917 and 1918 made it difficult for engineers and operators to understand them.<sup>758</sup>



**Figure 23. Pembrokeshire War Agricultural Executive Committee watching a display of ploughing during the First World War**

*Source: Pembrokeshire Archives, HDX/818/2*

Tractors had been introduced in Pembrokeshire at the beginning of the century in Penllwyn in Narberth, and in 1917 tractor owners were instructing soldiers how to plough. Ploughing demonstrations were organised at Lamphey and visiting farmers, described as having a ‘deep-rooted prejudice in favour of the old system’, were sceptical because of the delays in turning and thought that the tractor was more or less a failure. As one farmer said

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<sup>758</sup> Joan Thirsk, Gen. Ed., *The Agrarian History of England and Wales, Vol VIII, 1914-1939*, op.cit., p.106.



“a horse would be halfway up the field again in the time they take to turn this tractor”. However this was because of the inexperience of the soldiers driving and when the experienced tractor owners took over the demonstration there was no delay in turning, the ploughing was as ‘straight as an arrow and the ejaculations of delight showed that the tractor had won its way to the farmers’ favour’. However cautious Pembrokeshire farmers were to new ideas, they knew that they needed the tractor to cultivate the 30,000 extra acres the Board of Agriculture expected of them.<sup>759</sup> Even in this experimental stage their value was established and only the most sceptical farmers remained unconvinced.<sup>760</sup> The PWAEC’s register of the use of Tractors shows the numbers of hours of tractor use per farm, as the following extracts show:

*14-16.9.18 Mr Lewis, Prendegast, 6½hours thrashing Tractor 2123*

*20.9.18 Mr Rees, Springfield, 4hours thrashing Tractor 2123*

*18-20.9.18 Mr Jenkins, Picton, 3½ hours corn cut, Tractor 175*

*21-27.9.18 Committee’s Fields, Clarbeston Road, 8½ cut, Tractor 175*

*Week ending 11.10.18, Mr James, Woodbine, 24½ hours thrashed, Tractor 5831*

*Week ending 25.10.18, Mr Philpin, Haroldstone, 15 hours ploughed, Tractor174*

*25.10.18, Mr Young, St Brides, 4 hours ploughed, Tractor 176*<sup>761</sup>

The Government requested 50,000 additional acres in Carmarthenshire and although the farmers knew it was their duty to carry this out, the greatest difficulty was labour and the county was supported with the supply of 50 – 60 motor tractors in order to double its corn area.<sup>762</sup> The War Cabinet weekly reports from the Food Production Department showed that for the week ended 11 April 1919 there were 3586 tractors in the

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<sup>759</sup> *Haverfordwest and Milford Haven Telegraph*, 31 October 1917.

<sup>760</sup> Lord Ernle, *The Land and its People*, op.cit., p.131.

<sup>761</sup> PA, PCC/SE/71/33 War Agricultural Executive – Register of use of tractors, 1918.

<sup>762</sup> *Haverfordwest and Milford Haven Telegraph* 27 June 1917.

hands of the Committees. Although not all were being used due to repair or lack of labour there were 8800 acres ploughed and 14,100 acres cultivated by 1448 tractors in England and in Wales there were 1400 acres ploughed and over 550 acres cultivated by the 200 tractors in commission.<sup>763</sup>



**Figure 24. Ploughing the field above Scotchwells to make allotments for the Dig for Victory Campaign during the First World War**

*Source: Pembrokeshire Archives, HDX/1498/1*

Having compelled the farmers to plough and sow additional acreages there was insufficient labour for harvesting the crops. There were many large farms in Pembrokeshire where the staff consisted of one single *crwt* (boy) and perhaps the farmer's children all below school age. It was considered a mockery to ask those farmers to increase production without devising a plan for harvesting and it was felt that if farmers could be punished for wasting crops then the Committees should have also been fined for failing to supply the farmer with the means of saving his crops due to the lack of farm

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<sup>763</sup> TNA CAB/24/78/74 War Cabinet paper, Board of Agriculture and Fisheries, Food Production Department April 1919.

hands. The Committees were criticised for not organising the additional help from women, soldiers and schoolboys in time and that too many people were engaged in distribution and not production.<sup>764</sup> This was harsh criticism when the day to day work of Gunilda Margaret Griffiths, Group Leader in the PWAEC is considered. Her diary entries show the extent to which she cycled around Pembrokeshire parishes talking to farmers, farmers' wives, schools and ministers. She made surveys of empty houses, checked labour requirements for harvests, recruited women workers and organised sales of vegetables. A typical week in her diary was:

*Saturday 19<sup>th</sup> January 1918 Called at Plas-y-Bridell...discussed what could be arranged for the coming Spring, Summer and harvest work in the district and whether it would be possible to get a group of women to reside in the district...owing to the extra land under cultivation additional labour will be required and farmers have told me that they would prefer women labour to some of the military labour sent last year.*

*Monday 21<sup>st</sup> January 1918 - Went to St Dogmaels called at Mr Hughes and School Master, also made enquiries about empty houses, vegetables etc, and if people were in favour of establishing institutes there. Found them very much in favour as fishing industry curtailed and would be good to start something profitable in the garden.*

*Tuesday 22<sup>nd</sup> January 1918 – called Mr Sandbrook Anedd Wen Crymych enquired about various things. Mr S said pre-war pay for women labour by the day was 1/6 ...called at the rectory Rev Evans, wife, a farmer's daughter, 2 children, keep a maid, and servant boy, 2 or 3 cows, fowls etc. a few acres of land. Rev E looks as if he never did any physical work...seems a decent kind of man, but why does he not attend to the little farm more, when he has the time I know at his disposal.*

*Thursday 24 January – Filling up papers for information to the board about amount of labour needed last year 1917 and under what conditions employed and housed.*

*Saturday 26<sup>th</sup> January – From Maenclochog to Clarbeston Rd, back to Maenclochog to Maenachlogddu Parish, no empty houses....Mr Bowen said that he may be glad to employ girls for turnip hoeing and they could be lodged in the*

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<sup>764</sup> *Haverfordwest and Milford Haven Telegraph*, 17 February 1915; *Haverfordwest and Milford Haven Telegraph*, 29 May 1918.

*village.*<sup>765</sup>

Having more land ploughed however did not necessarily mean there was more food as a Carmarthenshire grassland farmer pointed out:

Last year there had been a fine herd of bullocks grazing. This year there was an oat crop rotting away. The land was too well manured and the crop failed even in this dry summer.<sup>766</sup>

Another problem the farmers faced in the First World War was the use of sulphate of ammonia on their soils. It withdrew the lime from the soil and although it gave a big crop at first, it then exhausted the land and farmers reported that it became sour, bad in texture and full of weeds. The use of lime was advisable for pasture but was considered an absolute necessity for arable land. The proper use of lime did not exhaust the soil nor did it feed the crops, it aided fertility as was described in chapter five. As a rule of thumb the farmers were advised that the more lime that was applied to the land, the more manure should be applied too and that ‘the lime is to the fertility what the cook is to the food’. It was also described as ‘... like cement; it cements the land and keeps the manure in’ and makes the ‘sour land sweet’ for all the cattle to eat.<sup>767</sup>

The government was also supporting farmers to obtain potash for their soils. The Food Production Report for July 1919 outlined the progress that was being made to arrange the import of potash from Germany in exchange for food. This was achieved without offending the French government as they did not want to appear to be buying product from an enemy rather than one of our Allies. The Alsatian Government purchased large quantities of potash from the German government at a cost price. They were also given

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<sup>765</sup> PA, HDX/1017/8 Diary of Gunilda Margaret Griffiths, 1918.

<sup>766</sup> *Carmarthen Weekly Reporter*, 3 August 1917.

<sup>767</sup> *Carmarthen Weekly Reporter*, 3 August 1917.

permission to import an equivalent quantity of Kainit. Therefore they were in a position to export potash to Britain giving the British farmer access to potash of all grades at a reasonable price.<sup>768</sup>

The First World War was described by John Davies as strengthening the belief which was already held by some landowners, that owning an estate was no longer a viable business.<sup>769</sup> Between 1918 and 1922 there was an intense phase of land transfer where more than a quarter of the landlord held farms in Wales were bought by their tenants. This transfer increased the number of freehold farmers in Wales from ten per cent before the war to thirty-five per cent by 1922.<sup>770</sup> Although there was a pride in achieving freehold status there were many farmers who had bought their farms in this period who were not fortunate and saw a rapid decline in their capital investment in the inter-war years and found that the mortgage payments were more of an encumbrance than rent.<sup>771</sup>

Government support in the 1930s took the form of subsidies, marketing schemes and protection. The Marketing Boards for milk and potatoes were seen to stabilise prices, while import quotas controlled competition, and the subsidies on sugar beet, wheat, barley, oats and fat cattle gave farmers control of guaranteed prices.<sup>772</sup> However, even with the help of State support, agriculture remained in a depressed condition and for some farmers it took the onset of another war to see their fortunes reversed.

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<sup>768</sup> TNA CAB/24/84/91 Board of Agriculture and Fisheries, Food Production Department, 23 July 1919.

<sup>769</sup> John Davies, *The Making of Wales*, (Cadw: Welsh Historic Monuments, Alan Sutton Publishing, 1996), p.137; John Davies, 'The End of the Great Estates and the Rise of Freehold Farming in Wales', *WHR*, Vol. 7, 1974, pp.193-94.

<sup>770</sup> John Davies, *The Making of Wales*, op.cit., p.137; Kenneth O. Morgan, *Rebirth of a Nation*, op.cit., p.186.

<sup>771</sup> John Davies, *A History of Wales*, op.cit., p.524; Kenneth O. Morgan, *Rebirth of a Nation*, op.cit., p.187.

<sup>772</sup> Sidney Pollard, *The Development of the British Economy, 1914-1967*, (London: Edward Arnold Publishers Ltd, 1969), p.314; Peter Self and Herbert J. Storing, *The State and the Farmer*, (London: George Allen & Unwin Ltd, 1962), p.19



### THE BRIDGE-BUILDER

GILES. "BIT RICKETY LOIKE, BAIN'T IT, ZUR?"  
THE MINISTER OF AGRICULTURE. "DON'T YOU WORRY; WE'RE GETTING YOU ACROSS GRADUALLY."

Figure 25. The Bridge Builder by E H Shepard, Punch 16<sup>th</sup> June 1937. Reproduced with permission of Punch Limited.

### 10.3 Scientific Support in the Second World War

There is mutual trust and harmony between the man of science and the man of practice. In this plough-up business the farmer will consult the scientist.<sup>773</sup>

The Second World War was described as being a good war for farmers as the output of wheat, barley, oats and potatoes increased and income overall improved more than three-fold. These improvements, following the depression of the inter-war period, are studied in this section with reference to the work of the WAECs and the scientific support available. The work of the WAEC during the First World War resulted in better preparation for the Second World War and at the outbreak of war in September 1939 the Committees were ready with contingency plans for food production.<sup>774</sup> In 1939 the county council agricultural staffs were placed under the control of County War Agricultural Executive Committees (CWAECs) by a regulation under the Emergency Powers (Defence) Act. These committees organised the ploughing up of millions of acres of grassland for arable cropping, they supervised cultivation, controlled the supply of fertilisers and feeding stuffs and organised labour and machinery. Regulation 62 of the Act also allowed the committees to oversee the production and management of livestock and meat.<sup>775</sup>

As in the First World War the case for ploughing was justified for producing human food and feeding-stuffs for stock to replace the annual imports. The War Cabinet report in October 1939 showed that the CWAEs were working well and 400,000 acres of grassland had already been ploughed. Orders were issued for over twenty-three acres to be ploughed in Glynhenllan, Cilgerran of which one and a half acres were to be for sugar beet, forty-three acres were ploughed at Trellan, Fishguard, of which two and a half acres were

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<sup>773</sup> Sir R. George Stapledon, *The Plough-up Policy and Ley Farming*, op.cit., p.27.

