



Australian Nuffield Farming Scholars Association

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Report of Study Tour to the United Kingdom and Europe

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1990 Western Australian
Nuffield Scholar

Subject: Soil Conservation, Straw Pulping and Wool.

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1. Acknowledgements

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2. Introduction

There is no doubt that the whole world is in a state of flux, both economically and politically, and this situation has, and will continue to have, an enormous impact on agriculture. On top of this we see the growing prominence of the "green" movement, another of the mass movements, over these last few decades, with considerable influence over the policy makers.

Whilst I was aware of these aspects before embarking for Europe, their impact became far more apparent once there, and the farmer, always subject to the vagaries of climate and markets, is likely to find himself in an increasingly volatile situation in the decades ahead.

The momentous nature of current world events and their potential impact on Australian agriculture was perhaps the strongest impression of my trip and will be expanded upon.

Otherwise the major purpose of my trip was to study aspects of soil conservation. I also took the opportunity to visit the SAICA straw pulping mill at Zaragosa in Spain, of particular interest with the possible construction of a plant using this process in my home town. Also of great interest, because of the dramatic events taking place in the wool industry were my visits to a large wool combing mill in Germany and a number of mills in the U.K.

The following are the impressions I gained during my Nuffield Scholarship, February to August, 1990.

3. The Changing World

If, just 12 months ago, one had suggested that we would have a united Germany today, you would have been laughed at. If at the same time you were out warning that the Australian wool industry was in imminent danger of collapse, few would have taken you seriously.

These two instances demonstrate the volatile nature of the world political and economic scene and the consequences for the primary producer.

1990 was a particularly interesting time to be in Europe with the events taking place in eastern Europe and Russia and the inclusion for the first time, of a Russian Nuffield Scholar was a great bonus for the other five overseas scholars as it provided, during the six weeks that we were together, some insight into the events in that country.

3.1 Eastern Europe

Everywhere in Europe that I travelled the events in the eastern bloc were a popular topic. Where was it all leading and what were the implications?

The changes taking place have the potential for considerable, if not dramatic, impact on Australian agriculture. It would be a brave man however who could predict when, if or how.

Within 8 or 9 months of the Berlin Wall being torn down, we have the political union of the two Germanys. Throughout eastern Europe there has been a decline in the influence of the USSR and, within that nation itself, a remarkable easing of the stringent controls over its population. Reportedly the USSR is moving towards a "market economy".

What seems likely is that East Germany, in a state of economic chaos, with aid of the efficient West German

economic machine, will develop rapidly and will eventually enhance substantially the total German economic and political force. The rest of Eastern Europe is less certain as to when and how fast it will change.

There are however a few factors that should be considered in assessing the future rate of development.

The first is that, as with East Germany, other East European countries are politically and economically in an appalling state. If they are to move to a western style government and economy they have an enormous task ahead to develop the infrastructure, know-how, political and economic institutions, and even trust, to make the system work. For most there is a new generation that has never experienced the freedom of the free enterprise approach to business.

I had a number of discussions with people experienced in agriculture who have visited the USSR and other Eastern bloc nations and invariably they had stories of gross mismanagement or incompetence. I spoke to the head of Research and Development at the Soil Survey and Land Research Centre at Silsoe in England and he related a recent visit to Rumania to advise on a large irrigation project. To his dismay he found that the results they were achieving were well below the potential of dry land agriculture. The stories in the USSR are similar.

It has been estimated that the wastage of grain in the USSR each year through poor storage or incompetence is 10 million tonnes. This represents a large proportion of the Australian export tonnage.

The second factor is, that whilst there have been dramatic changes taking place in the eastern bloc, a quick reflection will demonstrate that the media's track record in presenting an accurate picture of events in these communist countries over the last half century has been poor indeed. As one commentator pointed out, a few heads have rolled, but in most cases the same political hierarchies remain - and leopards don't usually change their spots. It would appear that the pressure of events has forced the leaders to liberalise the communist system, however only time will tell if this process is to continue. Events in China should remind us of this.

With the exception of East Germany, I don't believe we will see dramatic improvements in the Eastern bloc's agricultural production in the short term unless they receive substantial assistance from the West.

On this point I see an intriguing contradiction. The Eastern bloc nations have enormous potential for agricultural production and there is a growing band of entrepreneurs looking for the opportunities that this openness presents in developing these nations.

If they succeed over the next 20 years, and instead of being nett importers these nations join the ranks of those contributing to the grain and food mountains, where does that leave us? Bigger surpluses, further "trade wars"?

