Farmers Conference

Lincoln College

University College of Agriculture
Canterbury

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Lincoln College
University College of Agriculture
Canterbury
New Zealand
Conference Organising Committee
1982

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Part 1

THE N.Z. MEAT INDUSTRY
There can be no doubting the importance of the meat industry as the nation's number one earner of overseas funds. What does the future hold? Will our industry accept the challenges and grasp the opportunities? I believe it can and must do so. I quote Sir Frank Holmes:

The state of agriculture is less dependent on special incentives for farmers than on the general condition of the economy and on the overall economic policies which governments follow. None of the other export sectors can match the scale of opportunities available in our traditional pastoral industries. The continued steady growth in production and exports of meat, wool and dairy products over the decade will do as much for our balance of payments as spectacular growth in smaller export sectors. On the other hand a drop in agricultural output can wipe out benefits of growth in all other areas put together.

What is the current situation?

For the second successive year sheep farmers' returns are insufficient to maintain present stock numbers and performance levels, let alone provide for further expansion.

A projection into 1982/83 of the farm income and investment situation on the average sheep and cattle farm reveals a quite alarming situation. Assuming the same volume of production and the same level of SMP's plus an 18% increase in on farm costs, the likely result is that farmers will receive, in real terms, their lowest net income for a decade and also make the lowest investment per stock unit in the
decade. This is bad news for every New Zealander because it means fewer jobs for those in the many groups servicing agriculture and lower export earnings with which to purchase essential imports.

How has this come about?
In spite of steady price increases in our major markets over recent years returns have not matched the rapid internal cost escalations over which we should surely be able to exercise some control.
If current levels of cost increase continue by 1990 killing and freezing charges per lamb would be $52, and per cattle beast $610.
Impossible? Unless we create widespread public awareness and a consequent determination to act to prevent this happening.

Can’t we get better prices from the market?
Most of our major markets have available to them a wise range of competing meats, both domestic and imports.
Our product may be attractively presented, of consistently good quality and available every week of the year but if it is not competitively priced, signalling ‘good value for money’, we won’t make a sale. Customers simply won’t pay us the kind of price we need to cover our excessively high costs, when their own inflation rate is only one third to one half of ours.
Although we face the toughest possible internal competition, I’m quite clear that we have the ability and the resources to overcome the problems. But we must mobilise now and act this year.
The future is not predetermined but is a consequence of human action at all levels of industry, Government and society generally.

What then can we do?
While there has been a steady lift in productivity on the farm, if knowledge was applied by a greater number of farmers a considerable national production increase would occur.
A recent analysis of North Island hill country survey farms by the Meat Board’s Economic Service showed that the best farmers not only lifted their output very substantially over the past 10 years, but also increased their nett income at more than twice the rate of inflation.
The approach adopted by these farmers has not only benefitted them but also conferred permanent benefits on the nation.
The study also shows that the gap in performance between the best and the poorest farms has widened.
Are our slaughter stock as far as possible appropriate to changing market requirements? There is room for further significant improvement.

What is the Meat Producers Board doing?
You will be familiar with the Meat Producers Board’s involvement in export meat grading, the arrangement of shipping services and freight rate negotiations and product promotion in key markets. In addition the Board finances half the cost of the Economic Service and contributes almost $1 million to the Meat Industry Research Institute.
Projects in progress include

• A major report by San Francisco based consultants on our shipping needs and services for the next 10 years. This is expected in July.
• A thorough survey of the organisation and cost of internal transport of meat.
• Our ‘in house’ review of our export meat grades, for which submissions have been received from a number of farmers and organisations.
• A study of by-products and their processing, packaging and marketing to define more clearly what credits for them should be set against billing and processing charges.

The meat processing industry has tremendous scope for improving on capital have fallen and charges to farmers have escalated so that we now compare most unfavourably with other exporting nations with whom we are competing.

Company management, union leaders and all employees, like farmers want a strong, expanding and profitable industry. All will benefit from a stabilising of unit costs of processing. New technology must be introduced with scales of pay rates reviewed realistically and adjustments made. Public opinion must be mobilised to support such constructive action. It’s not only the meat industry that needs a searching re-appraisal of its operations.

The International Market Scene

The world economic recession persists and this affects consumer demand particularly for high priced meats. In addition, large supplies of pork and chicken are moving into world trade, not to mention heavily subsidised beef from the E.E.C. second only to Australia last year in terms of export tonnage.

Given the concentration of buying power into fewer hands, restrictions on quantities we can sell in some markets (some 75% or more of our lamb is today sold to countries imposing quotas or acting as single buyers) and the high cost of financing, a changed approach to marketing is essential.

To obtain maximum returns we need a system to handle effectively differential pricing, single buyer markets and markets requiring heavy development expenditure.

We need greater co-ordination of marketing effort and a departure from commodity trading concepts which are no longer appropriate. In our view the setting up of the Joint Meat Council will strengthen the ability of the Meat Producers Board and the Meat Exporters to work effectively together to develop and service markets and achieve maximum returns.

The role of government

• Acceptance of the need for urgency in tackling the challenges and problems outlined.
• Helping to create a favourable climate for progress through consultation and agreement by industry leaders.
• Encouraging all export sectors to deal jointly with mutual problems, with decisions based on the realities of international marketing and competition from highly efficient alternative suppliers.

The alternatives are clear

South American meat industries were devasted by the same kinds of forces we
are now facing. Unused packing plants, jobless meat workers, declining livestock numbers, reduced stock performance, inadequate topdressing and poor pasture growth. The list is depressing and the symptoms becoming too familiar. It must not happen here. We have the people and the resources. The situation is critical, so let's accept the challenge, tackle the problems, keep all New Zealanders posted on progress (like any top sports team) and win through to a soundly based expanding and profitable future for our industry's second century. It can and must be achieved.
Manipulating carcase composition to meet changing market requirements

A. J. Kampster, Planning & Development Division, Meat & Livestock Commission United Kingdom.

Our prime concern at present is to consider how market requirements for lamb and beef are changing and how carcase composition can be manipulated to adjust to the changes. Greatest benefit will be gained by concentrating on breed substitution as a means of improving carcase composition. Information about this topic has been drawn particularly from the breed comparison trials carried out recently by the Meat and Livestock Commission in Great Britain.

Motivation to Change

At the outset it is important to place carcase characteristics in perspective with other factors which influence the profitability of meat production. Producers will only change from one breed type to another if they can be shown a clear profit advantage. Those concerned about carcase objectives and who are considering the choice of breeds which give the best opportunity to meet market requirements should be asking four basic questions:

- What type of animal will be in most demand in the foreseeable future? In other words, what is the target area in terms of carcase composition and weight where the market is likely to offer the highest price?
- Which breeds should I use to get more carcasses into the target area?
- What will it cost me in terms of the purchase of new breeding stock and possible changes in production system?
- What are the returns; how much more will the market pay for carcases in the target area?
In some circumstances, a change to breeds capable of increasing the proportion of carcases in the target area can be justified simply in terms of greater production efficiency (reduced costs per unit live weight gain). But often a significant improvement in price per kg is required before it is in the producer’s interest to change. This is particularly so if his existing breed use has production advantages. Herein is the major stumbling block to carcase improvement because price differentials for quality are usually very small.

If every producer sold his finished stock as retail cuts through his farm shop he would be in no doubt about the economic significance of carcase quality and meat yield. He would also have a powerful reason for doing something about it, namely a firm financial incentive. Few producers sell in this way and most have to rely on price differentials in wholesalers grading schedules as a stimulus to change. Such price differentials are often confused and weakened by many factors in the marketing chain. Consequently they often fall seriously short in getting a clear message about consumer requirements through to the producer and stimulating change. Nevertheless, the long term future of the meat industry depends on producing what the consumer wants, so let us look at changing consumer demand.