<sup>774</sup> J. K. Bowers. 'British Agricultural Policy Since the Second World War', *AHR*, Vol. 33(1), 1985, p.66; Gordon E. Cherry and Alan Rogers, op.cit., p.75-76.

<sup>775</sup> Anthony Hurd, *A Farmer in Whitehall*, (London: Country Life Ltd., 1951), Appendix II, pp.124-27.

for potatoes, and thirty-five acres were ordered to be ploughed at Trellyn, Dinas Cross of which two acres were for potatoes.<sup>776</sup> Although Treginnis Isaf farm already had sixty-nine acres producing barley, oats, turnips, swedes and mangolds the PWAEC ordered a further eighteen acres for potatoes and barley. John Bennion at Stackpole Home Farm was producing large quantities of quality produce, namely fifty-eight acres of barley, ninety-five acres of oats, 132 acres of first early potatoes, seven acres of sugar beet and sixty acres of flax. The committee ordered a further twelve acres of wheat and ninety-seven acres of potatoes, rape, broccoli and barley in 1941 with a further seventeen acres more of wheat, seventeen acres of sugar beet and twenty acres of potatoes, turnips and swedes the following year. Mr Bennion had the advantage of the assistance of forty-three employees, five tractors, three engines and twenty-one horses.<sup>777</sup> Potato picking in Pembrokeshire was helped by both schoolchildren and POWs and records show Camrose South schoolchildren helped out at Summerhill Farm and Hayscastle Council School helped out at Brimston Grange.<sup>778</sup> There was also help provided by POWs who were stationed at Penbanc, Priskilly and Castell from October to December 1942.<sup>779</sup>

Producing larger quantities of cereals and vegetables and saving on shipping led Edgerton to comment that ‘the nationalization of food supply and its scientization (sic) went hand in glove’.<sup>780</sup> Technical experts brought agricultural science to the farms in many ways to help increase production. For example they carried out soil analysis to help with fertility requirements, wireworm surveys for disease control, cropping programmes for

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<sup>776</sup> TNA CAB/65/1/37 Meeting of the War Cabinet at 10 Downing Street Wednesday 4 October 1939; ‘The Farming Front, The Round Table’, *The Commonwealth Journal of International Affairs*, 33:130, 1943, p.125; PA, D/VJ/19/5 County of Pembroke War Agricultural Executive Committee, Cultivation of Lands Orders, 1939.

<sup>777</sup> Donnah E. Lewis, ‘The Impact of the Second World War on Agriculture in Pembrokeshire’, (unpublished MA Dissertation, University of Wales Trinity Saint David, 2007), pp.30-32.

<sup>778</sup> PA, HDX/1248/20 and PA, PCC/ED/2/618.

<sup>779</sup> Farm account books and WAEC account books of William Watts and Evan Evans courtesy of Gareth Evans.

<sup>780</sup> David Edgerton, ‘War, Reconstruction, and the Nationalization of Britain, 1939-1951’, *Past and Present*, Supplement 6, 2011, p.37.



maximum production and helped with grants for field drainage for land improvements. The Committees were also responsible for a national farm survey, a comprehensive survey of land ownership and an assessment of both the condition of the farms and the ability of the farmer. As in the First World War, farms were graded and the survey revealed millions of acres of grass land understocked and badly managed and neglected.<sup>781</sup>



**Figure 26. Camrose South School children after potato picking at Summerhill Farm, Roch, 1941**

*Source: Pembrokeshire Archives, HDX/1248/20*

The role of the CWAECs has been well researched by Moore-Colyer for Wales and by Short for England. Both authors comment on the success that the committees had on influencing land and labour for food supplies but they were also accused of bullying and

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<sup>781</sup> Edith H. Whetham, *British Farming 1939-49*, (London: Thomas Nelson, 1952), p.148; Viscount Astor and B. Seebohm Rowntree, *Mixed Farming and Muddled Thinking*, (London: Macdonald, n.d., c.1946), p.16; Brian Short et.al., *The National Farm Survey 1941-1943*, (Wallingford: CABI, 2000), p.42, the first survey in 1940 was carried out to greatly different standards and Pembrokeshire was noted for the fullness of its recordings.

heavy-handed behaviour. Doubts were also raised about the impartiality of some CWAECs and the number of dispossessions carried out in dubious circumstances were described as ‘uncontrolled action in authority’ and demonstrated that ‘bad laws are the worst from of tyranny’.<sup>782</sup> Dispossessions were defended by the Minister of Agriculture who stated at a meeting of the Council of Agriculture in 1942 ‘I have still to find one case of injustice. Hardship, yes, but we could not carry on a totalitarian war without hardships’.<sup>783</sup> Other critics described the CWAECs as ‘fascist in organisation’ and that they were ‘all failed farmers, or opportunists with dubiously relevant backgrounds who had wormed their way into their indefensible jobs’.<sup>784</sup>

The CWAECs were also described as a visible human chain which grew stronger with each year of war and the following description of how the committee worked was detailed by the Ministry of Information:

*The Government might say to the Minister of Agriculture: “we need so much home-grown food next year”.*

*The Minister assured himself that the labour, tractors, equipment, and so on, would be forthcoming, and said to the Chairman of a County Committee: “We’ve got to plough two million extra acres next year. The quota for your county is 40,000”.*

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<sup>782</sup> R. J. Moore-Colyer, ‘The County War Agricultural Executive Committees: The Welsh Experience, 1939-1945’, *WHR*, Vol.22, No.3, 2005, pp.558-687; Brian Short, ‘War in the Fields and Villages: The County War Agricultural Committees in England, 1939-45’, *Rural History*, Vol.18, Issue 2, 2007, pp.217-44; Brian Short ‘The dispossession of farmers in England and Wales during and after the Second World War’ in Brian Short, Charles Watkins and John Martin, eds, *The Front Line of Freedom*, (British Agricultural History Society, 2006), pp.158-78; John Martin, ‘George Odium, The Minister of Agriculture and “Farmer Hudson”’, *AHR*, 55(2), 2007, p.231; Living Casualties, The Farmers’ Rights Association, Salop, this pamphlet was dedicated to the memory of George Raymond Walden, aged 65 of Borough Farm, who was dispossessed by the Hampshire War Agricultural Executive Committee, and was gassed and shot to death while defending his home that he had lived in all his life.

<sup>783</sup> Keith A. H. Murray, op.cit., p.303. The author notes that less than one tenth of the 10,000 cases of dispossession involved a farmer having to leave his house and complete holding and that most of the cases concerned non-resident occupiers, parts of holdings, derelict land or land used for sport or empty houses.

<sup>784</sup> Frank Sykes, *This Farming Business*, (London: Faber, 1944), p.121; Edward Blishen, *A Cackhanded War*, (London: Thames and Hudson, 1972), p.38.

*The Chairman said to his District Committee Chairman: “You’ve been scheduled for 5,000 acres”.*

*The Committee-man said to his Parish Representative: “You’ve got to find 800 acres, then”.*

*And the Parish Representative, who knew every yard of the valley, went to the farmer at the end of the lane. “Bob,” he said, “how about that 17 acre field – for wheat?”*

*And Farmer Bob said “Aye”.*<sup>785</sup>

As previously mentioned the CWAECs had the power to dispossess or to take over farms to manage themselves. Treriffith Farm in Moylegrove, Pembrokeshire, was inspected in May 1941 and was found to be neglected. Ploughing had been executed badly and the fields were full of couch grass and needed to be cultivated and cleaned. Unploughed land was covered with thistle and weed growth, fencing was damaged and in need of strengthening and the land was badly infested with rabbits. The auctioneers and estate agents acting for the PWAEC recommended compensation payable to the land owner of £19 per annum under the Compensation Defence Act 1939 and due to the neglected condition of the property stated that the present occupier was not entitled to any compensation in respect of tenant rights.<sup>786</sup>

The Agricultural Improvement Council<sup>787</sup> considered that the technical development work of the WAECs addressed the problem of how to persuade farmers to adopt better methods by ensuring the results of scientific research reached the farmers in the shortest possible time. Before the war Viscount Astor and B. Seebom Rowntree commented:

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<sup>785</sup> *Land at War*, prepared by the Ministry of Information, (London: HMSO, 1945), p.12.

<sup>786</sup> PA DB/18/21 WAEC files of Treriffith Farm.

<sup>787</sup> TNA CAB/66/35/3/1 War Cabinet paper 10 March 1943, post-war agricultural policy. The Agricultural Improvement Council was appointed to bring scientific research and practical agriculture closer together and emphasised that more education for the promotion of farming efficiency was required.

...an unfathomable gulf yawned between the progressive farmer and the run-of-the-road farmer who muddled along on a rule-of-thumb wisdom inherited from his father or picked up over a glass of beer on market day.

They thought the progressive farmer was a scientist who kept records and ventured into field experiments and the ordinary farmer was a traditionalist carrying out routine with little understanding.<sup>788</sup> The combination of technical experts and volunteers from the farming community were said to have brought the agricultural scientists and practical farmers together and, despite all the criticism of dispossession threats and bullying, the CWAECs brought new and modern methods to farms, methods that some farmers had not heard of.<sup>789</sup> For example in January 1941 the PWAEC asked for twenty three acres of onions to be grown and as the majority of farmers did not know anything about growing onions they enlisted the help of a horticultural instructor.<sup>790</sup>

Efforts were also made to help farmers grow flax and the Committee gave permission for the Advisory Chemist at the University of Wales, Aberystwyth, to carry out manuring experiments on the Committee's farms. The Ministry of Agriculture allocated one hundred tons of muriate of potash to the County as the Pembrokeshire land was considered capable of producing excellent crops. Farmers, many of whom were hesitant to commit to growing this 'strange crop', were asked to grow the maximum acreage of flax in 1941 to establish a new industry as an asset during and after the war.<sup>791</sup> The Committee

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<sup>788</sup> Viscount Astor and B. Seebom Rowntree, *Mixed Farming and Muddled Thinking*, op.cit., pp.15-16.

<sup>789</sup> Edith H. Whetham, *British Farming 1939-49*, op.cit., pp.163-64.

<sup>790</sup> *The County Echo*, 23 January 1941.