3.2 The Expanding EEC

In a monthly newsletter put out by the Commission of the European Communities, the President, Jacques Delors of France writes: "We can go on to consider the question of governing Europe in the full sense of the term; what organisation of powers, at European level, could usefully contribute to the attainment of our common objective?"

"The objective is political. It is European Union as defined by the founding fathers of the Community and solemnly reaffirmed in the preamble to the Single Act. And, in a sense, by designating a frontier-free economic and social area as the ultimate goal in 1992, the Single Act has laid one of the foundation stones of the future political entity..."

If they succeed in establishing this political union of the nations of Europe, and then, as is now being openly discussed, some of the nations of eastern Europe are also admitted, what is already the world's most powerful economic bloc, will become mighty indeed.

Australia, already suffering as a consequence of the Common Agricultural Policy may find even more markets cut off from her.

This, along with the political uncertainties worldwide, and the social and economic consequences of the AIDS virus that is taking on frightening proportions in some third nations, the one thing that is certain about the decades ahead is its uncertainty and volatility.

As stated at the outset, the Australian farmer may find that the problems of fire, flood and famine are the least of his worries as he faces what undoubtedly will be a volatile conclusion to this century and a doubtful start to the next.

4. The European Economic Community

For the six overseas Nuffield Scholars our introduction to the European Economic Community involved two parts. The first was a two day briefing on the Common Agricultural Policy at Wye College in Kent. This was followed by an hectic two day visit to Brussels with briefings at the Commission.

I will restrict my comments on the EEC to a few perceptions that may be of relevance at the present time, rather than a lengthy elaboration on EEC policies which, to fully grasp, would have required a more detailed study than ours.

The first perception, and to me perhaps the most surprising, was the emphasis now placed on environmental issues by Brussels. We were informed that up until two years ago the emphasis was still placed on increasing production, or in a word - INTENSIFICATION. The new buzz word is EXTENSIFICATION - the opposite to intensification, and a policy being developed in response to "green" politics and the perceived environmental problems and threats. The aim is to reduce agricultural inputs that are environmentally damaging with the consequence of reduced output.

There is no doubt that Europe has considerable environmental problems, particularly the pollution of water as a consequence of agricultural practice. As a consequence this new policy aims at restructuring the use of fertiliser and even the number of cows per hectare that can be grazed, or the muck there from that can be spread, in an endeavour to reduce pollution.

■ In relative terms the prices received by farmers have been declining and under measures designed to restrict production (such as Maximum Guaranteed Quality scheme, (MGO) prices could well continue to decline. From superficial observations it would appear that farmers are already

under financial pressure. It is however recognised that there is considerable social and economic cost if there is a drift of population from country to city and within the EEC agricultural budget they are endeavouring to switch the emphasis from price support of commodities to income aids for farmers to achieve a reduction in production whilst maintaining farm viability.

It seems to me likely that farmers will continue to receive, in one form or another, a high level of support and that this will continue to have an impact on exporting nations.

The Common Agricultural Policy has spawned a vast array of measures to compensate, promote, stabilise and achieve an incredible array of economic, social and "green" objectives which at times seem to work against each other. Whilst they appear to be endeavouring to reduce the complexity of it, growing world economic problems, overproduction and pollution have placed before the bureaucrats in Brussels a growing demand for new policies to confront these issues.

With the inclusion of some of the poorer nations of Europe (Portugal and Greece) and the suggestion now that east European nations be included, a number of people fear that in an endeavour to bridge the differences economically (let alone politically) between these nations, the EEC will become (if it is not already) a bureaucratic nightmare, that will fuel discontent between member states. As one cynic suggested to me - "we are witnessing the collapse of one highly centralised economy in the USSR, why are we hell bent on creating another".

5. Spain

5.1 The Merino Industry

I visited Spain with a friend and merino stud breeder from Western Australia, our first stop being Sevilla in the south. We travelled a considerable distance by car and were struck by the similarity of the countryside to parts of Australia. In June the landscape was taking on the harsh dry look so typical of Australia and there were a number of places where we could well have been back home. It was not difficult to see why the hardy characteristics of the merino were still utilised in this landscape as the base to many flocks.

It was particularly interesting to visit a number of properties running merino sheep, distant relations to the Australian Merino, including what was considered to be perhaps the oldest merino stud in Spain.

The Spanish merino today is however a very poor relative to his Australian cousin in terms of wool. The sheep we saw, and we were reliably informed that this was the norm, had a staple length of 50 mm out 2 to 2.5 kg and with a yield of about 55%.

