AUSTRALIAN NUFFIELD FARMING SCHOLARS ASSOCIATION

REPORT OF VISIT TO THE UNITED KINGDOM

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(Tasmania 1985 Award)

A study of vegetable production in the United Kingdom

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REPORT BY

TONY ROBERTSON

VEGETABLE PRODUCTION IN THE UNITED KINGDOM

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1. REGIONS

The East Anglican region, made up of Lincolnshire, Norfolk, Cambridgeshire, Essex, Sussex, Bedfordshire and Northamptonshire grows about two thirds of the national hectarage of vegetables. Types of production range from the more traditional market gardens of Essex and Bedfordshire, supplying the fresh market, to the large scale growing of vegetables for processing in the more northern parts.

The importance of the area in the production of processing vegetables has developed over the past twenty years or more. The growing demand for convenience foods has resulted in vegetables becoming an increasingly important part of the farm operating program.

The factories were originally set up along the coast to freeze fish during the winter months and used to process vegetables during the summer months. Produce from the local farms is preferred because vegetables need to be processed quickly after harvest with minimum of transport costs. The region is therefore, important in the production of sprouts and peas for freezing and to a much smaller extent green beans, which have tended to be concentrated in an area south of the Wash because of the warmer climate. A number of factors have contributed to the increase in importance of the region for vegetable production.

As well as the existence of the factories referred to above there is a wide range of soil types suited to vegetable production within the region. The sand soils of Norfolk and Suffolk are particularly

suited for the production of carrots. This crop is also grown on the organic soils of Cambridgeshire which is an important centre for the production of onion, both over winter and spring sown.

The silt soils of Lincolnshire are suited to vegetable growing, and the cauliflower crop, both winter and summer, is important within that county, whereas cauliflowers are not grown much elsewhere. The main exception to this are the early potato and cauliflower crops which are produced in the southwest of England, in Cornwall, which has a much earlier, warmer climate than the east coast.

Farms in the region offer large areas of uniform soil suitable for mechanisation of all aspects of production. Larger field sizes encourage the use of big equipment, usually with the economies of scale in the cost of the operation.

The workforce in the area is now experienced in the production of vegetable crops and there is a large pool of labour employed in packing sheds on various post-harvest operations for a number of crops.

It is also interesting to note that another pool of labour exists on the fringe areas of the large nearby City of London, and this is increasingly being used by the vegetable pre-packers who transport them up to 50 miles, and return, each day for work. The reason behind this is that the labour is usually of Pakistan or Indian origin and is seen as a cheaper source of labour.

The importance of vegetables within the area has seen the establishment of machinery depots and chemical suppliers, as well as depots for purchasing and preparation of crops, both for processing and for pre-packing for the fresh market.

The climate of the area during the winter, and its range and location, from coastal to inland, and extending over 240 kms from north to south, means that a crop can be harvested from some part of the region at almost any time throughout the winter months.

The production methods of most crops are similar whether the crops are to be processed or sold through the fresh market. A high proportion of crops are sold fresh, mainly through the establishment of co-operative marketing organisations. A number of these organisations have been set up in the area, and there has been a large growth in the pre-packing of vegetables for supply to the large retail companies.

The area does have its problems for vegetable production. The flat nature of the land and the general absence of natural shelter means that wind damage can be a problem, and undoubtedly there is some reduction in yield as a result of this. More serious is the pre-disposition of some soils to blow under certain conditions and various methods have been adopted to minimise the impact of this on crops in the spring when the risk is at its greatest.

The silt soils of Lincolnshire are prone to capping and this can have a serious effect on crop emergence in spring, where a wet period is followed by a rapid dry, producing a thick cap on the soil

surface, which interferes with the crop emergence and plant establishment. In particular, the capping affects the emergence of small onion seeds and to circumvent this problem the Lincolnshire growers have begun transplanting their own onion crop by germinating the seed in cell blocks, up to six seeds per block, avoiding the problem incurred when the soil caps.

The organic soils have particular weed problems, in due part to the higher retentive capacity for herbicides, but for most crops, acceptable weed control programs exist.

The area is one of high evapo-transportation during the summer months and in many areas will not receive the full yield potential without artificial irrigation. This particularly applies to the sand soils. On the organic soils management of the water table is in part used to supply water to growing crops but the area is one which is not naturally well endowed with supplies of water and many different methods of obtaining and storing water are practised, as well as well abstraction from the main water courses.

The area is also important for the production of protected crops. There are about 600 hectares of greenhouses remaining representing nearly 31% of the total areas of protected cropping in England and Wales, used for the production of mainly mono-crops, such as cucumber and tomatoes.

Fruit, such as apples and pears, is also important. There is also a small commercial production of the soft fruits such as strawberries, blackcurrants, gooseberries and raspberries.

Another very interesting crop in the east Anglican region is the production of bulbs. The region has about 74% of England and Wales' bulb area with Narcissus being the most important crop. The main production area is the silt soils in Lincolnshire and around the Wash in Cambridgeshire and Norfolk.

There is an increasing interest in growing bulbs on potato cyst Nematode free land in other parts of the region. The bulbs are mainly grown for bulb forcing and for the dry bulb trade. There is a considerable export trade in dry bulbs and bulb flowers and exports have also played a significant role in stabilising the high market for Narcissus.