<sup>791</sup> MAF 80/4122 Minutes of Pembroke War Agricultural Executive Committee, 9 April 1941; MAF 80/4122 Minutes of Pembroke War Agricultural Executive Committee, 20 March 1941; *The County Echo*, 3 April 1941; Alan Owen, 'The Flax of Life', *Pembrokeshire Life*, September 2010, pp.29-30; G. O. Searle, 'The Past and Future of Flax Production in Great Britain', *Journal of the Textile Institute Proceedings*, Vol.27, Issue 7, 1936, p.197, the author notes that Britain used ten percent but only produced one per cent of the world's supply and that flax was not only essential to the linen industry but also of national importance to the army, navy and RAF and that shortages in the First World War had a disastrous impact.

was expected to help farmers grow two thousand acres of flax without encroaching on the sugar beet and potato acreages.<sup>792</sup>

To help the War Ags explain new methods to farmers and promote changes on the farm the government provided a staff of experts under the control of an Executive Officer. These experts included Cultivations Officers, experts on silage, ley-farming, drainage, milk production, fertilisers, and plant and animal diseases. The Ministry of Agriculture also had scientists and specialists to help and offered free advice for farmers.<sup>793</sup> The PWAEC appointed sub-committees to help farmers: the Requisites committee examined all applications for assistance under the Requisites Scheme and Farmers' Services Schemes; the Farm Committee supervised the management of the lands farmed by the Committee; the Machinery Committee procured and allocated machinery; the Labour Committee dealt with matters relating to Military Service, and organised Labour Gangs, supervised drainage, and helped farmers getting additional labour; and the Livestock and Supplies Committee supervised the Feeding Stuffs Rationing Scheme and dealt with the supply of fertilisers and seeds.<sup>794</sup>

The Committees produced letters, leaflets and pamphlets to help farmers. For example the Cardiganshire WAEC produced a 'Monthly Bulletin of Farming Topics of Interest to All Farmers' and the Pembrokeshire Committee produced and distributed 'Growmore' leaflets. The No.38 leaflet showed farmers how to deal with damage of crops by poison gas and the No.14 leaflet was 'Poultry Rations in War Time' and showed farmers the various substitute feeding stuffs.<sup>795</sup> Some were straight forward instructions

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<sup>792</sup> TNA, MAF 80/4122 Minutes of Pembroke War Agricultural Executive Committee, 5 February 1941.

<sup>793</sup> *Land at War*, op.cit., p.12-13.

<sup>794</sup> TNA, MAF 80/4122 Minutes of Pembroke War Agricultural Executive Committee, 2 April 1941.

<sup>795</sup> *County Echo* 25 September 1941, *County Echo*, 2 May 1940.

such as how to apply for TT licences, or advice on stock culling.<sup>796</sup> Some were not so straight forward such as the following described in a letter to the editor in *The Times*:

The ways of Government departments have always been mysterious, but the satellites that have come into being around them seem to be well able to evolve cumbersome methods for themselves. I have just received a letter from our County War Agricultural Executive which is headed "Our Ref. H.Q/TD/F.Stuffs/DH/(1)/B. 886/M.M." The layman's mind can hardly gasp the intricacies of such correspondence, but all praise must be given to the official mind that handles these matters.<sup>797</sup>

The Potato Order No.1060 was described as 'more intricate than *The Times* crossword puzzle':

On the occasion of a sale by retail of ware potatoes the maximum price which may be charged and paid for potatoes of the variety, classification, and grade set out in the second column of the Third Schedule of the Order sold in the districts set out in the first column of such Schedule shall be in accordance with the scales set out in the fourth, fifth, sixth and seventh columns of the said Schedule as the case may be.<sup>798</sup>

Many farmers disliked being told what to do with their land, particularly by neighbouring farmers when they were recruited as a War Ag. It was questioned that they were considered necessary as it was a bad reflection on British agriculture if the individual farmer was not prepared to make the best possible use of his land for the national interest. A Pembrokeshire farmer complained that his unpopular War Ag regularly visited his farm at dinner time expecting to be fed.<sup>799</sup> Another farmer said 'this WAEC business seems a bit of a racket', when a Welsh War Ag official manipulated the hours booked inspecting

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<sup>796</sup> NLW C43/31 Farm Topics, June 1943, Vol.1, No.6, pp-2-3, NLW C43/33, November and December 1943, Vol1, No.11, p.4.

<sup>797</sup> *The Times*, 4 Oct 1943.

<sup>798</sup> A. G. Street, *Hitler's Whistle*, (London: Eyre and Spottiswoode, 1944), pp.188-89.

<sup>799</sup> Oral testament of George Mathias MBE.

bracken cutting and drainage work.<sup>800</sup> Traditional cultures were also at odds with government policies. Despite the war few farmers in rural Wales would carry hay on a Sunday for fear of being ‘criticised for his shamelessness’ and ‘no good would come of it’, and some held on to the tradition that ‘in the old days’ harvesting was achieved with scythes with no Sunday work and no tractors and binders.<sup>801</sup> However some traditions were welcomed as wartime contractors cutting oats with tractors and binders were given meals by the farmers ‘as was the custom for all callers’, a custom described by Short as ‘wartime arrangements and modernity suffused with traditional courtesy’.<sup>802</sup>

Others complained of the inconvenience of having to stop work to accompany the War Ag around the farm but the Committee requested that:

...occupiers concerned should make a point of accompanying the County Committee representative during his visit, even if it involves some personal inconvenience. This may mean some short interference with the farmer’s programme of work for the day, but in all fairness he will recognise his visitor cannot possibly give a few days’ notice of his intended call and that, with so many visits to pay, his visitor cannot possibly hang about for a few hours whilst the farmer finishes the job on hand.<sup>803</sup>

As well as distributing letters, leaflets and pamphlets to farmers the CWAECs used local newspapers to disseminate information. For example the Executive Officer of PWAEC requested through the Press that farmers grew more acreage of spring wheat, drew attention to farmers that unripe corn crops were not to be cut and issued a schedule for the lifting of the varieties of potatoes.<sup>804</sup> Newspapers were also used by the CWAECs to inform farmers about grants available; for example grants for the eradication of bracken

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<sup>800</sup> Brian Short ‘The Social Impact of State Control of Agriculture in Britain, 1939-1955’, in Paul Brassley, Yves Segers and Leen Van Molle, eds, *War, Agriculture, and Food*, (New York: Routledge, 2012), p.180.

<sup>801</sup> Alwyn D Rees, *Life in a Welsh Countryside*, (Cardiff: UWP, 1996), p.128; Brian Short ‘The Social Impact of State Control of Agriculture in Britain, 1939-1955’, op.cit., p.180.

<sup>802</sup> Brian Short ‘The Social Impact of State Control of Agriculture in Britain, 1939-1955’, op.cit., p.180.

<sup>803</sup> *County Echo*, 18 July 1940, Farmers’ Union Notes.

<sup>804</sup> TNA MAF 80/4122 Minutes of Pembroke War Agricultural Executive Committee, 22 October 1941; *County Echo* 10 July 1941.

on hill sheep farms towards the cost of machines, hand implements or use of government machinery and grants for water supply to upland pastures to make the land better for grazing stock from lower pastures in order to use them for arable crops.<sup>805</sup> The Committees also used newspapers to inform farmers about fertiliser supplies to increase crop production, and how to ration and substitute when supplies were unavailable. For example when superphosphate was unavailable the farmers were advised to use basic slag and to use at least one hundredweight of Sulphate of Ammonia, Nitro-chalk or Nitrate of Soda on each acre of land sown with corn. They were also advised to use nitrogenous fertilisers on grassland to improve the yield of hay and silage as the average response to one hundredweight of sulphate of ammonia was an additional five hundredweight of hay. Newspaper columns were also used to advocate the making of silage as recommended by the National Silage Campaign.<sup>806</sup> Grass-drying demonstrations were organised by the PWAEC at Stackpole Home Farm which was attended by 150 farmers and who were said to have been impressed that the high protein grass would boost milk yields. A processing plant was planned for but did not materialise.<sup>807</sup>

The Land Fertility Scheme was reported to have far reaching effects and the better knowledge of the use of lime and fertilisers allowed farmers to farm as best they could throughout the war years.<sup>808</sup> In the Second World War, Mr W. E. D. Jones had to manage the supplies and distribution of lime to farmers and soil analysis showed that the average amount of ground limestone needed for the Pembrokeshire soils was about forty five cwts per acre in about ninety five per cent of the samples taken. There was a difficulty obtaining both lime and ground limestone and farmers were urged to place orders for their

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<sup>805</sup> *County Echo* 24 July 1941; *County Echo* 24 April 1941.

<sup>806</sup> *County Echo* 19 February 1942, *County Echo* 2 March 1943; TNA, MAF 80/4122 Minutes of Pembroke War Agricultural Executive Committee, 3 September 1941.

<sup>807</sup> Caroline Wendy Marmara, *op.cit.*, p.44.

<sup>808</sup> *Land at War*, *op.cit.*, p.55.



needs so the agricultural committees could give the Land Fertility Committee the counties' requirements. The Gellihalog Quarry and Pembro Carblime Ltd. in Narberth had difficulties increasing the output to meet farmers' needs. The extra price that would have been charged if the lime was supplied from outside the county prompted the Executive Officer of the Pembrokeshire Agricultural Committee to write to the Electrical Development Association requesting the laying of an extra cable to the Gellihalog Lime Works so they could double the output by working two shifts.<sup>809</sup>

The focus of the Committees was food production and distribution. The Cardiganshire WAEC wanted radical alterations in stock management and proposed rigid stock culling, better stocking policy to stop indiscriminate crossbreeding and a closer relationship between the stocking policy of the farm and its arable cropping programme. There was no room for sentiment as the Milk Production Officer stated:

There are far too many mongrels and parasites. Such stock are a liability, they do not beautify the landscape and they involve a considerable expenditure in terms of food and labour. There is truth in the story of the farmer who was determined to retain a 15 year old cow entirely for sentimental reasons – she was born on his birthday – saying “Mae hi'n hanner fy mywyd i”. What a costly way to celebrate a birthday; costly to the farmer, the industry and the nation.<sup>810</sup>

The requested increase of food production necessitated an increase in machinery including potato spraying machines to help with Blight disease, large and small corn dressing machines, bracken cutting and bruising machines and dusting machines to be supplied by the County Committee.<sup>811</sup> The farmers on Cerbid Farm were entirely dependent on horses in the first two years of the war but then acquired a tobacco plantation

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<sup>809</sup> TNA MAF 80/4122 Minutes of Pembroke War Agricultural Executive Committee, 6<sup>th</sup> August 1941 and 27 August 1941.

<sup>810</sup> NLW C43/31 Farm Topics, June 1943, Vol.1, No.6, p.2 (translation: 'she is half my life').

<sup>811</sup> TNA MAF 80/4122 op.cit., 15 January 1941, 30 April 1941, 7 May 1941, 13 November 1941.

three wheeled tractor to help harvest the potato crop in 1942 and through the American Lease Lend acquired an Allis-Chalmers tractor in 1944.<sup>812</sup>

Although increased prices and the arable subsidy were an incentive there were farmers who refused to comply with the Committee's directive to plough, some because they disagreed with the directive, others because of lack of labour. However, failure to comply often resulted in a fine and the Committees urged the courts to support them in prosecutions to ensure their ploughing orders would be carried out as the Bench had the power to fine up to £100 or enforce imprisonment. They asked that fines should be 'steep' otherwise they would fail to be the deterrent necessary.<sup>813</sup> British farmers were described by A G Street as being in five classes and comments:

One, those who are either ploughing-up grassland: two, those who are cultivating and sowing ploughed-up grassland; three, those who are talking about their intention to plough-up some grassland; four, those who are toiling and worrying on the local committees responsible for getting a certain acreage of grassland ploughed; and five, those who are objecting to any suggestions that they should plough up any of their grassland.<sup>814</sup>

Mr John of Southdown Farm in Pembroke was fined £15 for not ploughing a field near Bonvilston. His reply to the Committee was 'this is about the silliest thing I have ever heard... I am not ploughing .884 of an acre.'<sup>815</sup> Mr Morgan of Ambleston was fined £5 for

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<sup>812</sup> *Harvesting Our Past*, Croesgoch Heritage Group, interview of Leonard Rees, Cerbid Farm, held at Fishguard Library.