There seemed to be very little interest in improving the performance of these sheep in terms of wool and the reason is not difficult to see. There is only one price for wool in Spain, regardless of quality, and the wool is placed in 60 kg bags without any on farm preparation. In 1989 the price was in the vicinity of \$8.20 (Aust) and for 1990 \$1.40. As with most sheep in Europe, the wool is considered almost as a nuisance factor.

The money is in lamb, production and lamb dressing out at 10-12 kg brings \$70-\$100 (Aust). depending on the time of the year. The incentive is obvious.

We visited one particularly interesting property at Guadalcanal managed by Juan Cerrato. This farm of 7,000 ha was running 17,000 ewes, 2,200 of which were merinos and the balance being Rominoffs, Chamaus and various crosses with the merino. With the incentive to turn off lambs, they were mating 3 times in 2 years with an overall lambing percentage well over 200% per ewe per year (note: this based on 3 matings in 2 years, figure for each lambing would be less). His pure merino flock is giving a lambing of 112%, or 170% per ewe per year.

Whilst most lambs are weaned at one month, shedded and put on supplements, they are also experimenting with weaning at 1 day. These lambs are put under lamps, when necessary, for warmth, as with chickens. They are fed with an automatic lamb feeder, each machine capable of feeding 600 lambs and mixing, on demand, 1 litre of milk each 20 seconds. The cost of feeding these lambs for the first 50 days to achieve a 13 kg weight is in the order of A\$30. The lambs are then taken for another 40 days on a hay and grain supplement to produce the lean lamb that is the requirement of the Spanish market. Their incentive, and aim to produce more lambs per year from their ewes.

5.2 Paper Pulp from Straw

Whilst in Spain I visited S.A. Industries Cellulosa Aragonesa (SAICA) at Zaragoza, a straw pulping and paper mill. My interest stems from a proposal to build a mill using this straw pulping process at Moora in Western Australia, my local town, and the implications and opportunities this presents to farmers in the area. But first a little background:

The world consumption of paper is currently running at 235 (???) million tons per annum and increasing at a rate of some 10 million tons a year. The figures below give an indication of consumption of paper and trends in a few nations.

Country	Consumption/Head/.a.	Annual Increase
Japan	210 kg(?)	9%(?)
Australia	180 kg(?)	2%(?)
Indonesia	5 kg(?)	20%(?)
Korea	_____	30%(?)

Eastern Europe, now at a low consumption base, may well have a considerable increase if the current liberalisation trends continue. Much of the third world also has very low consumption figures and development brings with it an increasing demand for paper.

The world therefore has an expanding demand for paper that is predominantly satisfied by timber as a raw material. At the present rate of increase it necessitates the construction of something like 22 new pulp mills, each year worldwide, the size of the large Wesley Vale mill that was proposed for northern Tasmania. The prospects of achieving such an expansion of pulping capacity from timber are rapidly

diminishing, particularly as a consequence of the environmental lobby in targeting this industry.

One alternative to meet this growing demand is to recycle paper. The limitations on this however are that not all paper can be recycled and the number of times it can be recycled is limited. Therefore, the initial useable quantity diminishes with time.

Another alternative is to use cereal straw as a raw material for pulping.

5.3 The S.A.I.C.A. Pulp Mill

Founded in 1942, the S.A.I.C.A. plant at Zaragoza is an integrated pulp and paper mill producing 300,000 tonnes/annum of corrugating medium for packaging containers. For a daily output of some 1300 tonnes of finished product, 1000 tonnes of wastepaper and 400-500 tonnes of straw are required at the plant which is within the city boundaries.

Their waste treatment plant produces biogas which supplement the energy requirements for the operation and it would appear that the plant, originally outside the city limits, presents no environmental or odour problems as it is now bordered by a multi-storey housing estate. The only perceptible smell during our visit was one familiar to most farmers - that of hay.

5.4 Straw Collection

My main interest however was to look at the straw gathering operation of the mill and its relevance to the Australian situation.

In Aragon, the province surrounding Zaragoza, yields in 1989 were 3.4t/ha for grain and 1.5t/ha for straw, whilst in nearby Burgos province they were 7t/ha and 3t/ha respectively. The normal rotation is to have a ley every second year with the typical rotation of wheat, ley, wheat, ley, barley, ley, barley, ley.

The country we saw was not carrying any stock, and was certainly not fenced, so stubble was not utilised for stock as it is in Australia. When harvesting, as is the norm in Europe, the comb is set very close to the ground and particularly where the straw is to be baled, straw spreaders are not used, leaving the straw in a windrow easily collected by a baler.