**Consumer Attitudes and Changes in Retailing Methods**

Although there is still a small sector of the beef market in particular which continues to demand carcases with a relatively high level of fatness, the general trend in both lamb and beef is towards leanness.

The modern housewife is unwilling to pay for fat, judging quality and value for money by the lean content of the meat she buys. The cost-price squeeze is hitting the meat industry like other industries and the majority demand for cheaper lean meat is bound to dominate industry thinking in the future.

Consumer demand can be modified to some extent by the traditional butcher preparing individual cuts on demand. However, the gradual replacement of traditional meat retailing by self-service supermarkets, specialist multiple retailers and independent butchers preparing large quantities of meat for display, gives more emphasis to consumer demand.

The experience of self-service stores in which pre-packs have to be severely and uniformly trimmed of fat to avoid the risk of the pack being left at the end of the day is now common to their modern counter service competitors. They are thus becoming increasingly aware of the economic advantages of carcases with high saleable meat percentages. They are likely to become more and more demanding when selecting carcases and increasingly unwilling to pay the same price for lean and fat carcases.

The other trend which is evident is towards heavier carcases. Provided they are lean, such carcases are cheaper to process and offer greater flexibility in the preparation of retail cuts. The primary need, therefore, is to identify breeds which are capable of producing large lean carcases.

**The Target Area for Lamb**

In Britain the problem of improving carcase characteristics has been approached by defining the area in the national classification scheme where the main consumer and retail requirements lie.

The main band of carcase weight for lamb in Britain is approximately 15 to 22kg.
with heavier carcases normally receiving a lower price. The European market (Belgium, France and Germany) requires carcases in the narrow 15 to 19 kg range while lighter carcases are required for the smaller markets in the Middle East (12 to 15 kg) and the Mediterranean countries (11 to 13 kg).

Meat trade requirements for fatness levels are more uniform and essentially for fat classes 2 and 3L in the Meat and Livestock Commission Sheep Carcase Classification Scheme, with a European preference for lambs in fat class 2 with good conformation. (These are the fat classes with high meat yield and sufficient fat for quality meat). Some sectors of the domestic trade will accept somewhat higher levels of fatness (3H), but lambs in fat class 4 will be significantly discounted by retailers and those in fat class 5 heavily so. So the weight and fatness requirements of Britain’s primary export market (the European market) are not fundamentally different from home demand.

Good conformation is in demand particularly for the Continental market but since we know that differences in conformation have little influence on lean meat yield or proportion of higher-priced joint (Kempster, Croston and Jones, 1981) average conformation classes are not excluded from the target area.

Figure 1: Fatness × Confirmation Grid Used in the MLC Sheep Carcase Classification Scheme Showing the Target Area.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3L</td>
</tr>
<tr>
<td>3H</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Target carcase weight 15 to 20 kg

Taking the different factors together we consider the target area for lambs to be 15 to 20 kg carcase weight in fat classes 2 and 3L with average or good conformation. Figure 1 shows the target area in the Meat and Livestock Commission Sheep Carcase Classification Grid. (Details of the classification scheme are given by the Meat and Livestock Commission 1980).

Sire Breed Differences in Sheep

Results available from MLC’s Ram Breed Evaluation programme show how the main sire breeds compare in their potential for meeting target area requirements. The programme was set up in 1974 and extended over five years. The object was to compare some of the more important sire breeds in Great Britain and also to
assess the importance of recent importations. It was carried out in commercial flocks selected to cover a range of management systems, with an average of five flocks included per year. Three breed types of commercial ewe were involved Scottish Blackface, Scotch Halfbred (Border Leicester x North Country Cheviot) and Mule (Bluefaced-Leicester x Swaledale). Each flock consisted of ewes of one breed type. Within each flock, the two rams of each of the sire breeds shown in Figure 2 were used, each ram being run with 25 ewes. The lambs were grown under normal commercial conditions as one group.

Figure 2:

<table>
<thead>
<tr>
<th>Average carcase weights at fat class 3L (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WENSLEYDALE</strong></td>
</tr>
<tr>
<td><strong>OXFORD</strong></td>
</tr>
<tr>
<td><strong>BORDER LEICESTER</strong></td>
</tr>
<tr>
<td><strong>SUFFOLK</strong></td>
</tr>
<tr>
<td><strong>TEXEL</strong></td>
</tr>
<tr>
<td><strong>NORTH COUNTRY CHEVIOT</strong></td>
</tr>
<tr>
<td><strong>ILE DE FRANCE</strong></td>
</tr>
<tr>
<td><strong>HAMPShIRE DOWN</strong></td>
</tr>
<tr>
<td><strong>DOSET DOWN</strong></td>
</tr>
<tr>
<td><strong>SOUTHDOWN</strong></td>
</tr>
</tbody>
</table>

Lambs of each breed cross were slaughtered over a range of live weights corresponding approximately to fat classes 2, 3L and 3H of MLC’s Sheep Carcase Classification Scheme. The weights were selected on the basis of the adult body weight of the particular crossbred.

Carcase weights achieved for progeny of the different sire breeds slaughtered at fat class 3L are shown in Figure 2. These are the results averaged over the three dam breeds and equivalent to the performance of the sires with a Mule ewe. As would be expected, there were important differences in carcase weight, with a range of 4 to 5 kg between progeny of Southdown and Wensleydale sires. The ranking of the breeds was well related to their estimated adult body size although there were some small deviations.

The position of the Texel is particularly interesting because there has been speculation about whether the breed will achieve higher carcase weights than the Suffolk at the same level of fatness. The results indicate that there is not much in
The other requirement of the target area is conformation. In the MLC Sheep Carcase Classification Scheme we define conformation as the thickness of muscle and fat in relation to the size of the skeleton. Figure 3 shows how the sire breeds in the Ram Breed Trial compared in conformation. Since the lambs were compared at equal fatness, conformation can be regarded essentially as muscularity, i.e. the thickness of muscle in relation to the size of the skeleton. Lambs by Southdown and Texel sires had the best conformation followed by Ile de France, Dorset Down and Suffolk sires.

Figure 3:

**AVERAGE CONFORMATION**
**AT FAT CLASS 3L**

(all the average fall into conformation class A in the MLC Sheep Carcase Classification Scheme).

<table>
<thead>
<tr>
<th>Score</th>
<th>Breed</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.5</td>
<td>SOUTHDOWN</td>
</tr>
<tr>
<td></td>
<td>TEXEL</td>
</tr>
<tr>
<td>8.0</td>
<td>ILE DE FRANCE</td>
</tr>
<tr>
<td></td>
<td>DORSET DOWN</td>
</tr>
<tr>
<td>7.5</td>
<td>SUFFOLK</td>
</tr>
<tr>
<td>7.0</td>
<td>HAMPSHIRE</td>
</tr>
<tr>
<td></td>
<td>OXFORD</td>
</tr>
<tr>
<td></td>
<td>NORTH COUNTRY CHEVIOT</td>
</tr>
<tr>
<td></td>
<td>WENSLEYDALE</td>
</tr>
<tr>
<td></td>
<td>BORDER LEICESTER</td>
</tr>
</tbody>
</table>

* CONFIRMATION SCALE 1=low to 15=high

Texel crosses had an advantage over the other crosses tested in the carcase lean content (Figure 4), reflecting both a lower bone content and a lower kidney knob and channel fat. However, the conformation of Texel crosses was not sufficient to clearly identify their advantage. It is recommended, therefore, that Texel crosses should be sold as a special type with premiums for leanness.