A by-product from the numerous and sometimes large scale vegetable washing plants has been farm waste. There has been an increase in the tonnage of vegetables washed on farms and at the vegetable pre-packers, and these plants use large volumes of water which becomes polluted with soil particles and vegetable debris. The resulting effluent is in most cases unacceptable to the water authorities for discharge directly into streams and ditches. Effluent disposal is therefore a problem at a few plants, particularly when root crops from the peat soils are washed and these solids are particularly difficult to remove.

Mechanisation is playing a major part in all aspects of agricultural and horticultural production, and especially important in view of the continually reducing labour force, changing techniques for production and more demanding market requirements. The region is responsible for many innovations in mechanisation, particularly in the field of

intensive arable cropping. In particular, numbers of specialist tractors, including ultra-low ground pressure spraying vehicles, tool carriers for row crop work and rough terrain forklifts, are steadily increasing.

Although primary cultivation for cereal crops is usually carried out by tyne implements, the vegetable industry maintains the use of the Mouldboard plough, particularly in its reversible form, as the main primary cultivation implement for root crops, and for the burial of trash after the rapidly expanding area of oilseed rape growth.

Cultivation for potatoes has received a great deal of attention and advances in harvesting techniques have been largely the result of improvements, particularly cultivation which results in fewer clods at harvest time. The trend in harvesting has been towards harvesters not requiring hand labour for sorting, towards some cleaning at the store and towards storing part of the crop in boxes rather than in bulk. On less favourable potato soil stone separation and wind rowing in the field is now widely practised as an aid to satisfactory potato crop mechanisation.

The reduction of external damage and internal bruising of the tubers continues to be a major problem. The operation of harvesters and the design and operation of grading lights and farm transport is often centred around the need to reduce damage.

Technilogical advances in indoor storage continues to increase as a natural progression from traditional storage methods.

The mechanisation of vegetable production has developed considerably in recent years. The most important advances have been in harvesting, handling, crop grading and preparation and storage equipment, the pressure for improvement coming chiefly from the more sophisticated market requirements. Many one off machines are in use. Vegetable growing probably accounts for more activity in this field than any other aspect of farming. Some of the crops grown are so highly specialised and in the hands of so few growers, that commercial production of these machines would not be an economic proposition.

The most important development in the conditioning and storage of vegetables in recent years has probably been in onion and potato storage which has progressed to the point where the locally grown crop compares favourably with imported samples.

Marketing

The marketing of vegetables in the United Kingdom is highly competitive. The marketing organisations are competing in a generally over-supplied market. The economy is expected to undergo a period of slow growth and this will therefore affect consumer spending. Consequently there is a push to improve all facets of marketing, not only to gain a market share but to maintain that share. Constant research by those involved in marketing has become extremely important as the competitive nature of marketing increases.

Innovation in the post-harvest methods of handling, cooling and packaging come mainly from the pre-packers, rather than the retail companies, who are reluctant to invest in new and undeveloped high cost initiatives. The large retailers continue to place increasing demands on the suppliers to co-ordinate and arrange for the distribution of products on a year round basis rather than, as in the past, on a seasonal basis.

To this end there is considerable investment in Spanish and Portuguese land, to take advantage of their seasonal difference, to maintain the continuation of supply.

Competition among the large retail companies is reflected in greater pressure being placed on the producers to accept more responsibility for the quality of produce without a significant increase in return for the extra cost of imputs required. Attitudes of the large

retailers to producers is ofter compared to a commonly expressed opinion in Australia on the same subjects.

To quote some retailers:

1. "We prefer United Kingdom sources but foreign shippers seem to take a pride in their produce and check they are providing what the customer wants."

2. "To survive they must be able to store fresh foods in order to ensure continuation of supply. If necessary they should link up with overseas producers."

Commonly expressed points of view, but also relevant in the Australian context.

To illustrate point 2 further, we can relate it directly to the investment in Spain and Portugal. By investing in Spain and Portugal, as a hedge against seasonal factors, and as a method of continuing supply, the more progressive pre-packers are looking for greater support from the retailers because of their ability to meet the market demands of quality, presentation, service and reliability of supply on a continuous basis.

Competition between the British and the Spanish and Portuguese producers can therefore be expected to be fierce for a number of years, until such time as land prices and labour costs attain some relativity. The admission of Spain and Portugal into the Economic

Community will have a grave impact on the United Kingdom horticultural producer. Particularly vulnerable producers will be those who produce products such as salad crops, onions, new potatoes, apples, pears, strawberries and cut flowers.

The ten year transitional phasing-in period proposed by the EEC for the Spanish and Portuguese producers to accept Economic Community market disciplines in full is seen as not being sufficient to remove serious pressure from the British producer. In particular, the Spanish and Portuguese producers will need to upgrade quality standards and plant health regulations in both internal and external markets to meet strict EEC regulations.

At the producer level, the effect of the strong position of the retail companies has been that the smaller producers lack the flexibility required to introduce viable alternatives to traditional agriculture, while the larger producers continue to investigate and implement new ideas and technology.

There is therefore a large effort to co-ordinate the activities of the fragmented vegetable industry with the formation of co-operatives which, by nature of their size, and therefore economies of scale, give the producer better access to the more profitable markets.