The following chart gives a breakdown of those baling straw for the mill in 1989/90.

Tonnage	No. of Providers	Percentage	
Individual	(Under 100t)	38	22.5%
Farmers	(101 - 500t)	71	42%
Contractors	(501-1000t)	21	12.5%
	(1001-3000t)	24	14%
	(3001-8000t)	11	6.5%
	(8001 + t)	4	2%

90% of the straw is delivered to the mill in small rectangular bales with the balance between round and large rectangular bales. Because of its low weight/volume ratio, straw is expensive to transport and the round bales are least preferred because of their inefficiency in transport. The large rectangular bales are rapidly gaining popularity.

Once baled, the straw is usually stacked in dumps in the paddock to await transport to the pulp mill. 37% of the straw is carted to the mill in S.A.I.C.A.'S own trucks with the balance being delivered by carters on contract.

For the 1989/90 season average prices (A\$1 = 73 psts) were:

	A\$ Per Tonne
Straw delivered factory gate	\$79
Straw Ex farm	\$50 - 52
Straw in paddock, baled but not picked up.	\$37 - \$38
Transport cost to factory	\$20 - \$30

5.5 Conclusions

From what I say the straw collecting operation is quite simple and utilises existing hay-handling machinery. The major difference in Spain from current practice in Australia is that they usually harvest close to the ground and it is therefore a simple matter to leave straw in a windrow ready for baling. Generally in Australia we take as little straw as possible through the machine to increase performance and the stubble is then grazed.

This leaves two options for the Australian farmer wishing to deliver straw. First he can lower his comb, reducing his harvesting efficiency and increasing his harvest costs. The second is to rake the straw at some later date, perhaps after grazing, and then bale it - a practice already in use in Australia.

In view of the growing demand for paper and the diminishing availability of timber, it would seem that there is considerable potential for the development of paper pulping mills using straw as the fibre source, not only in Australia but worldwide.

Objections to such an industry on the grounds that this organic material should be returned to the soil has some validity but must be examined in the wider context of soil management. It is common practice to burn stubbles to prepare for the following year's cropping - collecting a suitable proportion to facilitate an unobstructed seeding operation may be a better alternative. The farmer however is not obliged to deliver straw and ultimately the conscientious farmer is the person best placed to make decisions regarding the welfare of his soil.

6. Wool

Whilst in Europe I was interested to learn more about the wool industry from the manufacturing end and learn of any trends that may be apparent. As it happened my time there coincided with the dramatic events in the Australian wool industry leading to the reduction in the floor price

from 870c to 700c in June 1990 and as my visit to one mill coincided with the dropping of the floor price it presented me with an ideal opportunity to assess and understand the reaction by the trade to that event. As I write, the situation in our industry has gone from bad to worse, and there is no doubt that the slump in demand that continues in late 1990 can in some degree be attributed to that decision. It is vital that we understand these reasons so that the mistakes that have been made are not repeated in the future.

My visits started with the International Wool Secretariat and the Australian Wool Corporation office at Ilkley in England. I visited a spinner, Thomas Ambler & Sons, and the Kirkheaton Mills, manufacturers of some of the finest worsted cloths in the world, both located in the Bradford area. Then to spinners Laidlaw & Fairgrieve at Selkirk in Scotland and finally to Bremer Wool-Kammerei Ag (BWK) at Bremen in Germany, one of the largest combing mills in the world, processing some 5% of the wool produced in the southern hemisphere.

6.1 IWS

I had an interesting afternoon at the IWS Development Centre and was given an extensive tour of that establishment which employs some 300 people. The IWS operations range from devising marketing strategies and the promotion of wool, through research and development to the policing of the wool mark.

However, their own brochure states - "IWS exists to increase demand for wool.... worldwide". During my visit they gave me figures of approximate market share as, wool - 4% cotton - 46% and other, mainly synthetics - 50%. Wool's share has dropped by half over the last 20 years. Someone needs to explain to the desperate Australian woolgrower why the returns on his investment in wool promotion appear to be so poor.

6.2 Fashion

Predicting trends in fashion is particularly difficult at any time, with resultant impact on demand. However whilst there was some hesitancy to commit themselves, most people in the industry that I spoke to saw the finer wools maintaining their popularity.

One of the reasons for this is not hard to see whilst travelling in Europe. Most offices and homes are centrally heated and people commute in heated cars, trains or busses. As a consequence they dress as we might in Australia - light clothes for comfort. If and when they brave the elements on the way to work or elsewhere, they wear a heavy coat which is removed on arrival. It was left to the hapless Nuffield Scholars, dressed to withstand blizzards, to swelter in centrally heated lecture rooms.