An interesting comparison in these results is that between Suffolk and Border Leicester sires (the Border Leicester is, of course, a component breed of the Coopworth, which has gained considerable popularity in New Zealand). It can be seen from Figure 3 that the Border Leicester has a poorer conformation than the Suffolk. However, when the results in Figure 4 are considered, it can be seen that the Suffolk and the Border Leicester crosses differ very little in the actual lean content of their carcase. Suffolk crosses, although of good conformation have the limitation of heavy bones which places them at some disadvantage in terms of lean content at the same level of fatness.
There is much less variation in the proportion of higher-priced cuts than is often supposed. The range between sire breeds in the percentage of lean which occurred in the higher priced joints (leg, chump, loin and best end of neck) was only 1.5 percentage units. The Texel crosses were slightly poorer than the Down breeds in this respect.

The Target Area for Beef

The target area concept has been applied to beef in Britain in exactly the same way. Figure 5 shows the target area in the EEC Beef Grading Grid which is now in use in Great Britain. (Details of the EEC Beef Grading Scheme are given by Kempster, Cuthbertson and Harrington, 1982). There is more diversity among wholesalers requirements than for sheep and a belief by many that relatively high levels of fatness are needed to ensure good eating quality. Figure 5 illustrates the way that three wholesalers in Britain use classification at the moment. Each wholesaler uses the scheme in a way which best meets his requirements yet there is an overlapping of the top grades in the target area. Even the major Scottish wholesaler (C) who is selling carcases at the fatter ‘quality’ end of the range has a demand for some target carcases.

MLC has carried out a Beef Breed Evaluation programme to determine how the main sire breeds used in Britain compare when used in different production systems. The programme was set up in 1972 at two purpose-built beef units and extended over eight years. Two dam types covering the two main sources of beef in Britain were involved: dairy bred cattle out of Friesian dams and cattle from the beef suckler herd out of Hereford x Friesian and Blue-Grey dams (Galloway x Whitebred
Shorthorn). Two systems of feeding were examined for each dam type; the result for one system for each dam type are shown in Figure 6 which also indicates the sire breeds involved.

Figure 5: Target Area and Different Buyers’ Preferences
(The identification of classes according to the EEC scheme is given in the grid for buyer (a))

Results are available for the single slaughter point phase of the trial in which cattle were slaughtered at a fixed level of fatness close to the national average on the borderline of fat classes 3 and 4L in the EEC Beef Grading Scheme. (Results for the dairy-bred comparison have been published by Southgate, Cook and Kempster,
Crosses by different sire breeds reach the same level of fatness at very different carcase weights as shown in Figure 6: there is a range in carcase weights of 30% in the suckler-bred system and 45% in the dairy bred system.

Figure 6: Average Carcase Weight at Fat Class 3/4L for Crosses by Different Sire Breeds

<table>
<thead>
<tr>
<th>Carcase Weight (kg)</th>
<th>Suckler-Bred</th>
<th>Dairy-Bred</th>
</tr>
</thead>
<tbody>
<tr>
<td>280</td>
<td>CHAROLAIS</td>
<td>16 MO</td>
</tr>
<tr>
<td>260</td>
<td>SIMMENTAL</td>
<td>CHAROLAIS</td>
</tr>
<tr>
<td>240</td>
<td>LIMOUSIN</td>
<td>SIMMENTAL</td>
</tr>
<tr>
<td>220</td>
<td>S.DEVON</td>
<td>S.DEVON</td>
</tr>
<tr>
<td>200</td>
<td>LINCOLN RED</td>
<td>•FRIESIAN</td>
</tr>
<tr>
<td>180</td>
<td>DEVON</td>
<td>HEREFORD</td>
</tr>
<tr>
<td>160</td>
<td>ANGUS</td>
<td>LINCOLN RED</td>
</tr>
</tbody>
</table>

Results coming forward from MLC’s beef breed evaluation programme enable the clear identification of the differences between the main breeds and crosses in the commercial value of their carcases. Figure 7 shows how dairy-bred cattle by different sire breeds compare in terms of the two main carcase characteristics which influence commercial value at the same level of fatness. Meat to bone ratios (which determine saleable meat yield among carcases of equal fatness) range from 3.4 (Holstein x Friesian) to 4.0 (Limousin x Friesian). If the cattle were three-quarters-bred beef from the suckler herd, the average level of the ratios would be higher by 0.1 to 0.2 but the relative performance of the sire breeds would be essentially the same.
Figure 7: Meat to Bone Ratio and Percentage of Higher-Priced Cuts for Crosses Out of Friesian Dams by Different Sire Breeds

<table>
<thead>
<tr>
<th>M/B</th>
<th>%HPC</th>
<th>Breeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.0</td>
<td>45</td>
<td>LIMOUSIN</td>
</tr>
<tr>
<td>3.9</td>
<td>44.5</td>
<td>CHAROLAIS</td>
</tr>
<tr>
<td>3.8</td>
<td></td>
<td>ANGUS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SUSSEX</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CHAROLAI S</td>
</tr>
<tr>
<td>3.7</td>
<td>44</td>
<td>HEREFORD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LINCOLN RED</td>
</tr>
<tr>
<td>3.6</td>
<td></td>
<td>FRIESIAN</td>
</tr>
<tr>
<td>3.5</td>
<td></td>
<td>HOLSTEIN</td>
</tr>
<tr>
<td>3.4</td>
<td></td>
<td>HINTON</td>
</tr>
</tbody>
</table>

There is much less variation between breeds in the proportion of higher-priced cuts than is often supposed and no detectable differences between the native beef breeds. Charolais and Simmental crosses have a slightly better meat distribution than the native breed crosses, and Limousin crosses a further advantage.

Estimates of the combined value of these differences in meat to bone ratios and meat distribution are shown in Figure 8 together with typical meat yields for cattle of the same external fat cover. The level of external fat cover is, on the borderline of fat classes 3 and 4L in the EEC Beef Grading Grid, close to the centre of the target area. The values also take account of any differences in meat yield which occur because some breeds have more intermuscular fat (seam fat) which requires trimming. The Devon and Lincoln Red crosses lose a little ground on this account. Limousin cross cattle are most valuable (the limited information available indicates that Blonde d’Aquitaine are equally good). Under British price conditions a producer of this type of cattle could realistically expect 5p/kg carcass weight more than the price for Hereford x Friesian and 10p/kg more than that for Holstein x Friesian with the same fat cover. This is provided carcass weights and levels of fatness were consistent with his buyer requirements.

In many trading situations, breed cannot be identified and estimates of meat yield among cattle of the same fatness have to be made on the basis of visual judgements of conformation. The relationship between breeds, conformation and meat yield is illustrated in Figure 9 using the conformation scale in the EEC Beef Grading Scheme. Moving up the conformation scale, there is a change in breed type from purebred Canadian Holstein through British Friesians to the native red breed crosses and on to the muscular Continental breeds which have the highest...
Figure 8: Value of Carcases by Different Sire Breeds Relative to Holstein Cross Carcases*

<table>
<thead>
<tr>
<th></th>
<th>Average Carcase Meat Yield (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIMOUSIN</td>
<td>72</td>
</tr>
<tr>
<td>ANGUS</td>
<td>71.25</td>
</tr>
<tr>
<td>CHAROLAIS</td>
<td>71.25</td>
</tr>
<tr>
<td>SUSSEX</td>
<td>70.25</td>
</tr>
<tr>
<td>SIMMENTAL</td>
<td>70.5</td>
</tr>
<tr>
<td>SOUTH DEVON</td>
<td>70.5</td>
</tr>
<tr>
<td>HEREFORD</td>
<td>70.5</td>
</tr>
<tr>
<td>DEVON</td>
<td>70.5</td>
</tr>
<tr>
<td>LINCOLN RED</td>
<td>70.25</td>
</tr>
<tr>
<td>FRIESIAN</td>
<td>70</td>
</tr>
<tr>
<td>HOLSTEIN</td>
<td>69.25</td>
</tr>
</tbody>
</table>

*All cattle were out of Friesian dams

Figure 9: Percentage of Carcases of Different Crosses Falling into Different Conformation Classes (Fat Class 2/3L)

<table>
<thead>
<tr>
<th>Purebred</th>
<th>Friesian Crosses By:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Holstein</td>
</tr>
<tr>
<td><strong>Conformation</strong></td>
<td>%</td>
</tr>
<tr>
<td><em>(U+)</em> 5 BEST</td>
<td>4</td>
</tr>
<tr>
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Average Carcase Meat Yield(%)

|                | 68.5 | 70  | 70.5 | 71.25 | 72  |

*EEC conformation classes.
conformation. Considered in relation to Figure 1, it is possible to see how breeds compare in their ability to achieve the target area.