There is a general realisation of the need to improve marketing structures within the vegetable sector. Tremendous help is given by the British Government and the Economic Community to help develop co-operative ventures. It is made easier by generous grant aid

schemes that avoid direct subsidies or intervention prices, but appear as direct grants to aid building development for pre-packing and storage facilities and the employing of highly credentialled management and sales staff.

The generous funding was continued up to the end of June 1985 when the high cost of the funding became apparent and there was a reduction made in the funds available for such purposes. An example of an area into which the grants were made available was in the managerial salaries and expenses. Salaries and expenses of key staff could be subsidised for a period of three years, during the first five years of a co-operative's existence and similar aid could be given to existing co-operatives to undertake new developments.

The main purpose for which grants are available is as follows; the amount of grant varying up to the maximums listed. The rates ranged from 33½% - 75%.

	Maximum		
	Off Farm	On Farm	Others
Agricultural buildings and ancillary work	32½%		
Horticultural buildings	32½%		
Horticultural production and harvesting equipment		15%	
Potato harvesting equipment		20%	
Storage and preparation for market	25%	15%	
Key staff salaries			33 1/3%

	Maximum		
	Off Farm	On Farm	Others
Surveys and investigations			75%
Selection and training of management			75%
Formation costs of new co-operatives			75%
Research instigated by Council			90%

Initially co-operative pre-packers were encouraged by the retailers who saw in their formation a rationalisation of the industry that could suit their purposes by providing a more centralised system for the control of quality and supply. This would help to overcome the underlying problem of the fragmented system of scattered markets and smaller inefficient marketers that had existed in the past.

The older wholesale markets such as New Covent Garden, Spittlefields and Great Western International, are suffering the effects of a much lower throughput and if the large retailers maintain their market share and continue to move away from the traditional markets, there can be little doubt that the swing to co-operative pre-pack suppliers will force the closure of a large number of these traditional markets.

Wholesale markets in the past were almost exclusively used for the distribution of imported products. The trend by the pre-pack co-operatives to have a continuation of supplies has seen a move to

import directly from exporting nations, thus avoiding the use of the wholesale markets. Not even the notion of stabilisation in the market share between the large retailers and the smaller greengrocer outlets would allow the traditional fragmented system of marketing to return.

Currently the large retailers account for 36% of the market share, the greengrocers 32% and the remainder is made up of smaller stores and stall owners.

Distribution

Almost without exception the larger companies deliver fresh fruit and vegetables into central depots or distribution points from which they are distributed to the retail stores. Distribution from central points is speedier than other methods and essential for highly perishable goods and enables firm control to be kept on quality.

Goods are now mainly delivered, graded and pre-packed to depots by the specialised pre-pack wholesale company.

Because of the highly perishable nature of the goods, deliveries from the depot are usually daily.

Perhaps the most obvious breakdown in the system to maintain quality becomes apparent with the reluctance of the retail companies to make use of temperature controlled vehicles from distribution points to retail stores and of efficiently cooled shelf space in their supermarkets.

The cost of providing refrigerated transport has been passed on to the transport companies who sub-contract the distribution. It is therefore naturally passed down the line to the producer; another impost on a hard pressed production industry.

Buying

Head office control of buying is strong and includes the suppliers to be used, product specifications, prices to be paid, and margins to be obtained.

Some companies may allow store managers to buy locally, particularly products such as strawberries, if there are problems with the quality or price of goods from the depots. A major aim of the large companies has been to build up long term relationships with the suppliers to ensure products are grown that meet required specifications.

Control of quality is seen by the retailers as being crucial to ensuring the customer is offered the product that the company believes is required. Quality is monitored down the line when it is being grown, harvested, pre-packed, distributed and in the store.

The integration of large companies with the pre-packers was once seen as a means of meeting their required standard, but is not now seen as being an alternative. The ability of the large retailers to manipulate the build-up of a large number of pre-pack co-operatives to meet their specifications has now resulted in the co-operatives being played by the retailers against each other.

Packaging

Methods of food distribution, both wholesale and retail, would not have been possible without the developments which are taking place in food preservation, packaging and handling.

Technical developments and the relative costs of applying them continue to affect distribution of fresh food.

Developments include the application of micro-electronics in wholesaling and its effects on operating costs, i.e. quicker, more efficient storage, packaging and distribution.

Improvements in storage methods for vegetables, particularly onions and potatoes, have made it possible to market high quality produce for a longer period in the year than was previously possible.

Developments in automatic grading machinery linked to machines which can pack and individually price packages at high speed, are having a very important bearing on certain fruit and vegetables, including potatoes.

Cooling is being used by the pre-packers and in some cases the larger farming operations. To remove the field heat from the vegetables, thus giving them longer shelf life, is a very important aspect in marketing fresh vegetables. The methods of cooling remain the ice pack and vacuum types with very little emphasis being placed on forced air cooling.

Another area recently being developed has been the preparation of products including lettuce, watercress, carrots and cabbage ready for serving, which are quick chilled and vacuum packed. This has been used by the catering industry but has now been successfully developed by a small number of large retailers for a specialist market; e.g. high quality office lunches.