<sup>813</sup> *County Echo*, 18 September 1941; *County Echo*, 10 April 1941. However, the court justice system in North Pembrokeshire was seen to be fair when three JPs farming over 400 acres in Priskilly and Penbanc had their farms dispossessed and taken over by PWAEC, I am grateful for Gareth Thomas sharing this information from his father's War Ag books.

<sup>814</sup> A. G. Street, *Hitler's Whistle*, op.cit., pp.16-17.

<sup>815</sup> *County Echo*, 27 June 1940.

not ploughing 2.156 acres. He pleaded not guilty stating 'I wasn't hard pressed for ploughing' and that 'the holding is too small and I can't get a living out of it'.<sup>816</sup>

One farmer recalled:

We were good farmers and we knew our land. Dad wouldn't plough up the land the War Agricultural Committee wanted for potatoes because it was boggy and he'd nearly gone bankrupt trying to drain it before. Not only was the order stupid, it was a financial impossibility. It was deeply traumatic for Father and he never came to terms with it. At the time of the farm sale he was in bed with pleurisy and pneumonia. All the furniture and animals had to go. It was heart-breaking. We were homeless...I learnt after that, all through the war no potato was planted on that land. But all through my life I always felt the stigma of our family being branded bad farmers.<sup>817</sup>

The Ministry of Agriculture's returns showed that all the counties in Wales exceeded their quotas for ploughing grassland between June 1939 and May 1940. Pembrokeshire's quota of 20,000 acres was exceeded by 1571 acres, Carmarthenshire's quota of 30,000 acres was exceeded by 5261 acres and Cardiganshire's quota of 15,000 acres was exceeded by 3100 acres.<sup>818</sup> Commendable as exceeding quotas were there was some criticism from the Select Committee:

It has been urged that the system of giving each county a quota of acres to be ploughed up was unscientific and conducive to error, if not to injustice; that land was ploughed up which had better have been left under grass and that land which ought to have been ploughed was left untouched; and finally concentration on ploughing fresh land led to the neglect of measures for much needed improvement of existing arable and pasture.<sup>819</sup>

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<sup>816</sup> *County Echo*, 29 August 1940.

<sup>817</sup> Steve Humphries and Beverly Hopwood, *Green and Pleasant Land*, (London: Macmillan, 1999), pp.153-54

<sup>818</sup> *The Times*, 27 May 1940.

<sup>819</sup> PP 1940-1941 (59), Sixth Report from the Select Committee on National Expenditure, p.24.

Throughout the Second World War, Pembrokeshire was reported to have not only ploughed its full quota but also was commended for its production of food. As C. E. Sinnet of the Ministry wrote:

...the sugar beet grown in the Dale Peninsula had the highest sugar content and the earliest maturing crop in the United Kingdom. Flax was also grown very successfully within the County. The crop was processed at a factory built for the purpose at Milford Haven. The total area of ploughed land in Pembrokeshire was 107,000 acres, over one third of the total area of clean land.<sup>820</sup>

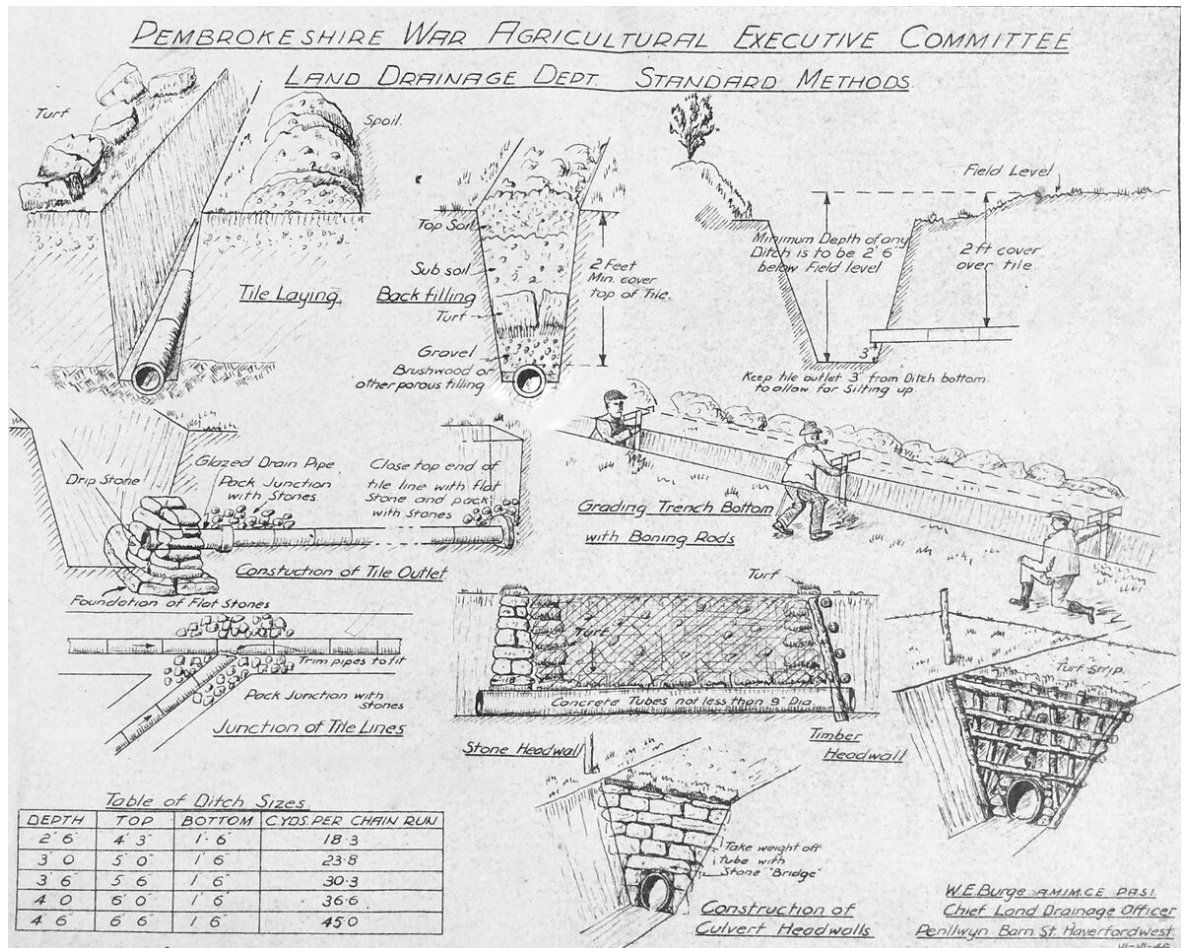
The survey of farms in 1940 showed how lack of drainage was the main handicap to increased output. With the aid of grants more than five million acres in England and Wales benefited during the years of the war from drainage in some form or other, much of it done by farmers themselves, much executed by the CAECs for land in their possession or on contract for farmers in their respective areas.<sup>821</sup> The Chief Land Drainage Officer, W. E. Burge, of the PWAEC issued technical notes for ditching, growth clearing, culverts, tile draining and back filling, as shown in Figure 29. The main purpose of the Ministry's Grant Aid Scheme for Land Drainage was based on the assumption that the drains had been in good order in the past and that they could be reconditioned to be working again. The Head Foreman and Gangers were provided with a plan showing the position of the ditches and culverts and were given instruction on how to cut the ditches, spread the soil and secure fencing but their main duty was to maximise the efficient work from the Prisoners of War.<sup>822</sup>

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<sup>820</sup> PA, HDX/273/1 Victory Churn folder.

<sup>821</sup> Edith H. Whetham, *British Farming 1939-49*, op.cit., p.49.

<sup>822</sup> PA, HDX/1559/2 Technical Notes and drawings for drainage, PWAEC.



**Figure 27. Technical drawing for drainage by the Pembrokeshire War Agricultural Executive Committee in the Second World War**

Source: Pembrokeshire Archives, HDX/1559/2

In 1941 although there were 128 drainage schemes approved by the Committee only fifty six schemes were being undertaken due to a shortage of labour in Pembrokeshire, forty ditch draining, fifteen tile draining and one mole draining. Although a number of areas were considered for draining the Land Drainage Officers chose over 676 acres of good land to be drained in Freshwater in preference because there were no engineering difficulties, there was a perfect outlet to the sea and the ground was soft for

steady digging and they could therefore use this scheme to prepare accurate costs for the others.<sup>823</sup>

Although there were significant increases in the arable sector this was offset by the decline in livestock production. During the war the government wanted the quality of the remaining grassland improved and research had shown that temporary grass leys was the best solution for impoverished soils and inadequate fertiliser supplies. As Ward commented:

The inevitable consequence of falling livestock numbers was less dung, and the reduction in the amount of imported oil cake in the diet of the farm animals meant that the dung that was produced was of inferior quality.<sup>824</sup>

The matter was made worse when there was a shortage of imported phosphates and potash and only home-produced nitrogenous fertilisers were available at a time when there was a rapid increase in demand. As Whetham commented ‘it was one of the ironies of war that so many farmers first learnt the value of fertilisers at a time when supplies were strictly limited by loss of overseas sources and by the shortage of ships’.<sup>825</sup> Although livestock was deliberately curtailed, milk production was given priority in allocating feedstuffs and Ald. J. M. Griffiths, J.P. Chairman of the PWAEC was presented with the Victory Churn by the Rt.Hon. Gwilym Lloyd George on 10 July 1943 as Pembrokeshire farmers had the highest increase in milk production in the United Kingdom and the county exceeded its annual target by two million gallons.<sup>826</sup>

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<sup>823</sup> TNA, MAF 80/4122 op.cit., 8 January 1941 and 28 May 1941.

<sup>824</sup> Sadie Ward, *War in the Countryside 1939-45*, (London: Cameron Books, 1988), pp.27-28

<sup>825</sup> Edith H. Whetham, *British Farming 1939-49*, op.cit., pp.98-99.

<sup>826</sup> PA, HDX/273/1 Victory Churn folder; Donnah E. Lewis, op.cit., p.20. The author notes that there was great public celebration and that two farmers who had exceeded their production by twenty percent were invited to a presentation ceremony in London.