Recent studies on conformation (Kempster and Harrington, 1980) show that knowledge of breed is a more valuable guide to meat yield than conformation. This is because conformation assessments are easily confused by differences in fatness even within the same fat class, and because there are breeds, for example the Aberdeen-Angus and Sussex, which have high meat yields not because they are heavily muscled (and hence of good conformation) but because they have light bones. In view of this there is a case for wholesalers to include breed type in their buying specifications together with weight, fatness and conformation. By the same token, producers using breeds known to have high meat yields should be looking for wholesalers willing to pay realistic prices for them.

Meeting Market Requirements

As indicated at the outset an objective has both an ideal to aim at and a reason for wanting to achieve it. In Britain it is argued that the objective for the producer is best summed up as follows: to maximise the proportion of carcases he can shoot into the target area, provided benefits exceed costs, and then sell them in such a way as to get the best realisation. For the target concept to carry any weight there must be clearly defined benefits. This involves better market information which means prices (both offered and achieved) linked to appropriate descriptions, leading to clear price differentials and the necessary incentives for improvement.

The British pig industry has had this market transparency for the past ten years and the improvement in carcase quality has been dramatic. This has resulted in lower pig meat prices to the consumer and a more favourable position vis à vis the red meats. It can be argued that in pig production, reductions in fatness and improvements in efficiency of production are intimately linked and support one another. But there is no obvious reason why this should not be the case for sheep and beef production as breed substitution and production systems develop and push more carcases into the target area. If beef and lamb are to compete with pig meat and poultry, they too must move in the consumer orientated direction.

References


For an exporter of any product, it is imperative to fully understand a proposed market. In recent years, meat exporters must be given credit for considerable effort in market study. It is very time consuming and hard work to study, develop and service an overseas market efficiently. This of course applies to any commodity.

Having made this point, I would like to go over with you some basic knowledge of the USA, and in most cases, my figures and explanations apply similarly to Canada.

Many people seem to perceive the USA as being covered by major cities, this is perhaps understandable when most visitors see the urban sprawl and mind-boggling size of New York City, Chicago or Los Angeles. Unfortunately most people, for example do not see the beauties of residential areas no more than 30 minutes out of Manhatten. The USA covers 3,675,545 square miles, or about 2300 million acres. In reality, it is one giant farm, park and forest.

About 90 per cent of land area is in use for some form of agriculture or forestry a huge food-producing capacity. Nevertheless, the population density is double that of New Zealand.

Figure 1 represents the USA, with each square being 100 million acres. Only the two shaded squares, or 9 per cent of total land area, represent urban and transportation etc., or non-productive land for agriculture or forestry. It is interesting that the mountains in many areas (up to 11 or 12,000 feet) are grazed for limited periods.
Figure 1: Land Use U.S.A. 1977

Each square equivalent to 42 million hectares

Crops, Pasture & Range

Forest Land Not Grazed

Urban Road & Rail & other Non-AG. Land

Agriculture 615 million ha
Forest not grazed 250 million ha
Urban, Transport, etc. 85 million ha

TOTAL LAND AREA 950 million ha

Figure 2: Cattle, Sheep & Hogs – U.S.A. % by Region 1-1-80
This map of the USA in broad geographical regions illustrates particularly the disposition of livestock farming. In the large central belt are concentrated 70 per cent of all cattle, 85 per cent of hogs and 45 per cent of sheep and lambs. In this same area there are of course many major cities, such as Chicago, Dallas, St Louis, Cincinnati and many others. For comparison, the New Zealand total land area equates to that of the State of Colorado, the shaded square.

In a country with in excess of 220 million people, the demand for food products, and the variety demanded, ensures very substantial trading. If we look at imports of livestock, meat and meat products, the value in 1981 was almost 3000 million U.S. dollars. Exports of these products were slightly in excess of that figure giving close to a balanced trade. It is important to note here that meat exports are growing and quite often the USA is a competitor of New Zealand. In 1982, beef and veal exports from USA were worth 300 million dollars, and offals a further 306 million dollars.

Figure 3: Comparison of Beef, Offal and Pork Exports to U.S.A. 1976-81

Figure 3 clearly shows that while pork exports were falling, beef and offal exports enjoyed considerable increases over the past 5 years.

Figure 4 shows the countries exporting primarily frozen beef to USA. Australia is still by far the largest shipper but greatly below the level of 3 years ago. New Zealand is an easy second place with the Central American area just ahead of Canada.
Imported fresh or frozen beef into USA/Canada provides only about 7 per cent of total supply, nevertheless it will amount to about 500 million kilograms this year. New Zealand provides about a quarter, but we have several competitors, all with a similar product. Fourteen countries contribute to this category illustrated by diagram D. It is important to remember that in the 1980/81 season 84 per cent of New Zealand’s beef production went to North America.

Meat production in USA shows a clear pattern over recent years. A considerable loss of beef production while pork and poultry have made significant gains. The population during this time (from 1973) increased by about 15 million. Mutton and lamb is not shown as the chart starts at 5 million tonnes, whereas sheep and lamb production was only 149,000 tonnes in 1981.

Politics and trade policy of other countries you may well say are their business. Today, regrettably this is not so. We live in a world of ever increasing protectionism. By far the greatest part of my time in North America, and that of our Government representatives overseas, has been taken up with such issues. Thankfully, the USA seems now to be on a clear international free trade path. They are very determined to do something about problems with Japan and the EEC particularly. The Japanese now have 23 per cent of the USA automobile market, 90 per cent of motorcycles, and 50 per cent of the camera and electronic market, while all efforts to improve access to Japan have so far not met with much success. Similarly, the effects of EEC export policies are causing the USA and ourselves very great concern.

It is ironic that during my time in North America, domestic USA pressure for import protection was extremely strong but hopefully the tide was turned. Much of
my travel was due to the necessity to constantly defend New Zealand's position and fight anti-import efforts. There were never-ending Congressional and agency hearings, covering regulations and bills before Congress. These covered import quotas, labelling, hygiene and inspection, humane slaughtering, duty provisions, and many others that could have drastically affected our beef and lamb trade. To a lesser degree, but no less serious, the same applied to Canada. No opportunity could be missed to make our case to Government agencies, committees, farmer groups, meat packer groups, etc. A key function of Board officers overseas has been to work as closely as possible with producer groups. In my case, regular liaison and dialogue had to be maintained with such groups as the National Woolgrowers, Lambfeeders, Sheep Producers Council, Farm Bureau, National Cattlemens Association, Canadian Cattlemens Association, Canada Sheep Council, American Meat Institute and various importer and packer associations. To assist and advise we engaged a lawyer/lobbyist in Washington DC, who frequently in the past two or three years has been almost full-time on our case.

For domestic producers and politicians, imports become a convenient whipping boy, frequently being cited as being the cause of downward price pressure in the market. These attitudes, current activity and resultant laws and regulations must be understood by a seller, to get a feel for the environment into which our exporter is selling. Presently, both the USA and Canada have beef import restriction mechanisms in place, although they have not been activated for several years. It is
most likely pressure will continue by the inspection and labelling activists, and in both USA and Canada, lamb producers are very sensitive of our market activity.