One comment from the mills, which I believe is now being redressed, was that more promotion should be placed on the wools that are proving difficult to sell rather than in the finer, high fashion end of the market which is already consuming most of the wool produced.

6.3 Responding to Demand

A tour of any mill soon convinces the woolgrower that he is part of a truly amazing industry. Not only is the scope, diversity and complexity of the Australian wool growing

industry an epic story on its own, but the marketing, manufacturing and fashions side of this industry combines to make it one of the more remarkable industries in the world.

One of the disadvantages of such a long, tortuous and labour intensive pipeline (up to 18 months from sheep to shop) is the time it takes for reactions to market signals. There is no doubt that wool is an outstanding fibre, but there are now alternatives to wool where once there was not. The wool grower must respond to the demands of the market place and not assume that producing wool is an end in itself and, that regardless of what he produces, there will be a consumer.

6.4 Contamination

The mills I visited confirmed that Australia is the world leader in clip preparation standards ("South Africa good but South America a disaster") and that contamination represents a considerable problem with perhaps 70% of this as a result of packaging material, with rehandled wools one of the main areas where this is happening. For this reason one mill stated that they avoided these wools because of the risks involved.

6.5 Dropping the Floor Price

As previously stated my visits spanned the period before and after the dropping of the floor price from 870 to 700c in June 1990. I was therefore well placed to witness reaction within this section of the industry to this action.

The consequence of the reduction was that stocks held by processors were immediately devalued by 20%. The reason for this is that most mills are only involved in one section of the wool processing chain and as a consequence need to sell to the next stage. The scourer will sell to a combler, he to a spinner, and then to a weaver etc. At any stage however each is aware of the base price of wool and, as a consequence, of any market movements. At the moment of the reduction of the floor price, mills throughout the processing pipeline ceased purchasing at the higher price level in anticipation of the lower levels, effectively devaluing all stocks in the pipeline. Because of the highly competitive nature of the industry, it appeared from my discussions that margins were tight and many mills were already under financial pressure.

It is known that as a consequence of the large losses incurred resulting from the drop in the floor price, a number of mills in Europe and Britain ceased business and others are in difficulty.

It is however difficult to imagine that the processors were taken completely by surprise by this drop, particularly in view of the debate leading to the decision taken by the Minister, Mr Kerin.

Perhaps one of the most important aspects of any business is to know the rules under which you operate. If the rules are known, and fixed, regardless of the obstacles and the uncertainties of markets, you can assess your risk and trade within those known parameters. We told the world, rightly or wrongly, that the rules for those wishing to purchase our wool included a reserve price scheme and that was the bottom line.

Having already sustained considerable losses, and with the continued low levels of clearance and industry uncertainty, it is little wonder that the trade is reluctant to take the word of an industry that has already changed the rules once this year.

I believe that the processors reluctance to buy is not primarily a desire to stick it out in anticipation of cheaper wool, but rather a desperate need to avoid any further losses that would result from another devaluation of their stocks. It is a self perpetuating disaster - low clearance of wool at auction add to the stockpile, maintained by a high wool tax that has become no more than a debt servicing levy on a burgeoning debt, that must in the eyes of the trade, at least those who can do their sums, add up to the prospect of more turmoil and change.

The trade is now resorting to the wools from New Zealand, South Africa and South America, as opposed to their preferred supplier Australia, and it is understandable in the light of the factors stated. Having sustained considerable losses already, they are operating from hand to mouth, and like all businesses trying to reduce the impact of a loss, they are trying to cut costs by purchasing cheaper wools from these countries sheltering under the Australian Reserve Price Scheme.

Ironically, the impression I received was the processors did not consider the price of wool was too high, especially after the heady prices of the previous few years. In fact all sections of the trade would be happy to see maintenance of the price at higher rather than lower prices as it spells more incentive and potential profit.

The situation is complex and likely to cause great pain and disruption whichever way the industry goes. It seems obvious however that the industry has failed dismally over recent months to provide the trade with the one thing that is essential for it to operate with confidence - a concrete set of rules. Perhaps the only option remaining that would provide them with that certainty is to remove the reserve price scheme.

The implications of removing the RPS could be that a number of processors may go out of business with no certainty of being replaced. A further reduction of processing capacity would naturally exacerbate the industry's dilemma and some scheme to reduce the impact of such a decision on the mills would have to be considered if the impact is to be minimised.