The use of shrink wrapping backed by poly-styrene has been in common use for some time and has aided ease of handling throughout the transport and handling system. The use of larger poly-styrene boxes that can be stacked vertically without the risk of collapse, causing damage to the products they contain, has meant greater efficiency in handling and transport. The trend is likely to continue as improved relationships are established between the strength of the wrap or container, the light weight of the wrap or container and the handling requirements become more important.

The methods of assembling truck loads quickly and efficiently have been developed through the use of these specifically designed containers to facilitate bulk movement of the products from the pre-packers to distribution points, to retailers.

The physical costs of distribution are high and are predicted to remain high. Developments in reducing the weight of specialised chilled transport is seen as one of the few prospects available to reduce the overall distribution costs.

Conclusion

British producers have been able to utilise Government incentives to allow them, the producers, a greater share of the profits.

By encouraging grower participation in the build-up of co-operative pre-packing, the British Government is, to my mind, showing a responsible attitude toward a stable and co-ordinated marketing effort. One that is allowing participation at all levels of the fresh vegetable industry.

Participation by producers at pre-packing and marketing levels is ensuring consumer demands filter all the way through the system, to the extent that the consumers are getting what they want at the price they want to pay.

The emergence of co-operative marketing in Australia is the logical progression of the old and fragmented marketing system we have today, but without Government support, in the form of tax initiatives and incentives, the likelihood of greater grower participation in marketing is likely to be well down the track.

I would suggest it is also possible that there are likely to be more and more growers by-passing the wholesale marketing system and dealing direct with the supermarkets.

I see this as being viable in the short term but as a long term initiative it can only give the supermarkets more power over producers.

The more co-operation between producers the greater the likelihood of retaining a viable industry.

2. PROPOGATION AND TRANSPLANTING

Propogation of Cell Blocks

The use of vegetable propogation system, based on production in individual cells in trays made of moulded expanded polystyrene, has only recnetly been used in Great Britain.

The transplants offer an alternative to the bare root and compressed peat block raised plants. It has been recognised that these new systems of propogation can provide a means of controlling seedling growth, faster transplanting, improved crop establishment, particularly under dry conditions, and subsequent crop uniformity.

In the United Kingdom, the number of vegetables raised in cellular trays has risen from a few million in 1981 to about 250 million in 1984. In the main these plants were brassicas, chiefly cauliflower, with onions and celery making up most of the remainder. It is in the brassica growing areas of South Licolnshire, where irrigation is not available, that the system has been most widely adopted.

There are four main trays currently used in commercial seedling production. These are outlined in the table supplied.

DESCRIPTION OF FOUR TYPES OF CELLULAR TRAYS

Tray Name	Material	Tray Dimension (mm)	Cell Volume (ml)	Cells per m^2
SWC 308	Expanded Polystyrene	410 x 650 x 50	15.0	1158
HASSY 308	Rigid polyethylene	390 x 615 x 40	14.0	1284
PG 308	Rigid polyethylene	390 x 610 x 40	14.0	1285
Speedling 080	Expanded polystyrene	338 x 605 x 48	9.0	1538

Although these trays differ slightly in cell shape and size, a very similar plant product can be grown in all of them.

It is interesting to note though that individual farmers have developed their own uses for each of the trays, e.g. multi-seeded onions are generally grown in Hassy 308 types, brassica growers generally use the Speedling type and leeks and celery are grown according to individual preference in any type of tray.

There is much work being done on the characteristic make-up of composts to be used on the cellular trays. It is necessary to take into consideration both the physical and nutritional contents of these composts. Very important in controlling growth and development of cell raised plants is limiting the nitrogen and potassium availability in the compost by carefully controlling the liquid feeding of these nutrients.

Work is continuing at experimental stations to more correctly understand the form of manipulation needed to control the growth of the seedling plants. For example, care must be taken when

using compost containing the higher rates of nitrogen to raise vigorous growing species such as broccoli, brussel sprouts and Chinese cabbage, as excessive early growth can lead to poor quality plants which affect the crop performance and handling at harvest time; e.g. bent stems in the brussel sprouts.

With most other seedlings it would seem that all composts can produce an acceptable transplant as long as slight modifications are made to subsequent liquid feeding.

It is very important in seedling production to ensure that the very highest quality seed is available as it is essential to have 95% of the cells with viable plants. Some seed companies are now offering special grades of seed for plant raising in cellular trays. Economising on seed costs is expensive and subsequent quality of the plants suffer as a result.

Very few farmers are undertaking to actually grow their own seedlings because of the considerable management expertise required. Some of the very big farming operations producing up to 10 million plants for their own use employ specialists to grow their seedlings, but generally the farmers rely on specialist seedling producers to supply their seedlings.

Another significant factor in farmers employing specialist seedling growers to produce their plants, is the high initial capital costs of providing the sort of propogation facilities and growing space necessary. These include a storage area for the sterile trays and

compost, work area for filling and seeding trays, a means of applying water and fungicide drenches to the trays, germination room, hygenic and well ventilated glasshouse equipped for watering.

An advantage of cell raised plants is the ability to hold and store the plants. When the plants run out of feed, growth slows and the plants can be held for considerable periods. This can be very important in the silt soils and the Fenlands of East Anglia as delays at transplanting can directly affect the time at which the transplants can be used.