This field is extremely specialised and to be briefed, an exporter requires expert advice. The complexity of regulation and government affairs is enormous especially in Washington DC. In concluding this subject, a few facts illustrate the problem. In 1979 it was estimated there were 15,000 special interest lobbyists in Washington DC, who spend around one billion dollars annually attempting to influence Congress. There are a large number of Congressional Committee with a strong agriculture bias in membership, and many members of Congress have agri-business interests. And just imagine one has to find a way around about 9000 employees in USDA head office in Washington.

Although my figures are primarily for the USA, it is necessary to appreciate that it is a North American market, allowing for some relatively minor differences between USA and Canada. It would be nice to say that our export beef prices are about to take off. That would be patently untrue. Some people are saying the ingredients are almost right for an improvement, but an improvement in the state of the USA economy may be the one signal still to be in place. Currently inflation is reducing but interest rates are still very high. The CIF price of New Zealand cow beef when I went to New York in January 1978 was 69 cents per lb, and in May 1979 reached 143, but during that time and since, its graph looks more like a roller coaster design in an amusement park.

Figure 6: US cents per lb prices – (C.I.F)

Figure 6 shows the volatility all too clearly. The brief peak in August 1981 was the result of the Australian substitution scandal. All this year we have struggled along around the level at the end of 1981. The lower line for comparison is the wholesale price for grade A broilers in New York during 1981.
At present inventories are low and imports this year will be well down, beef from Costa Rica is banned, Danish pork is greatly reduced and US pork production is down nearly 10 per cent, and domestic cattle prices have strengthened. An improvement in the US economy added to these other factors might hopefully stimulate demand, and price. You will note from the graph though, that rising periods never maintained an upward trend or even steady levels, higher price periods being short-lived and followed by sharp falls. This tends to be characteristic of the commodity type of trading, into which category our beef to North America falls. In real terms, applying the USA C.P.I. as a deflator, the end December 1981 price is only 74.2 cents.

Figure 7: Retail Price of Pork & Chicken as a % of Choice Beef at Retail

It is also interesting to observe the retail trend and this chart shows pork and chicken prices as a percentage of beef prices. The trend is obvious with chicken only 30 per cent of beef and pork at 64 per cent.

This leads me on to consumption, specifically of animal protein. Firstly the production side. The phenomenon of the cattle cycle is well known to you. They have been well documented and traced in USA back to the last century. In general terms, it has 10 year phases, but the phenomenon, although addressed by many analysts, it is still not well understood. Charlie Gracie, the Canadian Cattlemen's Association Manager, in a recent paper suggested four different aspects, viz total cattle numbers, beef cow numbers, beef supply, and beef consumption.
Let us trace for a moment the USA livestock inventory.

Cattle enjoyed a steady upward trend from 1950 to 1975, then probably the most defined cycle this century and the herd fell by 21 million head from 1975-1980. Hogs have been steadier but 13 million were gained from 1975-1980. Sheep and lamb an inexorable decline from 1960, with just a slight turn upwards from 1980. In the 1940s, USA had 50 million sheep, now 13 million.

Figure 9 illustrates consumption patterns. Beef down sharply, while pork and poultry became the main competitors. You will also note that cheese has enjoyed steady upward movement, while veal, lamb and eggs have fallen away.

Why is consumption down? Mainly because less beef has been produced in recent years. Why? Recent near record supplies of pork, and ever-growing poultry supply, came at a time when beef prices were near record levels. The consumer presented with lower priced pork and poultry at a time of high unemployment, high interest rates, and inflation fed prices for the other necessities of life, simply chose competing products more frequently than beef. Beef has a high cost of production and is a high priced product.

In a recent report the National Cattlemen's Association gave breeding growth figures for livestock and chicken. In Figure 10 the figures have been graphed, cumulatively from index 100 in 1950. The result is all too abundantly clear.

The inferences are clear. To maintain the competitive position of beef, a concerted effort must be made by all involved from producer to processor through distribution to market to retail and to consumer, to improve efficiency. Production, education and promotion must be improved to counter the negative of waste through excessive fat, and the negatives of the perceived diet and health lobbies.

Again quoting NCA figures, the average cow produces 0.7 progeny, per year.
about 70 per cent of her body weight, the sow 14 progeny for 8 times body weight, and a meat type hen 150 progeny, 100 times body weight. The average broiler breeder hen accounts for 440 lbs of retail meat weight per year, while the cow accounts for 325 lbs at retail.

Scientists, farmers, processors the challenge is yours. Time is running out;
Figure 10: Livestock Production per Breeding Unit
Chicken Production per Laying Hen

30 Year Movement

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Livestock 62.7%
Chicken 505.0%

there is more room for development and improved efficiency in the technology of beef production, and significant catching up is necessary on the technology achieved in the production of competing meats.
Farmers' responses to the market demands of the 1980's

K. J. Dunlop, farmer, Winton, Southland.

Before looking to the future we should review the influences many farmers have responded to since the mid-1960's.

First, there was the push for increased stocking rate. I joined the move and lifted my sheep from 14 stock units to 20 stock units per hectare. I managed to push my lambing percentage down from 125% to 115% and even grazed out the Californian thistles.

Farmers were told they were better off. In my case, I was producing 365 kg lamb meat per hectare and 101 kg wool per hectare by 1971. The average in Southland is current 185 kg meat and 80 kg wool on similar farms.

This drive for increased production per hectare and per labour unit resulted in the move to easy care sheep. It saw the emergence of large-scale group breeding schemes.

After a few adverse climatic season and disappointing financial returns in the 1970's, there was a change in emphasis from increasing stocking rate to improving per head performance.

I joined the move in 1976 and cut my stocking rate back to 17 stock units per hectare but lifted the lambing to consistently above 150% and a wool clip better than 5kg per head. This came from a change in breed and from selection within breeds. This year my sheep have given a gross margin return of $525 per hectare; wheat at 5.4 tonnes per hectare has returned $507.

Since I began farming in 1964, the returns from sheep and wheat in Central Southland have been remarkably comparable. While wheat yields from new varieties have increased, so has the productivity of sheep.
Wool-Pull

Another important response in the last 10 years has been the move away from short woolled terminal sires to long woolled sires. The margin in extra wool value increases from 50c per head early in the season to more than $1.50 in March and April. It would be a misjudgement of the situation to encourage producers to go back to early maturing sires which enhance extra fat deposits at lighter weights.

So why should I be talking to you about responses to the market demands of the 1980’s?

It is because I’m interested in the long-term welfare of the New Zealand meat industry, sheep in particular, and because I’m in a position as a stud sheep breeder and as a director of a freezing company, to influence decisions all along the line from the selection of stud rams to the marketing of meat to satisfy the consumer.

Two years ago I was fortunate enough to spend six months on a Nuffield Scholarship studying meat marketing in Europe amidst the lamb war (or “guerre de mutton” as they say in France) which gave me another perspective of the politics in world trade.

What do I see?

• The world does not owe us a living.
• We can no longer think of putting a cheap product on the European market. People will pay for quality if the marketing has expertise and the product is up to standard.
• The New Zealand producer cannot afford to be complacent.
• Prejudices and misconceptions must go.

For example, here is a description of the ideal mutton breed:

“A ram should have a masculine head, and the ewe a feminine one, but not so narrow-nosed as we sometimes see. By activating the kind of head I have indicated you not only get an unmistakable type but a really handsome head denoting a combination of quality, kindliness and good constitution.”

This is a description of the Southdown by a breeder last century quoted in the book, “Keys to Prosperity”, written for the Southland Frozen Meat Company’s centenary.

I sometimes wonder how much farmers’ attitudes have changed when I hear saleyard talk of good heads denoting good constitution and conformation. I also wonder why the schedule doesn’t make clearer signals to producers to avoid sending in overfat lambs.

It is worth noting that the percentage return per kg from an overfat lamb compared to a PM or YM grade is considerably higher in 1982 than the previous season.