The disastrous situation facing the wool industry should surely teach us many lessons. Whilst few over the years have knocked the benefits of having a floor price for wool - least of all the farmer who faces all too many risks in agriculture before his produce gets to the market place - it must now be obvious that when anyone undertakes the responsibility of dictating to the market price levels, they set artificial rules around which the whole market naturally develops, and to which the producer performs. Misjudgments can have disastrous consequences for both the producer and consumer.

7. Soil Conservation

The basis and starting point of all soil and it is, and always has been, the farmer's primary asset. There is little doubt that in Australia we suffer from varying degrees of soil

mismanagement and as a consequence soil degradation - from mild to frightening degrees of soil erosion.

In his introduction to a paper titled Soil Manipulation, Professor R.J. Godwin of Silsoe College in England writes:

"The principal aim of soil manipulation is to improve the soil structure which will in turn improve crop development by improving the rooting environment. This is achieved by ensuring:

- The removal of excess water.
- Sufficient subsoil fissuring for root, air and water movement.
- Correct distribution of nutrients.
- A suitable tilth for crop establishment.
- Minimum structural damage from traction and transport operations.

"The management of soil must be considered as an integrated process as changes in structure, from any operation, affect not only the physical condition of the soil but the water and air status and hence drainage and crop water requirement"

My interest on this trip was to look at the role that reduced tillage systems now played in U.K., from whence the idea originated, and to look at any developments with new tillage techniques.

7.1 Initial Impressions

I went to Britain expecting to find the minimum tillage/spray-seed techniques fairly extensively used; I expected to dig in their fields and turn up sods with soil structures that we could only dream about here in Australia. On both accounts I was disappointed.

The Spray - Seed reduced tillage technique, originally pioneered in Britain and now extensively used in Australia, particularly Western Australia, is now rarely used by farmers there. The reasons I was given for this is that after 10 years of minimum tillage they developed grass problems, soil compaction problems and the problem of straw incorporation for following crops.

With their highly productive soils and the climatic conditions to promote high levels of production, I had anticipated well structured soils. Instead I was surprised to find that the soils generally appeared to be over-worked and as a consequence, had poor structures and were subject to compaction.

It seems to be a vicious cycle. The high level of trafficking and cultivation compacts the soil and destroys structure so when it is next ploughed it requires rolling, power harrowing and a few more cultivations to get tilth, at the same time destroying any structure there may have been there, and so requiring the same procedure the following year I was quite amazed at the number of times the soil is worked.

It also reminded me of an analogy I had heard. In Australia, when we want to prepare a good solid base for a road, we go out and rip the road up, water it and then roll it down, usually with rubber tyres, to produce a good compact foundation. We seem to do much the same thing when it comes to our farm lands.

Whilst in Britain it is the clay soils that suffer most from this problem of soil compaction, poor structure is also a problem in the loamy soils. I suspect that the absence of the climatic extremes that we have in Australia allows them to get away with it, whereas the obvious results of soil degradation have forced us to take action in Australia.

7.2 Soil Compaction

There is a long history of deep ripping in the U.K. to overcome the compaction problems that result from their intensive system of agriculture and the high degree of trafficking that takes place on their soils. In most areas it is common practice to deep rip on a regular basis, more particularly on the heavier clay soils.

There are numerous machines commercially available for this work, including one which was developed in Australia under the name Shakerator, and now built by F.W. McConnel Ltd and marketed with considerable success.

Considerable experimental work into deep ripping has been done over the years in Britain, particularly by Professors G. Spoor and R.J. Godwin of Silsoe College and they have a number of publications relating to this work (G. Spoor; R.J. Godwin - An Experimental Investigation into the Deep Loosening of Soil by Rigid Tines, J. Agric. Engng Res. (1978) 23, 243-258; G.C. Soane, R.J. Godwin and G. Spoor - Influence of Deep Loosening Techniques and Subsequent Wheel Traffic on Soil Structure, Soil & Tillage Research, (J. Agric. Engng Res. 1977 22 (3) 213-228).

7.3 Other Alternatives

The other approach to the problem of soil compaction is to avoid compacting the soil in the first place. The options here are to increase the size of the tractor and implement tyres so that the weight of the machinery is distributed over a greater area with the lower ground pressure resulting in less compaction. Better still, move to crawler tractors which provide even lower ground pressures, but at an increased purchase cost compared with a wheeled tractor.

We visited the Drayton Experimental Husbandry Farm near Stratford upon Avon where long term compaction studies were being carried out. The soils here are heavy clays and the trials included deep ripping and low compaction with the use of Terra tyres etc. Whilst the experiments have shown results in terms of better penetrometer readings and other soil compaction indicators, there has been no appreciable increase in yields.