It is interesting to note that for demonstration purposes cauliflower plants have been down at mid-March, grown slowly with low nutrient levels for up to 26 weeks before transplanting and subsequently produced marketable yields. Often the cell raised plants are held in cold store for up to two weeks without deterioration when the weather affects transplanting. At the end of this period the plants are returned to the glasshouse, fed and watered and allowed to revive. This usually took about two days but occasionally, because of weather factors, they were returned to cold store for a further two weeks and the treatment repeated.

Transport to the field is usually done in stillages. Stillages are shelf arrangements built on a pallet that can hold up to 80 trays at a time. The loaded stillages are handled by forklift trucks and transported to the field.

The transplanters generally have a carousel that holds four trays in position, and the plants are removed as the transplanting takes place. Another advantage of the plants raised in cells is that they have the ability to establish rapidly and uniformly. The plants are watered thoroughly and fed with a high nitrogen feed just before planting. The application of water or a nutrient to the root ball at planting can also prove to be beneficial. Generally existing planters are used by the producers although some of them are slightly modified, thus avoiding the necessity of investing in expensive new machinery to plant the cell raised plants. The newer generation of machines do have the advantage of speed and they can handle up to twice as many plants in a given time. Disadvantages are that some of the machines can only handle plants of a certain size range.

An interesting new development in transplanting has been a Japanese machine that has the potential to become almost fully automatic. It is known as the paper pot system. This machine has the potential to plant a range of crops including lettuce, onions, brassicas, sugarbeet, at a significantly lower cost than other transplanting equipment.

The system begins with a paper tray made up of thin paper tubes formed together to resemble a honeycomb. It is filled with compost and seeded in the same way as the ordinary trays. Its main difference is that it can be opened up to form a belt with the seedlings that are fed into the machine to fully automate the

the transplanting system. This is an important development when considering transplanting high density crops such as sugarbeet and celery as the labour costs of transplanting are becoming extremely high.

In conclusion it can be said that greater cost pressures and the need for greater efficiency and high production yields have caused the shift in emphasis from bare rooted transplant systems to cell tray seedling systems. Better establishment and better uniformity has a flow-on effect to viability that is recognised by both the farmers and the buyers of their produce.

Control of Stones

Stones seldom help any crop production and in many areas are detrimental to achievement of maximum productivity since they displace soil which could contain nutrients and moisture and inhibit the efficient operation of machinery.

In England the potato crop is particularly susceptible to damage during harvesting, and the presence of even moderate amounts of stone in the ridges significantly reduces harvester output, increases tuber damage and causes a considerable increase in wear on harvesting machinery.

A lot of work between 1974 and 1976 was done on identifying the problems caused by stones in potato growing and possible ways of dealing with them. Work was carried out by Dr. Brian Whitney, Head of Department of Agricultural Engineering and Mechanisation at the Edinburgh School of Agriculture and this work formed the basis of most stone removal techniques to remove stones from the ridges into which potatoes were being planted in the spring.

The ideas were based around the adaption of a single row potato elevator-digger to lift the stones, clods and soil from a pre-formed ridge, sift out the loose soil and then deposit the stones and clods in the windrow at the edge of the hill where they were pressed into the soil by the tractor wheel on the following pass. Apart from removing stones and clods from the soil, from which the ridge was to be formed, it was found that this operation was

a very effective cultivation in itself since it left a very fine seed bed in which to plant.

It wasn't until the mid 1970's that stone and clod separation in the spring became an accepted technique among potato farmers outside Scotland.

Dr. Whitney commenced his three year trial program in 1974 to establish the effect of three types of stone treatment - stone removal, stone windrowing and stone crushing, on potato yield, harvester performance and tuber damage. The principles of the three techniques are as follows :-

Stone Removal

This method entails the use of a stone picking machine to remove the stones from the soil, unload them into a trailer for removal from the field. Whilst this method has some long term effect on a field's stone content, the problems of carting and dumping large quantities of stone makes the operation expensive and time consuming. Care must also be taken not to remove the top soil in the form of clods, along with stones. A further major disadvantage is that stone removal is never complete since, contrary to popular belief, it is not the stones that move towards the soil surface, the soil surface moves towards the stones. By removing 5% of the plough layer subsoil may well contain a disproportionately large volume of stones or even the tips of large boulders which have to be dug out to avoid continual machinery damage.

From the results of the trials the benefits gained from this technique are not as cost effective as the stone windrowing technique when applied to potatoes.

Stone Crushing

Stone crushers and land conditioning machines are designed to reduce the amount of oversize material present in the soil. Land conditioning machines are essentially heavy duty rotary cultivators which treat the soil where it lies, whereas the stone crushing machine separates the oversize material from the loose soil, prior to crushing it between pairs of spring loaded rollers.

As with stone removal, this method has a long term effect on the amount of oversized material remaining in the soil. However results from trial work relating to harvester output and severe tuber damage, show little improvement compared with untreated control areas.

Stone Windrowing

In the stone windrowing technique, the separated clods and stones are deposited via a cross conveyor or chute to the valley bottom of a ridge or bed, reformed by an underslung or adjacent ridger body, thus retaining the separated material in the plough layer. This is a relatively low cost method of removing stones from the soil used to form the ridges and it avoids the problems associated with either removal or crushing. It is particularly advantageous in soils containing both stones and clods. The windrowing

technique has largely superceded the earlier ideas of stone burying because of the high draft requirement of placing stones in the subsoil and also because of the danger of forming stone drains which could overdrain the land and reduce yields on lighter soils.