**Figure 28. Programme of presentation of the Victory Churn**

*Source: Pembrokeshire Archives, HDX/273/1*

The advice given to farmers as to the type and quantity of food to produce had implications for animal health. Specialist pig production was undermined because of the need to preserve cereal for human consumption and consequently numbers dropped by sixty five per cent as the scale of production decreased and shifted to mixed farms. They were fed on farming by-products and swill but this diet caused respiratory and gastro-intestinal diseases. The uncooked and infected meat scraps in the swill led to an increase

in swine fever and foot and mouth disease.<sup>827</sup> During the Second World War technical agriculturalists devoted time to exploit new sources of animal feed supply which included household waste, slaughterhouse offal and synthetic products as a substitute for part of the animal protein requirements.<sup>828</sup>

The WAEC were considered a crucial element in wartime farming and the conversion of pasture to arable farming directed by them was considered a success story and was described as ‘the most successful example of decentralisation and the most democratic use of control this war has produced’.<sup>829</sup> The impact on the farming landscape was substantial and although Committees were criticised by some for impartiality and heavy handedness, this study has shown the evidence that science and technology was used to great effect in directing farmers to increase productivity for the country’s food supply. Furthermore, the application of agricultural science was seen to change farming and to change farmers too. C. Bryner Jones commented that he had seen a great change in the attitude of farmers towards agricultural education during the food campaigns of the war and commented:

One of the most remarkable things in connection with the campaign had been the demand by the farmer for technical advice and his appreciation of the advice that was given. The success of the food campaign had been in no small measure due to the services of the technical advisers.<sup>830</sup>

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<sup>827</sup> Abigail Woods, op.cit., pp.1946-47, this problem led to the establishment of the swill-boiling plants run by the Government’s Waste Food Board in 1943.

<sup>828</sup> I. D. Blair, ‘Wartime Problems of English Agriculture’, *Agricultural History Society*, Vol.15, No.1, 1941, p.18.

<sup>829</sup> K. A. H. Murray, op.cit., p.340; *Land at War*, op.cit., p.12; Gordon E Cherry and Alan Rogers, op.cit., p.76.

<sup>830</sup> Bryner Jones, presidential address of the Jubilee of the Agricultural Education Association, 13 December 1944, *AP*, Vol. XIX, 1944, p.36.



The war years were seen to have brought farmers and scientists together and the public image of farmers was transformed from a work-force demanding state hand-outs to national heroes on the home front.<sup>831</sup>

#### **10.4 The Control of Rabbits in the Second World War**

The Prevention of Damage by Rabbits Act and The Rabbits Order 1939 gave the CWAECs the authority to enter and take rabbits from any land, and Rabbit Control Officers were appointed to coordinate their destruction by trapping, snaring, ferreting, and gassing.<sup>832</sup> The Rabbit Officers of the PWAEC had difficulty getting enough trappers because many were engaged in other work. The serious destruction caused by the rabbits in the county impelled the executive officer of the committee to buy 2000 rabbit traps and to advertise for trappers to work for the committee for £3 per week.<sup>833</sup> The rabbit trappers who were prepared to work throughout the summer on the committee's farms were able to keep all the rabbits they caught instead of receiving the £3 weekly wage.<sup>834</sup> A farmer in the south of Pembrokeshire reported that many farmers could catch and sell enough rabbits to pay the rates and rent as well as buying themselves motorbikes. Often five ton lorries laden with rabbits for sale were driven to Birmingham.<sup>835</sup>

The damage on land around the Admiralty Works at Trecwn was so serious that it prompted a letter to the Ministry asking for rabbit trappers under the age of thirty to be given postponement from Military Service.<sup>836</sup> However, it was known that many trappers were not interested in eradicating rabbits and, while they may not have deliberately chosen

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<sup>831</sup> Sir R. George Stapledon, 'Grassland During the Last Fifty Years', *AP*, Vol. XIX, 1944, p.48; Clare Griffiths, 'When Farmers Grumble', *History Today*, Vol. 49, Issue 6, p.5.

<sup>832</sup> John Martin, 'The wild rabbit: plague, policies and pestilence in England and Wales, 1931-1955', *op.cit.*, pp.267-69.

<sup>833</sup> TNA MAF 80/4122 *op.cit.*, 14 May 1941.

<sup>834</sup> *Ibid.*, 21 May 1941.

<sup>835</sup> Oral testimony of George Mathias .

<sup>836</sup> TNA MAF 80/4122, *op.cit.*, 12 March 1941.

to, they frequently removed only the surplus population leaving a good breeding stock behind for another year. Marking and release experiments in West Wales indicated that the proportion of rabbits removed by a trapper could have been as low as forty per cent.<sup>837</sup>

The PWAEC minute books detail complaints and instructions to the district Rabbit Officers. For example landowners of Brimaston Hall, Wolfscastle, and Whitewell Farm, Penally, did not fulfil obligations to destroy rabbits enforcing the Committee to serve Orders.<sup>838</sup> Similarly, the Cardiganshire WAEC served Orders on the landowners of Nanteos Estate, Aberystwyth, because the rabbits were damaging the corn in surrounding areas and the estate staffs was not dealing with the pest. Mrs Powell of the Nanteos Estate objected to the gassing of rabbits around the woodlands on the estate and the Executive Officer of the Committee made their powers quite clear and served orders to gas immediately under the provision of the Rabbit Order 1940.<sup>839</sup>

In 1947 the Agriculture Act transferred the powers of the Rabbits Order to the CAECs and this new legislation introduced grant aid to help farmers and landowners with the costs incurred in controlling rabbits through the establishment of Pest Destruction Societies.<sup>840</sup> The Committee on Cruelty to Wild Animals believed the policy of rabbit control in the interests of agriculture and at the same time exploiting the rabbit for its commercial value to be wrong as it would inevitably lead to maintaining large rabbit populations and hence suffering in the process of controlling them. They recommended that the Agricultural Departments have a policy of extermination and encouraged the use

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<sup>837</sup> Harry V Thompson and Alastair N. Worden, *The Rabbit*, (London: Collins, 1956), p.181.

<sup>838</sup> TNA, MAF 80/4122, op.cit., 26 February 1941 and 30 July 1941.

<sup>839</sup> NLW L-4553 War Agricultural Executive Committee, Rabbits Order 1940; NLW L-4554 War Agricultural Executive Committee, Rabbits Order 1940.

<sup>840</sup> John Martin, 'The wild rabbit: plague, policies and pestilence in England and Wales, 1931-1955', op.cit., p.273.

of gas to destroy rabbits especially on derelict grounds where the number of rabbits could spread to surrounding lands.<sup>841</sup>

Wartime meat shortages meant that rabbits were important in livestock production and the number killed each year for food alone was likely to have exceeded thirty-six million. In Pembrokeshire in 1945 the rabbit meat production from trapped wild rabbits was 1460 tons and was almost half of the county's beef production.<sup>842</sup> The government also estimated that over six million rabbit carcasses were moved by rail from thirty-two counties in England and Wales in 1947 and over seven million in 1948.<sup>843</sup> It was estimated that there were approximately two million rabbit carcasses transported by rail out of Pembrokeshire alone and for every hundred pound of domestic carcass meat Pembrokeshire produced thirty-six pounds of rabbit meat, Cardiganshire twenty-four pounds, and Carmarthenshire ten pounds.<sup>844</sup>

The contribution of rabbit meat to the national food economy was at the expense of crops and stock. The rabbits caused considerable damage to grass, herbage, green shoots, spring corn and roots. The damage to pasture land reduced stock-carrying capacity, and even if the rabbit carcasses had some value as food it was calculated that the rabbit produced less than one-seventh of the meat produced by a sheep from the same quantity of fodder.<sup>845</sup> As quoted in the House of Lords '...the rabbit has seldom been killed which, on sale, did not owe somebody several shillings as a result of its depredations.' The Committee recommended that it would be in the economic interests of the country for the

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<sup>841</sup> PP 1950-51 (Cmd.8266), Home Office. Scottish Home Department. Report of the Committee on Cruelty to Wild Animals, pp.88 and 112, for example rabbit skins were the primary raw material for the manufacture of felt hats and were exported to the USA and Belgium.

<sup>842</sup> R. M. Lockley, *The Private Life of the Rabbit*. (London: Andre Deutsch, 1978), p.129.

<sup>843</sup> PP 1950-51 (Cmd.8266), op.cit., p.87.

<sup>844</sup> Miss W. M. Phillips, Miss M. N. Stephens and Prof. A. N. Wordern, 'Observations on the Rabbit in West Wales, *Nature*, 24 May, 1952, p.869. Domestic meat included beef, veal, sheep meat and pig meat.

<sup>845</sup> *Ibid.*, p.869; PP 1950-51 (Cmd.8266), op.cit., p.88.

total elimination of the rabbit because of its poor meat-producing capacity and the damage it does to agriculture and forestry.<sup>846</sup>

A programme of scientific investigation was instituted in West Wales between 1946 and 1950 to study the biology and control of rabbits. This study included looking at how effective commercial trapping was on rabbit populations and it was found that the rabbits were fairly local in their movements and kept to the same warrens or areas. In 1947-48 a 293 acre farm that had been neglected and requisitioned by the CAEC was used for experimental eradication by trapping, cyanide fumigation and ferreting as part of the land reclamation programme. This successful trial resulted in banks becoming free of warrens with vegetation regrowth and cereal crops being grown right up to the hedgerows. Although some boundary re-infestation occurred it was controlled by trapping and snaring and the greater part of the farm remained free from rabbits for the period of the study, 1948-51.<sup>847</sup>

Other experiments included looking at the effect of rabbit grazing on reseeded pastures. Two fields in Cardiganshire were ploughed and reseeded with a mixture of perennial and Italian rye-grass, red and white clover and rape. Two plots were fenced with rabbit-proof wire and two with pig-netting with the objective to determine the effect of rabbit-grazing on the botanical composition of the pasture. Yields of herbage on the rabbit-proof wired protected plots were much greater and in order to make the experiments more convincing to farmers, lambs were permitted to graze on all the plots and it was found that the lambs that were grazing on the protected plots had a significant higher weight increase.<sup>848</sup>

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<sup>846</sup> Report of the Select Committee of the House of Lords on Agriculture (Damage by Rabbits) 1937 quoted in PP 1950-51 (Cmd.8266), *op.cit.*, p.88.

<sup>847</sup> Miss W. M. Phillips, *et.al.*, *op.cit.*, p.869.

<sup>848</sup> Harry V Thompson and Alastair N. Worden, *op.cit.*, pp.167-69.

The outbreak of myxomatosis in the 1950s was an animal disease crisis which had mass public concern with government inquiries and interventions. There was extensive media coverage as these headlines illustrate: “Myxomatosis: is this suffering necessary?”, “Doom to Rabbits”, “Crops improve as the Rabbits Die”, “End of the Rabbit Pest”.<sup>849</sup>

The lethal virus had originated in South America as early as 1898, and experiments on the virus and potential methods of transmission were investigated at the Department of Experimental Pathology at Cambridge University in the 1930s where experiments in enclosed paddocks showed the disease to be one hundred percent fatal to wild rabbits. Lockley, described as a gifted amateur naturalist, was also experimenting at this time carrying out scientific assessments on the ecological effects of myxomatosis. He was working on the rabbit infested island of Skokholm off the Pembrokeshire coast and his investigations were believed to have given a reliable guide to the repercussions and development of the disease and formed the basis of his study *The Private Life of the Rabbit*.<sup>850</sup>

## 10.5 Scientific Farming and Post War Strategy

Agrarian policies in place following the Second World War focussed on agricultural stability and agricultural improvement for farming communities. Two government acts, the 1946 Hill Farming Act<sup>851</sup> and the 1947 Agricultural Act<sup>852</sup>, were seen to help farmers progress their industry. In the first year of the implementation of the Hill Farming Act the government provided four million pounds in grants for farm improvement schemes in the

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<sup>849</sup> *Mercury & Herald* 13 August 1954; *Northern Daily Mail* 5 August 1954; *The Courier and Advertiser* 27 July 1953; *The Luton News* 21 October 1954.