7.4 Gantry Farming

Another concept now being developed in Britain is Gantry farming. The idea behind this system is to have set wheel tracks within a field, similar to the 'tramlining' that is now extensively used in Europe for spraying and spreading fertiliser on growing crops. Rather than having a tractor to pull implements, the field work is done by a 'Gantry' which has a 12 metre beam under which it carries tillage machinery, seed/fertiliser hoppers, spraying equipment etc. as required. At either end of the gantry are drive wheels, driven by the machines own motor, and the operator's cabin is located above and behind a drive wheel at one end. The operator is then well placed to follow

permanent, compacted, wheel tracks within each field with the result that these tracks are the only part of the field that is ever compacted.

The idea originated with a Warwickshire farmer Mr David Dowler, who, trading as Dowler Gantry Systems Ltd., is now producing gantries commercially, though all those sold when I visited in July had been to researchers and not farmers.

The AFRC Institute of Engineering Research at Wrest Park, Silsoe, U.K. is engaged in a Controlled Traffic Research programme which is based on the results from trials conducted between 1982 and 1986 which studied the effects on soil and wheat responses to field vehicle traffic.

These early studies showed "that compared with conventional practice:

- During shallow cultivations, energy input on unwheeled soil was about 50% less than the 200 MJ/ha required following conventional traffic; energy requirements were increased slightly by a low ground pressure system.
- Where traffic was precluded, soil clods became absent and a friable tilth could be obtained easily within a wide range of soil moisture conditions.
- Cone resistance and soil dry bulk density below 100mm generally increased with wheeling pressure, but the greatest increases were between unwheeled and wheeled soil. Above 100mm depth, there was little difference between conventional and low ground pressure traffic".

Some of the results obtained at Wrest Park since the start of the current research in 1986, and the development of a 12m research gantry for these trials, are impressive:

- "In the replicate trial, where autumn ploughing was followed by spring cultivation and drilling, the energy required on conventionally trafficked soil was increased by 221% (79MJ/ha to 253 MJ/ha) compared with the gantry system.
- The draught of a shallow plough working at 95mm deep was increased by 119% (11.0kN to 24.2kN) when worked on trafficked compared with untrafficked soil".

Dowler Gantry Systems Ltd is also conducting trials under contract for Wrest Park "to identify the cultivation draught and fuel savings of a gantry compared to a conventional tractor system. The gantry system made use of conventional machines for harvesting and a tractor for primary cultivation, (ploughing and tining) on sites with a history of this treatment. All secondary cultivations and drilling were with a gantry. Compared with conventional practice it was found that:

- During ploughing, specific draught (kN/m²) was reduced by 16% and specific fuel use (l/ha) by up to 14%.
- For spring cultivations and drilling specific fuel use (l/ha) was reduced by between 29% and 57% and for the overall system, (including primary cultivation) by between 19% and 44%.
- In a shallow tine system, where conventional practice included subsoiling one year in three, the overall system specific fuel saving was 61%.
- With both ploughing and autumn tining, soil tilth was visibly poorer on the conventionally trafficked soils".

With regard to economic studies, the AFRC publication states the "results from an operational research model have suggested that:

- In a rotation of cereal crops, the gantry was about 40 pounds/ha more profitable than a conventional tractor system and about 70 pounds/ha more profitable than a 6m tractor-based zero traffic system.
- Controlled traffic systems reduced fixed costs largely as a result of lower cultivation inputs.
- A non-plough tractor-based system has the lowest costs, but has an unacceptably high predicted loss of yield due to permanent wheelways.
- Farm profit is relatively insensitive to transport gantry and gantry harvest price.
- The gantry system was the most profitable, particularly when used on heavier soils".

7.5 Conclusions

I found the research into, and the whole concept of gantry farming to be particularly interesting. It would appear to me that this is a concept of the future and with further development of equipment to use in conjunction with the gantry, it will provide a workable option as a farming system for farmers not only in Europe but also for the broad acre farming of Australia.

Some of the large machinery now used in Australia, requires an enormous super-structure to provide strength and the capacity to fold up for transport. The penalty in this machinery is in the initial capital cost and the enormous weight that has to be dragged around the paddock. The gantry overcomes the problem of folding for transport because it can be driven end on, it eliminates the need for wheels and tow hitch, and is already commercially available in a 12m version, this could be increased for broadacre if necessary.