Dr. Whitby summarised his trial findings in the following terms :-

"In a three year experiment, potato yield was not affected by either stone removal, stone windrowing or stone crushing, although one dry summer, there was a significant yield increase for the stone windrowing treatment compared with the control. There was no yield effect on the subsequent cereal crops. Field stoniness levels of up to 200 tonnes/ha or material over 32mm nominal diameter, can be reduced to 7-10 tonnes/ha in the ridge by either stone removal or stone windrowing, but stone crushing had less effect.

Harvester speed was increased by 43% after stone windrowing and by 22% after stone removal, but not after stone crushing. On a manned, single row complex harvester, there was a reduction in severe tuber damage of 13% after stone crushing and of over 30% with the other two treatments. The decrease in tuber damage was due partly to the lower harvester web speeds which were only possible on the areas of low stone content. The combination of higher harvester rates of work or fewer pickers and less tuber damage makes stone windrowing the most economically viable as well as providng an opportunity to attain some of the mechanisation benefits formerly available only to potato growers on stone-free land."

These results prove clearly to me that there are distinct advantages to be gained from stone treatments in general, but stone windrowing in particular when growing potatoes in soils with stone content.

Drainage

The British climate is unpredictable and wet and most of the soils under cultivation are medium loam to heavy clay. Since early times it was recognised that artificial drainage was needed to remove surplus seasonal water before the land could be farmed efficiently.

The economic benefits gained from drainage throughout England, Scotland and Wales have been terrific. There is no reason to believe that this would not be the case in Tasmania. When expansion of food production was urgently needed in the Second World War the Government did provide a 50% drainage grant and even ran its own drainage contracting business until well into the 1950's.

But times have change and British and Continental agriculture have become extremely efficient in gross output, if not in terms of net profit. This has prompted the Government to re-appraise its attitude to drainage. The result of this has been a reduction in grants available to producers in arable areas where most of the drainage work is being done. These grants have been reduced from a maximum of 50% down to 15%. The lower grant availability has called for some very straight thinking on the drainage front.

Old systems have been wearing out and must be replaced, just to maintain a status quo. The minimum replacement rate in Scotland and Wales is at least 40,000 ha/year and nearer to double that if

any nett gain is to be achieved. The rate of annual activity has been sufficient to ensure a continued viability of a sufficient land drainage contracting industry, whose members have invested heavily in mechanisation which has contained costs for producers.

Services including drain installation, ditching and secondary moling and subsoiling treatments are essential if farming efficiency is to be maintained. Land draining undertaken at a slower rate and funded more out of annual cash flow in the future will still be undertaken in most parts of Britain. This in itself is directly applicable to our financing situation.

Those who go to the trouble of seeking the latest advice on soil types, local climate and the drainage systems best suited to the farming system they practise, will continue to drain and obtain a worthwhile return on investment. On most medium to heavy land farms efficient drainage is a combination of permanent pipes and ditches with appropriate secondary moling and subsoiling treatments. Well maintained drainage schemes will last a lifetime.

The traditional drainage approach for much of the heavier land was tiles at 20 metre intervals with straw backfill over the pipes. Many of those old schemes are now breaking down and a layer of rotting straw over the pipes means that is nearly impossible to revive assistance by subsoiling.

Most of the work today is done by laying plastic pipes, also at 20 metre intervals, straw backfiller is out and stone is being

used to within fifteen inches of the surface in arable land to within twelve inches for permanent pasture.

Many trials have been conducted in the past to do with drainage. A trial presently being conducted at a site at Wimstone Farm near Farrington in Oxen was started in 1978 as a joint venture between the Ministry's Field Drainage Experimental Unit and a then A.R.C. Lecton Laboratory. The trial was designed to continue for five years. A twenty plot layout, each plot measuring 59 metres x 41 metres, includes two drainage and two cultivation treatments. Tile drains with permeable backfill are at 46 metre intervals and 0.9 metres deep with or without mole drains across the tiles at 0.6 metres deep and two metres apart.

Trial treatments are conventional ploughing and cultivations compared with direct drilling or shallow tyne cultivations. Results are now starting to emerge on drainage response and crop yields. One interesting observation is that the speed of water removal can be 30% higher off the drained minimal tillage plots, compared with those under the plough.

The drainage design implications in terms of main drains, outfalls, ditches and culvert capacity are obvious for areas where farmers attempted to put more land into minimum tillage methods. Five years observation of direct drill plots show that the surface water gets into the ground quicker through stable and continuous vertical crakcs in the soil profile.

By comparison ploughing and subsequent cultivations cause smear and a shallow pan which seals off vertical soil channels and slows down the absorption of surface water into the subsoil and a permanent drainage system.

It is interesting to note that although less total water is removed from the direct drill catchment you can get a temporary increase in surface run off. The reason is that the creation of a fine and shallow surface tilth can seal the access to the deeper and well developed cracks in the soil profile. This has run off implications and it is easy to see definite erosion effects on the minimal tillage plots which have a 10% slope.