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<tr>
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<th>1981 Cents per kg</th>
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<td>F Schedule</td>
<td>46] 40.4%</td>
<td>66] 56.4%</td>
<td>95] 65%</td>
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<td>PM Schedule</td>
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<tr>
<td>F Schedule</td>
<td>46] 41%</td>
<td>66] 61.1%</td>
<td>95] 69.3%</td>
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<td>YM Schedule</td>
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This is of great concern to the industry. To find that the F grade, from returning only 41% of the price per kg compared to YM grade last year now being nearly 70%, makes a mockery of all the requests to produce lean carcases. Southland may be an exception this year, but currently 10% of the lines killed are exceeding 10% of lambs grading overfat. In addition, many are being held on farms in order to reduce fat levels by starvation. Surely this is a waste and risks affecting the quality of meat.

The one clear message, which comes from virtually all commentators and people responsible for marketing lamb, is the need to reduce fat levels. When we discuss muscling, conformation and quality, the only thing we can be certain of is that we are talking about minimum fat content. How often, for instance, does the winning lamb on the hoof win the carcase competition? In fact, often the reverse occurs. In many cases, good conformation amounts to fat filling in the hollows.

For example, the 1st, 2nd and 3rd placed lambs judged live at the Gore Agricultural and Pastoral Show last December were subsequently placed 7th, 5th and 4th, as carcases when they were judged in London several weeks later.

To quote from the Meat Trades Journal, March 4th, 1982:

"According to London retailers, the live champions tended to be too heavy in the shoulder, they were too large and overfinished and demonstrated the difficulty of 'judging on the hoof' compared with appraisal on the hook.'

What then should be the farmer's response?

Clearly there are both farm management and genetic considerations.

Weighing of Lambs

More farmers are weighing lambs as a guide to achieving certain weights for slaughter and for management purposes. Weighing for slaughter may not be an exact science but it is rather like a budget. Once you have done it, better decisions are made. For most sheep farmers I would suggest that they work in close liaison with their drafter to condition score their lambs. After all, drafters are handling sheep all the time and should be competent to do this. Generally the more condition a sheep carries, the higher the killing out percentage. If lambs are run into the sheepyards and weighed promptly, the killing out percentage varies from 43% to 46%, but I have heard of some as low as 39%. Of course, it is important to have the scales accurate.

The advisory section of the Ministry of Agriculture and Fisheries could do well to give equal consideration to target weights for slaughter as they do for target weights for reproduction.

Often farmers reaction to weighing is, "Oh, it's alright for you, but I've got too many and it takes too much time."

All I can say is, if your wheat gets yellow stripe rust, you're probably inclined to spray it more promptly if you've got a 100 hectares than if you have only 10 hectares. It's a case of getting maximum yield and preserving quality.

So it's important to have your scales set up so that weighing becomes an automatic part of handling sheep. You will then be able to get maximum yield and preserve quality.

On our farm, we've used scales apart from stud work to advantage in contrasting seasons. The 1980/81 season was very dry in Southland and having had poor spring growth it was important to quit lambs at light weights. In January, I sold 383 stores at $13.33 per head (net after commission). One week later, after some advice, I ran the balance over the scales and all those over 26 kg (195) went to the works. They killed out at $14.38; that is, $1.03 more for each lamb. I had the
benefit of them being pooled and they qualified for a rebate as well. In January this year, the opposite applied and only lambs above 32 kg liveweight were sent. Another cut above 28 kg were marked and the balance were shorn. The result was that I had sent 85% of my available lambs to the works before space in the works became difficult to obtain after the end of March. There was an abundance of feed and lambs were “doing well”, but I was happy to take $26 for 15.5 kg lambs, knowing that space and the risk of overfat lambs would become real problems.

If the schedule is studied, it can be seen that the meat value for a PL 12.5 kg lamb at 128c is $16.00. Put on .5 kg to 13.0 kg PM and it is now worth $18.98 ($2.98 for that extra .5 kg) or $5.96 per kg. Surely the best paid price the producer will get!!

While it is acknowledged that pool returns and per head buying camouflage the schedule signals, there is a good case for farmers to study the schedule, use scales and assess the pasture available. Then, along with prospects for killing space, they can make better decisions of when and how many stock to kill.

As to killing space, both the producers and the freezing companies have a responsibility to look at ways of improving the congestion. From the 1981 New Zealand Meat Producers’ Board Annual Report, it can be seen that over 90% of the South Island kill occurs in a seven month period from December to June. In Southland, if given the opportunity, most of that 90% would be killed in the three months of February, March and April. Surely there is scope for a limited number of contracts to be given by freezing companies for producers to receive a premium for regularly supplying stock in off-peak killing periods.

Ram Lambs

There is clear evidence that there is significant advantage in terms of growth rate and leaness by leaving ram lambs entire. At this year’s Animal Production Society Conference in Dunedin, Dr. A. H. Kirton from Ruakura Research Station, showed that, killed at 19 weeks of age, lambs killed out as follows:

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<th>Ram</th>
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<td>14.6kg</td>
<td>15.2kg</td>
<td>16.0kg</td>
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<tr>
<td>fat</td>
<td>31.5%</td>
<td>28.0%</td>
<td>25.6%</td>
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It is time the extra cost to companies for killing ram lambs was dropped.

Genetics

Response to selection for growth rate can pay handsome dividends. It is moderately highly heritable, and there is certainly sufficient variation within our flocks for good gains to be made.
The following results from my flock show this:

Weight gain 100 days post-weaning:

1980/81 - highest sire group of ram lambs - 16.5kg gain
1980/81 - lowest sire group of ram lambs - 15.0kg gain
1981/82 - highest sire group of ram lambs - 17.88kg gain
1981/82 - lowest sire group of ram lambs - 13.98kg gain

The difference of 1.5 kg in the 1980/81 year and nearly 4.0 kg this year is significant. The variation of individuals is even greater with the top 10% of ram lambs putting on 20kg or more and the bottom 10% - 13 kg or less.

Quality

Let us face facts. There is little the producer can do to influence taste and tenderness. Processes beyond the farm gate, such as electrical stimulation, slaughter, freezing procedures, and subsequent temperature control in transit, have a far greater bearing on what the consumer reaction will be. By adding retail display and packing to this list, we see a further perspective of the producer’s role in influencing the final retail price.

We need continuing research to develop, with more authority, indicators on the live animal which represent better muscling and a higher cutting out percentage when slaughtered.

Summary

The major threat to sheep meat is the cheaper alternatives of grain-produced white meat namely, pork and poultry.

Therefore, in response to the market demands of the 1980’s, I suggest that we, as producers, should financially support efforts by the New Zealand Meat Producers’ Board to increase promotion and marketing campaigns.

We should look more carefully at our own management and, in conjunction with stock drafters using conditioning scoring, we should use scales to market stock for our financial gain.

We should concentrate on selecting breeding stock for fast growth rate to market weights, for heavy wool and improved fertility.

In doing this, an improved quality product will be available for exporters to market to advantage.

With the arrival of the 21st century, we will no longer have freezing works. New technology and market competition will have demanded that we have processing plants; freezing and exporting of carcasses will have become redundant.
SHEEP GROSS MARGIN 1981-82

Take 1000 ewes
  300 ewe hoggets = 1225 s.u.
155% lambing
Wool 5kg per ewe
  4.5kg per ewe hogget
Income: $ $

Wool $ 6350kg @ 300c nett $19,050
Lambs 1250 @ $26 15.5kg $32,500
  300 replacements
Cull Ewes 270 @ $10 $2,700

Expenses:
Rams - 3 @ $325 $975
Shearing 1300 @ $112 per 100 $1,456
Crutching 1000 @ $38 $380
  300 @ 26 $78
Animal health, eartags, harness,
  footrot formalin, penicillin
  lambing $400
Dipping 1300 @ 20c. $260
Drenching ewes @ 15c.
  lambs 4×1550×7c. $420
  hoggets 3×10c.×300 $90
Vaccination 1300 @ 12c. $156
Woolpacks - 40 @ $5 $200
Winter feed - electric fences
  - 1300 bales @ $3 $3,900

(Fertilizer)
Interest on Capital -
  1000 ewes @ $20 $200
  300 hoggs @ $25 $75
27,500 @ 15% $4,125

Total $12,690

Income $54,250
Expenses $12,690
Net $41,560 for 1225 s.u. @ 16.55 s.u. per hectare

33.92 per s.u. = 561.48 per ha
Fertilizer - 300kg 090 - Freight 4.34
  - Spreading 4.34
  - $112 per tonne 37.33

GROSS MARGIN PER HECTARE = $515.47 or $31.14 per s.u.