I was particularly impressed by the in-field observations of this gantry work, and for me it represented the best in terms of soil structure that I saw during my time overseas. I have stated previously that I was generally disappointed in the condition of soils whilst in Europe but my observations of the soil structure that resulted after a number of years under the gantry system would confirm the results of the researchers. It was without doubt the best I saw on my travels and what I found even more impressive was that these results were achieved by a farmer who did not initially set out to improve his soil, but rather the consequence of a system he was developing for other reasons.

With modern machinery and high horsepower tractors (with the operator encapsulated in a sound proofed, air conditioned cab) travelling at high speeds, the farmer has the capacity to inflict enormous damage on the soil, often without appreciating the consequences. The evidence of this can be seen around Australia in our soil degradation problems. Gantry farming, from early results, appears not only to offer a lower cost system of farming but, as a considerable bonus, would appear to result in better soil structure.

8. Organic Farming

One of the surprises of the trip was to see how the influence of the organic farming movement was developing. Just a few years ago they would have been derisively

referred to as the 'muck and magic bridge'. Yet from Brussels to the ADAS adviser, all were talking seriously about organic farming and its potentials and shortcomings.

Whilst Britain has a number of long established organic movements, their efforts have been given added impetus in recent years by the various conservation and "green" movement's effectiveness in conveying an often exaggerated picture of ecological problems and pending disaster. There is however good reason for concern and Europe in general has considerable pollution problems emanating from agriculture that need redressing.

I visited a number of organic farming organisations, organic research centres, farmers and processors of organic produce. From these visits it appears to me that within Britain, whilst there is much talk and an obvious willingness by many farmers to look at this alternative, there appears to be only a small percentage of farmers prepared to take the plunge. Their reason for this is mainly financial. One of the largest organic farmers in Britain frankly told me that with his lower yields, if it weren't for the premiums currently being paid for organic produce, he would not have a viable business.

The conversion to organic farming also presents a considerable problem for most with an uncertain income over the 4 to 5 years that it takes. This could be offset if proposed subsidies for conversion eventuate from the EEC.

Whilst there has been an escalation in demand for "organic meat" as a result of the "mad cow disease" scare, demand for the higher priced organic food is restricted to a small percentage of any market (2 to 5% were figures quoted to me) and likely to remain low as it is only a small percentage of the population that actively seek those products, the majority persuaded more of the "Green" lobby.

There may well be an opening for Australia to supply organic products to the EEC, particularly if the problems that the UK has with "mad cow diseases" escalates.

9. Conclusion

The Nuffield Scholarship not only gave me a wonderful opportunity for study into an industry in which I am actively engaged, but it came at a time of great uncertainty and flux for agriculture. After a half century of enormous development and improvement in agricultural technology and efficiency, agriculture has reached a most critical point in its development - it is at a watershed.

The development of machinery, fertilisers and sprays, coupled with modern transport, has greatly boosted our productive capacity in the western world and allowed markets, far removed from the farm gate, to be efficiently supplied. So efficient and adaptable has modern agriculture become that, even though we still live in a hungry world within the areas of active trade, it is difficult to think of any agricultural product that is not easily obtainable, and most of the major ones are so well supplied that the trading world is actively engaged in trade wars in an endeavour to shed their surpluses.

This new technology has not only heralded a new age of farming with a welcome relief from the physical rigours of the past, but it has so increased the efficiency of the modern farmer that we have seen a dramatic decrease in the number of individuals engaged in farming and corresponding increase in the size of farms. The social impact of this has been considerable throughout the western world, and particularly in Australia where we have seen a growing concentration of population in the cities at the expense and detriment of the country, and the demise of many small towns.

This whole process has been driven by an economic pressure - a relentless and ongoing pressure that never appears satisfied. Agriculture (as indeed the whole economy) both in Europe and here, is staggering under an increasing burden of debt, serviceable in good times, but overwhelming for many in a down turn. Always the farmer must be looking for better performance to stay in business. He has two options. He can improve his efficiency and output from a given area and/or he can increase the size of his holding to offset diminishing returns. In fact, so fine have the margins become, either flood or famine can spell financial ruin.

These pressures are likely to continue in the foreseeable future, and be added to by the demands, and some justifiable concerns, of the conservation movement.

Of great concern, I have found a disturbingly low morale amongst farmers, both overseas and in Australia, and this is perhaps reflected in the decreasing number of young people taking up agriculture.

A strong and stable agriculture is of primary importance to any nation, and history bears witness to this. We need to face the social and economic issues confronting our industry in Australia and determine a course that takes due regard of the natural world to which we must ultimately conform, and satisfies the economic requirements of man.

Peter F. Nixon

Western Australian Nuffield Scholar, 1990.

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