Many of the British land drainage techniques have been geared to the removal of subsoil, more than surface water. Erosion, much of it imperceptable, occurs in a variety of soil types. The effects can be aggravated on large sloping fields, which offer increased opportunity for unimpeded surface water run off to gather momentum.

There is therefore good reason to stop surface water from gathering momentum. Permeable backfill is used over land drains to ensure rapid removal of water carried by mole channels and ditches made by the subsoiler. The function is impaired and can be defeated when the backfill is contaminated with small particles known as fines. For instance, clinker containing 15% of fines can reduce the water carying capacity by a factor of 40 from 20,000 metres

to 500 metres a day. This is well below the 2,500 metres a day hydraulic conductivity required for a mole drainage scheme and the 1,000 metres a day for the close spaced pipe system with sub-soiling. As little of 6% fines in a sample of five mms to 50 mms gravel backfill has been shown to impede the discharge from moles into a 100 mm wide backfilled trench at a peak flow rate.

The result can be the temporary submergence of mole channels leading to a shorter life, the risk of mole blowouts on sloping site and a gradual reduction in drainage efficiency.

Specifications for permeable backfill material include clean gravel, stone chips, foam slag, hard clinker or other approved durable materials with no dimensions greater than 50 mm or less than five mms. Clean and well graded wash gravel is probably the best but it is also the most expensive backfiller material and costs rise with increasing distance from the source of supply. This has meant that farmers and contractors have tried alternative materials, one of which is crushed limestone. Many of the systems using the basis principles I have just described have over the years become extremely expensive because of the initial high capital cost of the equipment and the high cost of running such equipment.

Consequently a number of new systems have been tried, some successful, some not. An idea being developed by D.W. Clarke in Warwickshire aims to directly lower the cost of drainage.

To do this it requires a system devoid of large capital expenditure currently existing in drainage equipment. Simply, the system does away with lateral drains being fed by the moles which in certain soil types are subject to collapse.

The high cost of the refined gravel backfill is also a large cost factor but this, in the new system, has been replaced by a design feature on the trencher that pulls topsoil into the trench and uses that as the permeable backfill.

Instead of using laterals at 20 metre spacings and subsoiling, 35 mm agriculture pipe is laid 800 mm deep (depending on soil type) at three metre intervals on a grid system feeding into the main drains as in a normal drainage pattern. The most obvious advantages of this system are in the capital requirements.

It is possible to use a tractor with a horse power range of 100-150 and the pipe layer consists of nothing more than a single leg deep ripper with a specially designed foot to bury the pipe and to lay the thin layer of topsoil vertically in the trench.

It is possible to build the deep ripper in a farm workshop which puts the cost of the ripper within the means of the average farmer. As most farmers have a 100 H.P. tractor, the need to spend large sums on expensive, powerful machinery can be minimised.

Some of the advantages of the system can be summed up:-

(a) it is possible to construct the deep ripper in the workshop

(b) the horse power requirement is minimised

(c) the labour costs are minimised

(d) it is easily operated in high stone content soil

(e) using topsoil as the filtering medium does away with expensive backfill

(f) because the moles are non-collapsible, being lined with 35 mm agricultural pipe, the problems associated with mole blowouts are by-passed.

The system does not avoid the continual need for a deep ripping program but it is the initial cost of the system that makes it attractive. As an example of the cost to employ this system it may cost between 180 and 200 pounds per acre, whereas on the old system of gravel bakcfill 20 metre lateral intervals may cost between 500 and 700 pounds per acre, depending upon the site.

In conclusion it is easy to see how drainage has affected British agriculture as a whole and the importance the British farmers place upon drainage on their particular properties. It has the potential to increase yields quite significantly.

We in Tasmania are possibly 25 years behind the British in draining techniques, techniques that could and should be implemented in Tasmanian agriculture. I believe that in the coming years in Tasmania many more acres will be drained by our farmers.

3. COMMON AGRICULTURAL POLICY (C.A.P.)

So much has been written about C.A.P. I think it is important to move away from discussing the structures of C.A.P. and concentrate on the long term survivability of the C.A.P.

As I see it, C.A.P. came into being as a result of the years following World War II; years when much of Europe was homeless and starving; years when even if the food was available, the transport system did not exist to bring it into the areas requiring it. Even if enough food had been available and reached its destination, it is unlikely it could have arrived on the tables of those requiring it the most, at a price that did not contain a large black market component. A similar situation continued to exist for many years.

It was from this era that the people who were to form the basis of a self contained and modern agricultural industry came.

Men and women who had experienced the War and the starvation and the deprivation that followed, men and women of Europe who had known since the beginning of the 19th Century the long term effect of the Napoleonic Laws. Laws which divided land equally among the children of a family and the compounding effect of this was to make farms very, very small and in today's terms, totally unviable. Men and women of England who were isolated and on rations from 1939-1950.

This generation, from the time Europe began to rebuild, began to look at the possibility of re-organising and restructuring its agricultural industry to become a technilogically modern and economically, in terms of the people of the land, viable.

Protection, to protect their products from competition, would remove the reliance of Europe on countries miles away and in other hemispheres, who in their turn relied on Europe as a large market for their commodities.

As the barriers were put in place to protect the small farmers of Europe, the European countries began taxing their population to pay the high cost of protection.