46.01
WHEAT:

Income
5.3 tonnes @ $203 = $1075

Cost: $79.00
Seed 202kg - $32 per sk
Spray baylaton
Cultivation - 5hrs @ $28/hr
Fertilizer - 125kg @ $128/t
Spray weeds (MCPA)
Application
Heading 5.4 tonnes @ $24/t
Cartage - $14.80
Drying - $12.65/t
Levies - $1.75/t

$569.00

GROSS MARGIN PER HECTARE = $506
Farmers' responses to the market demands of the 1980's

C. J. McLeod, Farmer, Waitaki Valley.

About 4 years ago we made a decision to change from a Fat Lamb and wool policy, with some cattle to bull farming augmented by some sheep. There is nothing unique in that, there are plenty of people raising bull beef, and some of them doing it more efficiently than we are.

However the feature of our enterprise is the degree of our commitment to bull beef, and the type of country we are doing it on.

The farm is 550 hectares of bony ridges on the North Otago downs, too light and steep for cropping, and with 500mm rainfall, it is not what most New Zealand farmers regard as good cattle country. However there is plenty of drier country in Australia and North America producing excellent cattle, although not under such intensive stocking.

We made the decision to change at a time when it appeared the prospects for wool prices were not good, although they have held up better and longer, than I expected. At that time too the demand for bull beef was strong, and the prospects were at least as good as they were for lamb. No matter how hard I tried, I couldn't get any more than mediocre performance from my sheep, and bulls seemed to provide a more even work load. There are no peaks such as lambing, tailing or shearing with bulls. They don't even need dagging before they go to the works, and a good thing too!

We had been running 2500 Perendale ewes, with supporting hoggets and other dry stock, plus up to 200 bulls. This gave a stocking rate of 3 ewe equivalents per acre. We now winter 1000 bulls, of which 600 to 700 are calves, the balance tail-end rising 2 year olds. Sheep policy is now very flexible, having ranged this season from 2000 ewes down to 400, then up to 800 again. Most of the ewes are wintered off the farm, because the top priority is to keep the calves growing through the
winter. We like to see a gain of at least 0.5 kilogram per day from weaning to the end of August. When winter feed is at a premium, and most years it is, it makes sense to put ewes out onto crop residues and other relatively cheap maintenance feed, and feed the bulls well at home. In addition, nearly all of the 15,000 odd bales of hay and straw we use are bought in. We use spring and summer growth to put weight on cattle, and a slow rotation to build up a bank of feed to carry us into the dry late summer period. So why not buy someone else’s fertility in the form of baled hay? There are other paddocks a darn sight flatter than mine to make hay on.

The Farming Pattern
Calves are bought in November and December ‘forward of deliver’ so that they will not be castrated. The price is on a liveweight basis, so the heavier the calf the higher its value is on delivery. The price is related to the opening schedule for the benchmark weight range of bull. If I can buy calves at the same price per kilogram liveweight as I sell slaughter bulls, then my profit is the weight gained. And the liveweight value of slaughter bulls this year has been 79c per kg.

When we take delivery in April and May, all calves are drenched dehorned, and earmarked. Most are cleanskins, because the runholders don’t need to muster for marking.

They go onto the best feed available spelled pasture, they are drenched again and treated for lice before going onto winter feed crops of turnips and grass, or oats and tama, usually in June. Breaks are kept small, less than a week at a time. Single wire electric fence is sufficient after the first week or so. Good hay is fed on a run off every second day. Mobs are best kept small, no more than 50 - 60, and stay in the group they were in when they came onto the farm. Weaker calves and any being ridden are taken out immediately, and given preferential treatment. These mobs of backward calves will get an extra drench or two, but the rest probably get by with just one more, when they go off winter feed onto spring pasture. Selenium is included in all cattle drenches. Our limited experience with Ralgo implanted bulls has not been enough to form definite opinions. However it doesn’t stop them from riding.

Adult bulls clean up behind the calves, and are fed the proper hay and straws at about ½ bale each every second day. This is barely maintenance, but when the grass comes away in the spring their weight gain is phenomenal. Freisians especially will do better than 2kg a day. Behaviour problems with these adult bulls increase as the breeding season approaches, so we try to finish before Christmas. Any troublemakers get their one way ticket straight away.

Drafting starts in late November with the 2 year old bulls. We use scales, taking everything over 500 kg liveweight to allow bulls just under 270 kg carcase weight to make it next time around. By January the tops are ready to be taken out of the yearling mobs. Everything over 410 kg liveweight, should make the benchmark weight of 220 kg carcase.

By this time the grazing pressure on the whole farm is reducing and it’s too late to make much hay, but the clover dominant short feed is ideal for lamb fattening, so store lambs are bought and are spread out among the cattle. $8 per head profit on 1000 lambs bought 5000 bales of good hay. Some of the best paddocks are closed as soon as we get autumn rain, to provide weaning feed for the next crop of calves.

I’m often asked about breeds, and the answer is that any breed, or cross, appears...
suitable. Certainly Fresians and Charolais will give the best growth rates, Herefords and bucket fed Fresians appear the quietest, although you’ll get a rogue in any breed.

The Economics of Bull Beef

Comparing bulls with fattening steers is easy, bulls grow faster, and are all one grade. The price has been at least as good as P I steers in recent years, so the return is obviously in favour of bulls. But comparing them with fat lamb ewes is more complex. At a conversion of 1 bull to 4 ewes the interest on the extra capital employed in cattle is $2 per stock unit. Transport costs at schedule rates another $1.50 a S.U; and the extra hay would cost another $2.50 a S.U., making $6/S.U. in disadvantages.

But the costs associated with shearing would be at least $1.20/S.U. and the depreciation factor in a mixed aged ewe flock is around $5 per head per year, so these variables appear to balance. I have assumed that all other farm costs are relatively constant.

Now our market margin this year has been $120 for bulls, compared to gross revenue from 4 fleeces and 4 lambs of $146. Last year the figures were bulls - $98 and sheep - $96.

Although 4 ewes to one steer is the conversion figure used by M.A.F. and the Rural Bank, personal experience suggests that a bull operation is nearer to 3 ewes to one. I shudder to think what sort of stock performance we’d get from 4000 ewes on our ridges. So if I use 3-5 S.U. to one bull, I get $120 for bulls and $130 for sheep this year (1982) and $98 for bulls and $84 for sheep in 1981.

That’s clearly not good enough to convince the sceptics, but what about the future? Will wool returns continue to be as significant a factor? Will the fact that our bulls are ready for slaughter, at a time when the beef killing facilities are under-utilised, give me price advantage with processing Companies? We have heard a lot about these ‘under utilised’ beef houses in the South Island.

Will we see the day when the best cuts from well finished young bulls are marketed as table beef, instead of being used only for grinding into hamburger meat? Perhaps some of our ‘new rich’ customers, who have an aversion to eating the flesh of female animals, will get a taste for steak and kidney stews made entirely from ‘tender young bull’.

Finally, on the basis of sheer efficiency at converting grass into top quality carcase meat, bulls compare very favourably to lambs. In fact, they will almost double the 50kg that 4 average lambs will produce.