<sup>850</sup> Peter W. J. Bartrip, op.cit., p.149 and p.202; John Martin, ‘The wild rabbit: plague, policies and pestilence in England and Wales, 1931-1955’, op.cit., p.265; R. M. Lockley, ‘Some Experiments in Rabbit Control’, *Nature*, Vol.145, No.3681, May 18 1940, p.768.

<sup>851</sup> PP 1946 (77), Hill Farming Bill.

<sup>852</sup> PP 1947 (24), Agriculture Bill.

upland areas.<sup>853</sup> This Act was very important for Welsh farmers as it provided grants for up to half the total cost for comprehensive improvements to land and buildings to assist in good husbandry and by the end of 1954 there had been 4054 schemes in Wales approved or under consideration with an estimated cost of £7,803,000 and covered 912,000 acres.<sup>854</sup> Thomas Evans who farmed Gelli Lenor and was Chairman of the local Hill Farming Committee saw first-hand the benefits of the Hill Farming Act to the upland farmers and shepherds that he knew in the community. He also believed the Agricultural Act had firm foundations and changed the farming era.<sup>855</sup>

The 1947 Agricultural Act was designed to provide a secure market and guaranteed prices for agricultural products as it provided a stable sector for farmers, farm workers and landlords and promoted an efficient system to increase food production and decrease rationing by implementing production grants.<sup>856</sup> An important feature of this Act was the establishment of the County Agricultural Executive Committees (CAECs) which succeeded the War Committees and were seen to help farmers increase productivity, comply with good husbandry practice and help the landowners with the principles of good estate management.<sup>857</sup>

However, the Agricultural Act had its critics. On April 14<sup>th</sup> 1950 Mr Stanley Evans MP, Parliamentary Secretary to the Ministry of Food severely criticised what he described as ‘the British farmers’ present privileged position’. His ‘feather-bed’ speech was described as protecting ‘dud’ farmers and also suggested that the producers rather than the

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<sup>853</sup> John Martin, *The Development of Modern Agriculture*, op.cit., p.69; G.P. Wibberly, ‘Some Aspects of Problem Rural Areas in Britain’, *The Geographical Journal*, Vol.120, No.1, (1954), p.45, the author notes that published financial returns from hill farms in Wales in 1949-50 showed an average of £320 net income per 100 acres as against £298 on the lower lying lands.

<sup>854</sup> T. J. Owen, ‘The Agricultural Land Service in Wales’, *JRWAS*, Jubilee year, 1954, p.48-49.

<sup>855</sup> Thomas Evans, ‘Gelli Lenor’, *JRWAS*, Vol. XXVI, 1957, p.36.

<sup>856</sup> Peter Self and Herbert J. Storing, op.cit., p.62; John Martin, *The Development of Modern Agriculture*, op.cit., p.9 and p.70; Michael Winter, *Rural Politics*, (London: Routledge, 1996), pp.104-07.

<sup>857</sup> Graham Cox, Philip Lowe and Michael Winter, ‘From State Direction to Self Regulation: the historical development of corporatism in British agriculture’, *Policy and Politics*, Vol.14, No.4, 1986, p.477; Philip Lowe et.al., *Countryside Conflicts*, (Aldershot: Gower, 1986), pp.40-41.

consumers were benefiting from ‘a political method of making food artificially cheap’.<sup>858</sup>

Although the Labour Party instigated the Act it was supported by the Conservatives and the NFU. In a speech at the annual dinner of the NFU in February 1953, Winston Churchill declared his backing of the Act and went on to say:

On behalf of her Majesty’s government I tell you that we shall back you in your efforts to make the fullest use of every acre, and we shall share in your pride of achievement as British agriculture shows the world what the land can give forth in this scientific age.<sup>859</sup>

In 1947 the government’s goal to increase agricultural output was set at twenty per cent in five years and farmers were encouraged to increase, in particular, their livestock products and grass whilst simultaneously reducing the imported feeding stuffs. Overall the plan achieved its objective of the twenty per cent increase but it was not consistent across the subdivisions of agricultural products. Potatoes, milk and pig meat exceeded targets but beef, mutton, wheat, oats and sugar beet did not. The arable sector was seen to be suffering from the legacy of the war years where continuous cropping exhausted the land. Also the expansion of sheep production had been seriously handicapped by the bad winter of 1946-47 when an estimated four million ewes died.<sup>860</sup>

During the post-war decade the National Agricultural Advisory Service (NAAS) and agricultural education was recognised as underpinning the government’s policy of agricultural expansion. The NAAS, established in 1946, brought the advisory work of the County Councils and the agricultural departments of universities and colleges together providing a two-way traffic of information between farmers and research workers. The Advisory Service was organised in eight regions with about five hundred general advisers

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<sup>858</sup> A. G. Street, *Feather Bedding*, (London: Faber and Faber, 1954), pp.11-14.

<sup>859</sup> Winston Churchill, *JMA*, Vol. LIX, No.2, March 1953, p.554.

<sup>860</sup> E. H. Whetham, ‘The Agricultural Expansion Programme’, *Journal of Agricultural Economics*, Vol. 11, Issue 3, 1955, p.313; John Martin, *The Development of Modern Agriculture*, op.cit., pp.73-74.

and also specialists within the counties.<sup>861</sup> The Ministry of Agriculture wanted the NAAS to help connect every farmer with the research institutes and also with his fellow farmers, stipulating that:

...this is a service for farmers provided by the Government: you don't even have to fill up a form to enjoy the benefits! The District Officer is the man you must get to know. He will pass on to you what he knows; and if he can't tell you himself he can call on experts in the different branches of husbandry and science to provide the answers to the problems that are troubling you.<sup>862</sup>

The NAAS personnel included specialist scientists for entomology, plant diseases, soil chemistry, animal nutrition and bacteriology as well as husbandry specialists for advice on farm crops, grassland, livestock, milk production, farm machinery, farm buildings and poultry. They also had horticultural specialists for glasshouse crops, fruit and vegetables.<sup>863</sup> Specialist Officers carried out investigations and analytical work for all farmers' concerns with soil quality, milk production and livestock products being just some of the subjects dealt with. The Soil Chemist analysed samples to guide the farmer on manuring and liming and the Nutrition Chemist analysed crops for feeding values and ration compounds. At Trawscoed, the Welsh headquarters for the Provincial staff, there were nearly 30,000 samples of soils and feeding stuffs analysed in 1953 and the number of advisory visits to farms during the year was between 60,000 and 70,000.<sup>864</sup> Although the NAAS worked closely with members of the NFU, local education authorities and with members of the NFYFC, it was considered that the service was successful in Wales largely because of the support and help from the CAECs especially the District Officers who knew the farmers and the local conditions well.<sup>865</sup> Research scientists were often accused of

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<sup>861</sup> Susan Foreman, *op.cit.*, p.50; Dunstan Skilbeck, 'Some thoughts on Agricultural Education', in J. Ashton and R. F. Lord, eds. *op. cit.*, p.69; PP 1946-47 (132-1), Third report from the Select Committee, p.lx.

<sup>862</sup> Ministry of Agriculture, 'Farming Signpost', No.32, December 1946.

<sup>863</sup> PP 1946-47 (132-1), *op. cit.*, p.lxi.

<sup>864</sup> D. Walter Davies, 'Agricultural Advisory Work in Wales', *JRWAS*, 1954, p.43.

<sup>865</sup> *Ibid.*, p.46.



being out of touch with the farming community and not familiar with the problems they encountered. As the complexity of science evolved it was a concern that the science was becoming so difficult it could not be understood by farmers and only by the specialist experts.<sup>866</sup> The combination of the roles of the advisory services and the district officers of the County Committees was significant in overcoming this dilemma.

An example of this service is seen in the Carmarthen Advisory reports where a sample of the soil at Blaencwm in Rhyd-cymerau was analysed and showed a deficiency of lime. The district advisory officer was able to discuss and make recommendations to the landowner on the use of phosphate, potash and nitrogen.<sup>867</sup> The advice from the NAAS given to the farmer was entirely impartial and the advisors did not promote commercial products or support policy laid down by the government. The responsibility was to advise the individual farmers rather than the official body that paid him.<sup>868</sup> In Wales some Local Education Authorities felt that following the formation of the NAAS their agricultural education staff had become divorced from the farming industry through lack of opportunity for contacts and that agricultural education could not be carried out effectively as they were confined to the principles of education only as any advice given could not conflict with the NAAS policy. Although there was encouragement by Mr D Walters Davies, the Provincial Director of the NAAS, for full co-operation between the NAAS and LEAs, staff shortages meant that the advisory officers could not meet all requests from the LEAs for assistance.<sup>869</sup>

The re-organisation of the Advisory service as the NAAS was considered by some to be a mistake as they thought that there were great advantages in having the service based

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<sup>866</sup> Sir E. John Russell, *A History of Agricultural Science in Great Britain, 1620-1954*, op.cit., p.482.

<sup>867</sup> TNA, MAF 180/8 letter and report to Mrs Ward from W .A. Maxwell, 17 and 22 January 1952.

<sup>868</sup> Sir John Winnifrith, 'The Advisory Services of the Ministry of Agriculture in England and Wales', op.cit., p.2; W. J. Thomas, 'Advisory Services and the Agricultural Community', op.cit., p.124.

<sup>869</sup> PA, PCC/ED/16/5 Note of Conference on Welsh Agricultural Education held at Aberystwyth on Thursday 16<sup>th</sup> November, 1950.

at institutions of learning and research where agricultural advice was ‘many-viewed and many-voiced’. Stapledon thought the NAAS suffered from a ‘monolithic rigidity’ and added:

A technique can only be proved efficient or even profitable by the farmer himself - nobody else can do it. An adviser cannot serve three masters: science, the farmer and the Government. The adviser’s job is to foster the right mental attitude to science. When we are young and know next to nothing, we are sent advising farmers: when we are experienced and able to give advice, we sit in London offices dictating policy which will reach the remotest country districts and have not the slightest application to their needs.<sup>870</sup>

The farmer and author A. G. Street also had reservations about the NAAS and commented that efficient farmers ignored and resented them and that ‘the duds toady to them in public, and try to dodge their instructions in private’, and he considered that the only farming supporters of them were the farmers who serve on them.<sup>871</sup>

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<sup>870</sup>Robert Waller, *op.cit.*, pp.55-56; W. J. Thomas, ‘Advisory Services and the Agricultural Community’, *op.cit.*, p.123.