The nations that originally supplied Europe began developing new markets for the commodities they were now producing. As the new markets of the Middle East and Asia and Africa were developed there existed a balance in the world trade of agricultural commodities.

As the Russian agricultural base was in the main unreliable and under-developed, it relied, and even now relies, heavily on the surpluses being produced by the Western nations. Surplus which, at the time, satisfied world demand but which did not overly exceed it.

At the beginning of the 1980's it became apparent the cost of C.A.P. was increasing and becoming a heavy burden on the taxpayer.

As yet surpluses were within reasonable bounds. Markets almost satisfield production and with the odd year when production did not come up to expectations, then the surplus declined and were able to satisfy markets and Economic Community (E.C.) demand. A balance existed.

But these were the dream years. The years when the expectations of the originators of C.A.P. were realised. Years when export markets were able to soak up a large percentage of the surpluses without biting too deeply into the export incomes of countries which placed a high reliance on export commodities. It was in the years when the United States was only beginning to feel the effects of another large competitor in the world agricultural trade. It was also a time when the industrially based European economy was able to support the cost of C.A.P.

It was in the early 1980's that European agriculture production capacity began to greatly exceed its ability to absorb its over-production, both internally and on the export market.

The E.C. began to presure their own member countries who had traditional suppliers to lower import levels.

In the case of Australia and New Zealand, in particular, this meant reductions in the quantities of meat and dairy products allowed to be imported into the United Kingdom.

They were on the one hand spending vast sums of money to produce commodities they could not sell, and yet the barriers they had in place allowed imports to continue.

It was at this time the Russians began to play on the ever increasing surpluses.

Dairy products were pushed to the Russians who still were having internal trouble with their agricultural sector, at substantially lower prices. The volume of wheat sales from E.C. began to increase, depressing world wheat prices. World trade in beef was beginning to feel the effects of a surplus European production. Dairy product prices began to sag under large increases in supply. Sugar prices were being depressed by an increase in European production. In fact just about all major agricultural trade commodities were becoming very difficult to sell in a grossly over-supplied market.

Up to this point I have a great deal of respect for the Europeans and their capacity to achieve their original aims.

They had achieved something that had up to this point, been an impossible dream. They had achieved self sufficiency. They had achieved reliability. They had managed to build an outdated, unreliable, inefficient agricultural industry into one of the most

productive agricultural industries in the world. They had succeeded in becoming net exporters of beef, sugar, dairy products and wheat.

But the cash cost was getting too high. They could not now convince the next generation of the increasing need of C.A.P. to absorb more and more cash to fund senseless over-production and surpluses.

They could no longer convince the United States and other exporting nations that, through their protectionist policies, intervention prices and direct grants, they are only trying to maintain self-sufficiency and independence. They now have little or no credibility in discussions with exporting nations, nations relying on exports of agricultural commodities, such as Australia and New Zealand.

They can no longer agree amongst themselves as the politicial realities of radically different problems take over.

The internal structures of the respective nations' agricultural policies make administration of rules and regulations impossible.

It is therefore my opinion that the E.C. is going to face very difficult times if it continues to maintain its current funding levels of C.A.P.

I do not believe there is an imminent collapse ahead for the E.C. but I do believe that it is going to be forced to make some fundamental structural changes to the policies that influence the funding of C.A.P.

Some of these changes will be forced upon them by the next generation, who do not harbour the same memories of years gone by, and who have not seen the deprivation of earlier generations. The younger generation, through its fortunate position of having had the opportunities of a far broader education base than their forefathers, and are now living in the world of instant and visual media, do not have the same respect for a bygone era.

The practicability of needing consensus from all member countries hardly seem possible when one considers the differences of the Greeks and the Spanish, the Irish and the German, the French and the English, for example.

An often discussed area for funding is that 20% of the farmers receive 80% of C.A.P. funding. This is a point of contention in the densely populated farming areas of France and Germany in particular. Although these areas represent the basis for support for the general C.A.P. principal, they do not look kindly on their well to do farming cousins, farming the larger, more productive regions of Eastern England, the Parisienne Basin and Northern Germany, growing wealthier under a system which encourages production with no sense of reality in marketing.

The American Farm Bill of 1985 recognised the imposition of the E.C. on world trade, and by ratifying the Bill President Reagan set in motion an inevitable slide into a world trade war from which there can be no real winners. Since 1985, the announcement of subsidised sales of wheat to Russia and the Middle East, fuel has only been added to the fire.

My feeling is that electors through the democratic system of Government will force the European Commissioners to bring back a sense of reality to ensure the survival of Europe as a whole.

Welfare will take the place of the agricultural subsidy, in the form of "payment in kind" payments to slow production.

The larger farmers who are taking advantage of the system, and account for such a large part of C.A.P. funding, will have to become more self-sufficient and an effect of this will be that they will need to become more responsible for the marketing of their productions.

The effect of a trade war and the depressed commodity prices it produces will force land prices down and therefore force the capacity of farmers who farm the land down. Many marginal areas will become totally uneconomic and unproductive.

In the short term, and in fact as we are seeing now, export commodities produced in Australia barely recover their cost of production. In the long term the political and financial capacity of the E.C. and United States to support agriculture as strongly as they have done will diminish and I believe our agricultural economy will survive and remain viable and continue to account for a large percentage of Australia's export income.