<sup>871</sup> A. G. Street. *Feather-Bedding*, *op.cit.*, pp.34-35



*“When I want your advice, I’ll chain the dog up.”*

**Figure 30. Norman Thelwell Cartoon, Punch Magazine Cartoon Archive reproduced with permission of Punch Limited**

By the mid-1950s, the NAAS had a total of 1500 advisory officers serving 300,000 farmers. These advisors and about two hundred junior laboratory staff cost approximately £1.75 million in salaries with additional costs of £700,000 for experimental farms, laboratories and technical development work and £159,000 for industrial staff.<sup>872</sup> The Arton Wilson report highlighted the fact that the NAAS was criticised for a tendency towards over-specialisation and the range of subjects which any advisor could master and keep abreast of was reduced by the great scientific advances in agricultural knowledge. It suggested that the advisor should not try to ‘become a jack of all trades’ and neither should

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<sup>872</sup> PP 1955-56 (Cmd.9732), Report of the Committee appointed to review the Provincial and Local Organisation and Procedures of the Ministry of Agriculture, Fisheries and Food, p.24.

be ‘an agency through which the farmer obtains a consultant’.<sup>873</sup> However W. H. Jones of the Pembrokeshire Agricultural Executive acknowledged that the service was greatly appreciated and that the combination of scientific principles and sound farming methods was essential for maximising food production in the county.<sup>874</sup>

This chapter has shown that the two world wars brought farmers and scientists together. It illustrates how farmers responded to the needs of the county and how agricultural science helped them provide the food that was required. One of the vital features was how the CWAECs helped disseminate information and how the farmers utilised this information on their farms. The study has shown that against a background of labour shortages and sometimes fertiliser shortages there was a framework in place to comply with government policy. The research uncovered strong evidence of cooperation between technical advisors and farmers and a marked willingness to listen to the advice given. The science behind the plough-up campaigns supported the philosophy of the government by directing the best crops to be grown and the best methods to do so. Past studies have focussed on the general success of the plough up campaigns but this chapter has specifically considered the role that science and the farmer played.

Science and technology played a significant part in the first decade after the Second World War. Both arable and livestock farmers were helped by the science; better seeds, fertilisers, herbicides and pesticides improved crop quality and output and quality animal breeding systems, improved feeding stuffs and appropriate buildings assisted improved and increased livestock production. The benefits that farmers saw from the advancement of science to their industry was a cooperative process; farmers, landowners, scientific and

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<sup>873</sup> PP 1955-56 (Cmd.9732, op.cit., pp.31-32, at the time of this report there were seven classes of husbandry specialists and five types of science specialists – crop husbandry, grassland husbandry, farm machinery, livestock husbandry, milk production, poultry husbandry, horticulture, bacteriology, soil chemistry, nutrition chemistry, entomology, and plant pathology.

<sup>874</sup> W. H. Jones, ‘Farm Productivity in Pembrokeshire’, op.cit., p.378.

technical staff of universities and research centres all worked towards the same goal – the development of agriculture.

## CHAPTER ELEVEN: CONCLUSION

This thesis has demonstrated that agricultural science applied to farming provided the essential foundation for agricultural progress in the decades of this study. It has shown that by the beginning of the twentieth century a new style of farming was emerging; a more modern industry based on scientific theory and practice. Farmers were still in control as they chose what equipment, inputs, crops and breeding that they wanted to use and they merged the new methods of application with their traditional practices within the constraints of their land and labour.

The thesis has drawn on a wide range of sources including scientific journals of the time, detailed laboratory experiments from the WPBS documented in the *Welsh Journal of Agriculture*, and publications from the commercial organisations that developed new products to improve the land and animal welfare. While this study acknowledges the important contributions of previous histories about the economic, social, political and cultural experiences of Welsh agriculture, its use of new sources of evidence such as the experimental work of Stapledon, Fagan, Jenkin and Griffith adds an extra dimension to scholars' understanding of agricultural development in the first half of the twentieth century. The study shows why science mattered to the farmer and how farmers made use of science in their daily lives. The research has illuminated the subject of agricultural history in a different way and offers new insights of the existing ways of thinking. Many academic and professional journals present varied perspectives within scientific agriculture and they are often presented in abstruse language. This thesis has interpreted the findings of these articles and combined them with traditional primary and secondary sources of text in order to create a new interpretation of Welsh agricultural history. It has linked the work of the scientists and advisors to the practical application by the farmer and has provided a number of case studies that demonstrate successful interactions which resulted in an

increase in production. It therefore offers a new perspective in the modern history of Wales.

There is a vast diversity of sources available to historians and the interpretation they make allows for each partial history to build the bigger picture. Social historians have used a wide range of sources to analyse and interpret the social structure of farming and the farming community. This social history has been essential to understand how farmers lived and worked and has provided an excellent foundation to work from. Using primary sources such as diaries, government reports and oral testimony historians have illustrated the attitudes and social relationships within their farming community. The publications of Jenkins, Howell and Moore-Colyer did not totally ignore the use of agricultural science in Wales but their focus was mainly on the social structure of farming life and farming families. Each academic author has their own perspectives, views and positions. They present focused views of key issues and draw on ranges of sources to produce coherent arguments. Jenkins' interpretation of rural life focussed on the relationships between farmers and farm workers and gave clear insights to the understanding of farming practice. He did not write about technical progress in a positive way but more on how it caused a deterioration of community relationships. Similarly Howell's publications had a strong emphasis on the social relationships, labour organisation, and economic independence within the Welsh rural community. Although he acknowledged the development of machinery and new farming methods he considered Welsh farming practices remained backwards and farmers were disinclined or unable to adopt modern methods. Moore-Colyer's studies covered a wide range of social, cultural and technical aspects of agrarian development especially in the eighteenth and nineteenth centuries. Although he acknowledges the contribution of individual agricultural scientists in some publications this was not extended to the use of science on the farm.

This study has extended and expanded the history of Welsh agriculture and addressed the neglected theme of the relationship between agricultural science and farmers and the use of science on the farm. It has built on the published works of historians such as Morgan and Davies and broadened the discussion by adding to the diverse aspects of agriculture and food production. Whilst many published books and journal articles have focussed on the land, rural communities, rural politics and the social history of Wales, this thesis draws attention to the often-ignored contribution that science made in the development of the agricultural sector.

In agriculture, scientific progress can influence production output in two different ways: firstly it optimises the level of application of a given product to deliver the best yield and improve the price-cost benefit; and secondly it leads to the discovery of a new product or technique which, if adopted, leads to an improvement in yield and/or a reduction in cost. The findings of this study has demonstrated the use of science on the farm and how the various approaches and methods were utilised by the West Walian farmer in the first half of the twentieth century to improve his industry. The farmers demonstrated an understanding of how they could improve their industry by seeking help from the appropriate scientific discipline.

As mentioned in the introduction, Welsh farmers may have had a conservative reputation, but in fact their slowness to adopt the new scientific advances reflected the complexity of their profession. Scientific innovation in agriculture is not universal and local characteristics such as soil type and quality as well as climate and geology needed to be taken into account. The complexity of agriculture denotes that not every aspect of the farming process can be improved by scientific methods. However, the relationship between farmers and scientists allowed them to identify opportunities where science on the farm could help increase and improve agricultural output. Experimentation was important for farmers to evaluate a new technique or product and the results of trials together with



local knowledge and intuition allowed farmers to make rational decisions. When the new science was tested and trialled and was found to be inherently sound it was then accepted as routine on the farm. Each chapter and subject area of this study has demonstrated how agricultural science helped the farmer and how this applied science was translated into progress.

The findings of this study suggest livestock husbandry and breeding was significantly influenced by science. Farmers interested in animal breeding and genetics were primarily interested in improving characteristic like milk yields or fleece weights. The Livestock Improvement Scheme supported by the Development Commission and the Board of Agriculture enabled local societies and clubs to purchase well-bred sires for improving farm livestock and this progress and development gave the West Walian farmers an insight into the main principles of breeding and an introduction of artificial insemination. Evidence for improvement came from experiments into crossbreeding and selection as well as the science of nutrition and progress was clearly seen in the optimum production of stock.

One of the major agricultural successes in this period was how science in the dairy improved milk hygiene and purity and this study has shown how farmers adopted new methods for clean milk production to avoid bacterial contamination. Mechanisation brought together the mechanical principles and physiological processes; the well-being of the cow with design of the equipment. Farmers introduced steam sterilisation and refrigeration to comply with legislation and cooperated with the County Advisory Bacteriologists in the adoption of new methods. Dairy farmers in West Wales saw many changes from advances in agricultural science and technology and, as outlined in chapter three, went from milking twice a day to the fully automated dairy, changed from delivery rounds with churns and measures to delivering glass bottles and went from delivering urns to stations to having collections from creameries. Agricultural science was seen as a key

focus in helping farmers produce quality herds and the high number of Attested Herds in West Wales in the late 1940s gave a strong indication that disease-free stocks could provide the nucleus for the eradication of tuberculosis on a national scale.

This study has demonstrated that the practical use of plant breeding science and genetics allowed farmers to secure the advantages of improved yields, plant strength and crop quality with associated economic benefits. As demonstrated in chapter four, a wheat giving increased yields which could withstand local weather conditions was the product of scientific research solving economic problems. The new variety of wheat improved the finances of farmers and lessened the dependence on imports. Science enabled farmers to use new varieties that suited their local conditions. They were also able to use the scientific principles of crop rotation to keep their land free of toxins and impurities and this knowledge allowed farmers to introduce a change of crops hence diminishing the effects of the noxious residues. The introduction and growth of early potatoes demonstrated several key initiatives associated with agricultural science: the foresight of the Agricultural Organiser to set up trials to validate the growing of the new crop; the progressive farmers willing to have the variety trials on their farms; the dissemination of the trials' results to other farmers; the extension to co-operative seed potato supply; and the expansion of the acreage of the appropriate variety to produce a marketable potato crop as early in the season as possible for the economic benefit of the county. This exemplary model of the application of science resulted in an almost five-fold increase in acreage of potato production in Pembrokeshire in the time period of this study and illustrated how individual leadership, research and advice produced a valuable commodity.

The scientific research into the quality and feeding values of grasses and clovers and the methods of conservation led to higher productivity farming with economic benefits. The farmers of West Wales were supported by research and results from the University at Aberystwyth and from the WPBS and grassland conditions in Wales

improved rapidly. Quantitative results from agricultural scientists gave farmers the information they required to improve their land and feed their stock. The relationships between the scientist and the farmer had mutual benefit.

Soil research has been shown to have been a fundamental application of agricultural science and farmers used the knowledge of the physical, chemical and biological processes to know the quality of the soil's constitution and nutritional value to correct any deficiencies and inferior qualities on his land. The evidence demonstrated that the use of fertilisers available allowed the farmers to maximise outputs and tailor the type of fertiliser and quantity needed for the choice of crop to be grown. The Advisory Service was invaluable to farmers as they could have their soils analysed and have remedial advice for the crops they wished to produce. As chemical and mechanical innovations are location specific and are dependent on the environment, each type of soil requires a specific combination of nutrients therefore the analysis took the guess work out of the amount of fertiliser to use and often there were cost savings to the farmer.

The evidence of this study showed that farmers took a lead from authorities that they trusted. This study has shown that the scientists from the University of Aberystwyth and from the WPBS were recognised as helping farmers by sharing experimental information and transferring new ideas to their local conditions. As mentioned throughout, Sir Reginald George Stapledon was a leading agricultural scientist who took an exceptional interest in grassland quality and helping farmers to grow the best grass within local conditions. His work with the WPBS influenced the art, science and principles of grassland management throughout the world and under his leadership the station became the most prestigious research establishment for grassland and plant breeding studies. His pioneering work of the Cahn Hill Improvement Scheme saw him convert minor experiments to improve the uplands of Cardiganshire into a large-scale practical project in

Cwm Ystwyth. His research inspired both agricultural scientists and farmers and his publications were well received.

The importance of agricultural scientific research is only of value to farmers if they understand what it is and how its benefits can be experienced on their farm. Therefore the dissemination of new technical knowledge was crucial for science to be a success. The diffusion of scientific information to farmers has been shown within this study to come from formal and informal routes. The thesis rejects the view of Calder that farmers ignored education and scientific findings, and instead argues that they were able to assimilate these in a manner that suited their own lifestyle and routine. The evidence collected proves that the flow of information between farmers and scientists was two-way, and that both parties had mutual appreciation of their respective strengths: the farmer gained new information from the scientist and the scientist reciprocally gained important local knowledge from the farmer. Where appropriate, the County Organiser used the new knowledge gained to ensure that the information was distributed to a wider agricultural community.

There were many experiments and trials of new crops by the progressive farmers of Pembrokeshire in the decades of this study. The Agricultural Organiser was influential in coordinating trials and experiments and disseminating the necessary information. He was also responsible for delivering the county organised and advisory support and had a pivotal role coordinating advisors, farmers and the Agricultural Executive Committee. This role was central to the successful transfer of knowledge to farmers and the training of students. There was a focus on lecture schedules, agricultural demonstrations, university and college scholarships and government initiatives. As demonstrated in chapter eight, the Agricultural Organiser had the support of progressive farmers in the county and the relationships formed enabled the well-executed experimental work to be efficiently shared

amongst farmers who not only trusted the results but had the confidence to adopt the new technology or products on their farms.

Agricultural advisors gave farmers the help needed to improve and change conditions on their farms which included advising new methods, new tools, varieties or breeds, and other inputs. Whilst supplying information they also encouraged education. It can be argued that the informal, non-institutional education of the farmer in Pembrokeshire had a much greater effect than any formal or institutional organised education. Although there were many university and college lecturers having the dual role of advising farmers it has been demonstrated that the advisory service, agricultural shows and clubs and agricultural newspapers gave farmers a more appropriate and relevant education - an education based on practical use and not theoretical instruction which had little value on the farm or in the geographical region.

Historians such as Dewey and Short studying agriculture during the wars tend to focus on the social interactions of officials and farmers. This study has shown that farmers relied on agricultural science to help in the First and Second World wars by using the technical advice to purchase the best fertilisers and seeds and managing their land to produce the maximum food for the country. The wars were seen to bring the full force of chemists, botanists, zoologists, entomologists, economists and engineers to help farmers meet the challenge of food production. The plough-up campaigns were supported by farmers, with some exceptions, but on the whole were successful especially in the Second World War having built on the experience of the First World War. The ploughing was justified for producing human food and feeding stuffs for stock to replace annual imports. The impact on the farming landscape was substantial and although the WAECs were criticised by some for impartiality and heavy handed behaviour, there is ample evidence that farmers were seen to cooperate and to use the science and technology available to them for the country's food supply. This application of agricultural science was seen not

only to change farming but to change farmers too. The evidence clearly demonstrates that the collaboration of the Committees and the farmers functioned effectively as a mechanism for increasing food production.

The central theme of this thesis has been to demonstrate that agricultural science and its application to farming provided the essential footing to agricultural progress in the first half of the twentieth century. The study has shown that the use of agricultural science has progressed from the enthusiastic pioneers and innovative landlords through to the established agricultural colleges and demonstration farms supported by progressive farmers. Science was then passed on to the advisors and leading practical farmers who took the science into their local conditions to trial, modify or even reject as appropriate for their needs. Innovation was seen as not being of universal economic application as it required adjustment to fit the soil and climate. The complex nature of agriculture and the traditional conservatism of Welsh farmers did not inhibit progress and this study has shown that farmers were confident in their use of the new science in an acceptable time frame for their needs.

The wide range of primary and secondary sources reviewed within this study have supplied valuable evidence that science transformed agriculture from an occupation governed only by custom and tradition to one that supports a more efficient and productive industry. Although science has played a major role in agricultural development it would be wrong to assume that the farmer became a scientist, as farming is too complex a process to be entirely scientifically run. However, a combination of traditional practices and new scientific approaches brought a new perspective and perhaps can be seen as a way of preserving the artistry of farming without hindering progress. Farming in the first half of the twentieth century was founded on scientific principles with the accumulated experience of generations of practical men. The continuous improvement in the efficiency of farm production was the product of the application of the results of scientific research and

technology transfer; it was achieved through better husbandry and the adoption of new technical and scientific advances.

By examining the problems within agriculture that were improved by science and technology it has been shown that two themes emerge: how farmers acquired the new knowledge to better their industry and how they used the new knowledge to change and improve their farming conditions. This research offers a new focus in the historiography of agricultural development by demonstrating that farmers became involved in scientific farming when they were given sufficient incentive to do so, thus dispelling the prevailing belief that farmers were suspicious of change and resentful of science.

The analysis has clearly shown the role science played within agricultural development and this study has provided a new qualitative and quantitative description of farmers' experiences in West Wales in the time period. There are few investigative studies on how farmers responded to the emerging agricultural science elsewhere in the UK or Europe and future research in this area could show interesting contrasts, similarities or divergences. The methodological approach used to analyse West Walian agriculture in this thesis could easily be applied to allow comparisons of attitudes, improvements and methods of scientific application on a wider geographical scale.

This thesis has provided an original view of farming in West Wales and has shown that the intelligent use of agricultural science made a positive impact on the farming industry and is a significant and valuable addition within the parameters of agricultural improvement. It presents a new interpretation of historical sources and illustrates new insights of farmers' experiences. The function and purpose of science mattered to farmers and this study stands alongside the social, economic and geographical investigations within the overall study of Welsh agriculture. This study has clearly shown that agricultural science contributed to agricultural development in West Wales. The effective

collaborations and cooperation between scientists, advisors and farmers resulted in improved conditions and production. Farmers played a crucial role in these collaborations – they identified the problems, they undertook experimentation to look for solutions, and subsequently increased production for consumers. Farmers used the new science to advance and expand their industry by producing healthy crops and well-grown livestock for economic success – they developed their farms by putting science into practice.



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Mrs Glenys Harries, retired farmer and founder member of Young Farmers' Club, St Nicholas and member of Young Farmers' Club, Croes Goch.

Mr Charles Edward (Eddie) Tamplin, retired farmer, Rhudry, Cardiff.

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## APPENDICES

### Appendix 1

#### University Degree Courses September 1939

University	Degree Courses
Cambridge	Three-year courses leading to pass degrees in agriculture and estate management
Durham	Four-year courses leading to the degree of B.Sc.(with honours) in agriculture. Three-year courses leading to a pass degree of B.Sc.
Leeds	Four-year courses leading to the degree of B.Sc. (with honours) in a) agriculture, b) agricultural chemistry, c) agricultural botany and bacteriology, d) agricultural zoology, and e) agricultural economics Three-year courses leading to a pass degree of B.Sc. in agriculture
London	Three-year courses leading to a pass degree of B.Sc. (agriculture), B.Sc. (horticulture), and B.Sc. (estate management)
Oxford	Three years' honours School in agriculture Three years' pass School in estate management
Reading	Three-year courses leading to pass degrees in agriculture, horticulture and dairying. Four-year courses leading to honours degrees in agricultural chemistry and agricultural botany
<b>University of Wales;</b> <b>a)Aberystwyth</b>	<b>Three-year course leading to a pass degree in agriculture.</b> <b>Four-year course leading to honour degrees in agriculture, chemistry (with agricultural chemistry), agricultural botany, agricultural economics, zoology (including agricultural zoology).</b>
<b>b) Bangor</b>	<b>Three-year courses leading to pass degrees in agriculture, agricultural botany and agricultural chemistry.</b> <b>Four-year courses leading to honours degrees in agriculture, agricultural chemistry, agricultural botany, agricultural zoology and agricultural economics.</b> <b>Three-year course leading to a pass degree in forestry.</b>

*Source: PP 1942-43 (Cmd.6433), Report of the Committee on Post-War Agricultural Education in England and Wales, p.21*

## Appendix 2

### University Diploma Courses September 1939

University	Diploma Courses
Cambridge	<p style="text-align: center;">a) Graduate Diplomas</p> <p>One-year course leading to a graduate diploma which may be obtained in one of a number of specialised branches of agricultural science. This course open only to graduates in agriculture or graduates in science who present evidence of a knowledge of agriculture.</p>
Oxford	<p>One-year course leading to the diploma in rural economy which may be taken in one of three selected subjects; agricultural economics, agricultural engineering and statistical method. Open to holders of a university degree or an approved diploma</p>
Durham (King's College, Newcastle)	<p style="text-align: center;">b) Initial Diplomas</p> <p>A three-year course of two terms each (Oct-March) leading to the college diplomas in agriculture</p>
Leeds	<p>A course consisting to one full year and two years of two terms each leading to the university diploma in agriculture</p>
Reading	<p>Two-year courses leading to university diplomas in agriculture, horticulture and dairying</p>
<b>University of Wales</b> <b>a) Aberystwyth</b>	<p><b>A three-year course of two terms each leading to the university diploma in agriculture.</b>  <b>A two-year course of three terms each leading to the college diploma in dairying</b></p>
<b>b) Bangor</b>	<p><b>Three-year courses of two terms each leading to the university diploma in agriculture and the college diploma in estate management</b></p>

*Source: PP 1942-43 (Cmd.6433), Report of the Committee on Post-War Agricultural Education in England and Wales, p.22*

## Appendix 3

### Number of Students in Farm Institutes in England and Wales in 1938/39

Name of Institute	Date of Establishment	Number of Students in 1938/39
<b>England</b>		
Essex Institute of Agriculture	1893	105
Newton Rigg Farm School	1896	18
County Council Farm School, Hutton	1896	66
Hampshire Farm Institute	1899	45
Rodbaston Farm Institute	1919	26
Chadacre Agricultural Institute	1919	47
Cheshire School of Agriculture	1921	66
Hertfordshire Institute of Agriculture	1921	80
Somersetshire Farm Institute	1921	53
Northamptonshire Institute of Agriculture	1921	38
East Sussex School of Agriculture	1926	44
Kent Farm Institute	1929	40
Durham County School of Agriculture	1938	62
Yorkshire Farm Institute	1939	-
<b>Wales</b>		
<b>Madryn Castle Farm School</b>	<b>1914</b>	<b>20</b>
<b>Llysfasi Farm Institute</b>	<b>1920</b>	<b>33</b>
<b>Monmouthshire Institute of Agriculture</b>	<b>1923</b>	<b>57</b>
<b>Pibwrlwyd Farm Institute</b>	<b>1926</b>	<b>21</b>

*Source: PP 1942-43 (Cmd.6433), Report of the Committee on Post-War Agricultural Education in England and Wales, p.19*

## Appendix 4

### Number of Students attending Classes, Correspondence Courses, Lectures and Demonstrations in 1938/9

	1938/9
<b><i>Organised day courses:</i></b>	
Number of Courses .....	412
Number of Students .....	3,940
<b><i>Evening Classes:</i></b>	
Number of Courses .....	690
Number of Students .....	13,101
<b><i>Correspondence Courses</i></b>	
Number of Courses .....	5
Number of Students .....	62
<b><i>Instruction in manual processes</i></b>	
Number of Courses .....	197
Number of Students .....	1,631
<b><i>Lectures and Demonstrations</i></b>	
Number of meetings .....	9,147

Source: PP 1943 (Cmd.6433), Report of the Committee on Post-War Agricultural Education in England and Wales, p.28