Appendix

79c kilo liveweight = 144c kilo carcase weight.
Hay ½ Bale every second day x 100 days - 25 bales for adult bulls; 1 bale to 5 calves every second day x 100 days - 10 bales for calves; ½ adults to ½ calves = 45 bales for 3 = 15 each = 15000 for 1000. 500 kg live = 275 kg carcase at 55% yield. 4c step in the schedule is worth $10 - 80/head.
410 kg live = 225 kg carcase at 55% yield, 8c step in the schedule is worth $17 - 80/head.
Lambs bought for $16 and sold for $24 average. Hay from $1.50 to $2 straw 40c - 60/head.
Interest on the difference between $150 average calf, and 4 ewes at $25=$50 at 16%
= $8 on 4 ewes or $2/S.U.
Transport $5/head calves onto farm; $10/head bulls to works = $15 for 3/5 of total bulls turned over = $10 or $2.50/S.U. About $1.20/S.U. for lambs and works ewes. Hay 15 bales/head for bulls, nearly 4 bales/S.U. at $2.50 fed out. Shearing $60 per 100. Shed hands wages $6 hour - $32 per 100 at 1 shed hand for 150 sheep shorn. Woolpacks, crutching etc for balance? Depreciation from $35 for 2th ewes to $10 for Works ewes, or $15 for good 5 year old ewes to $10 for works ewes.
Market margin between $330 average for 650 bulls sold to date and $150 average for calves is $180 for 3/5 turnover or $120 head. 4 fleeces at 4.5 kg x 300c/kg = $54, plus 4 lambs at $23 = $92 = $146 total. Last years margin $130 for 3/5 of total bulls, or $98 per bull 4 fleeces at $9 plus 4 lambs at $15 = $96.
Industrial relations in the Freezing industry

L. Fortune, Industrial Conciliator for the Meat Processing Industry Department of Labour.

My employer, the Conciliation Service, has the backing of the Mediation Service and the Arbitration Court. My function, of course, is to act as a Conciliator, not only to the meat industry, but to industry in general. We are provided with a warrant which gives us the power to act anywhere in New Zealand.

The freezing industry, of course, is an industry which attracts a lot of attention because of its importance. Not only importance to the producer but also the country as a whole because of income contribution from that industry. Because of this, the media cover the industry intensively. So we can be sure that the meat industry is never far from the headlines.

Unfortunately, this exposure is not always balanced or warranted. In fact, industrial relations within the meat industry are nowhere near as bad as they’ve been painted. When compared to other industries within the country they are neither better nor worse. But when one compares New Zealand’s record in this area with other countries, we look surprisingly good. The industrial relationship within New Zealand would be better than exists in many other countries.

Recently I was one of a group of people from the industry who visited Canada. We did so in the capacity of a consultative committee on the introduction of new technology into the meat industry. While we were there we were unable to communicate by post because the Canadian Post Office had been on strike for six weeks and it was expected the strike would continue for another six. Before we left Canada the timber industry had shut down completely and it was felt it would take six months to resolve the dispute. We were told that all this was quite usual. So our home scene looked decidedly efficient by comparison.

The main issues confronting the meat industry in New Zealand are the markets,
the need of holding space, and the importance of the industry to the economy. Add to these the introduction of new technology and one begins to appreciate the scale and complexity of our problems. Perhaps we should look further into the question to find out what the real problem in industrial relations is. Here's a country of just over 3 million people; there should be no problems in industrial relations. Because 3 million of those 3 million people are self-confessed industrial relations experts. No matter the problem there is always someone who has the solution to the problem and unfortunately their involvement can create greater problems than existed before they so kindly joined in. Many of those who teach and preach industrial relations are invariably academics without any practical experience. And many of their students end up hanging out a shingle and calling themselves consultants in industrial relations. They then proceed to advise people within their own industries, both union and employers, of what they should do. These academics are strong on theory but lean on practicality. Unfortunately they can afford to be that way. They appear to want to clone everyone: their basic assumption is that if everyone thinks the same, there can be no problems.

It doesn't work. There are many instances where this type of approach has been taken and failed. There we have The Oringi Freezing Works which could be regarded as model works for the future. It has a progressive management. It has a good workforce. Unfortunately, too many cooks got involved in cooking the broth and they burnt the lot. One could call it a comedy of errors of Oringi. Others could call it a tragedy. The frightening reality of the Oringi dispute was that the works could have ended a rusting pile of machinery. There were so many people involved in the Oringi dispute it was laughable. One notable exception was the Mediation Service. Oringi should never have happened. The means to solve the dispute at Oringi were available. The Mediation Service is the frontline troops that are supposed to go into the industries, cure the problems before they become too serious and at least put out the fire before it burns the building down. That did not happen.

The real problem with the Mediation Service is the reluctance to use it by those who need it and its abuse. It is one of the finest pieces of industrial legislation that was ever introduced into New Zealand. It has been smothered by abuse because some unions try to convince their membership they are working hard for them to use another piece of legislation. The Grievance Procedure is also first class legislation. It means that a worker has the right to take before a committee his grievance if he feels he has been unjustifiably dismissed. Unfortunately this piece of legislation was introduced not long after the introduction of the Mediation Service.

So when the personal grievance machinery came along it took the place of the Mediation Service. The personal grievance procedure has been abused to the extent that it now fully occupies the Mediation Service. This was not the intended use of the Service.

Invariably someone will say more Mediators are needed. What is needed is that Mediators should be used in the position that they were designated for. Mediators are willing and able to cure the problems in most of our industries. Unfortunately, they're running helter skelter all around the country trying to answer personal grievances that should never have become personal grievances. There is a responsibility on the people who bring personal grievances to hearings to ensure that the grievance actually exists. But naturally everyone who's dismissed becomes an unjustifiable dismissal. It's easy, it's a gamble, so they give it a go. You might get a sympathetic chairman. At least he may throw him a week's wages, he'll do something anyhow. It is clear that the unions themselves may destroy one of the best pieces of protective legislation that ever was provided for the workers.
Industrial relations is not a terrible thing to involve yourself in. Industrial relations are purely human relationships in an industrial situation. Quiet simple common-sense is 90 per cent of the industrial scene. There are arguments in the freezing industry and some of them get a little bitter. Some of the union officials can be unrealistic. Likewise, some of the employers can be fairly difficult too. It’s not a one-sided thing. The first step is to keep both sides talking and then eliminate the externalities or periphery issues. A compromise will only be achieved when opposing sides open their minds sufficiently to understand the other’s viewpoint. Once I’ve accomplished that, and its easier said than done, the rest is usually plain sailing.
Interpreting ewe killing sheets

A. M. Nicol, Animal Sciences Group, Lincoln College and R. Soper, Meat Division, Ministry of Agriculture and Fisheries.

When cull ewes are processed for export, a 'killing sheet' which contains considerable information about the ewes is prepared by the processor of the carcases. When farmers sell ewes on a per head basis on the farm to an exporter they forego this information since they will not receive the killing sheet.

The objective of this demonstration is to present to you (farmers) who receive a ewe killing sheet, information which may help the interpretation of the sheet. Information from the killing sheet can be gained in two ways:

- through understanding the contents of the killing sheet
- by comparing individual killing sheets with others such as the district average or between years on the same property.

A Typical Killing Sheet

A killing sheet for a mob of 465 ewes is reproduced in Figure 1. It contains the following information.

1. **New Zealand Meat Boards' Grades**

   The first seven computer listed lines of the killing sheet list the N.Z. Meat Producers Board (NZMPB) ewe grade names with the number of carcases in each grade as determined by the processing company's grader on the chain. The grading is supervised by the NZMPB through their Supervising Graders. The total and average carcase weight in each grade, the meat exporters price (c/kg) and the total value of the carcases in each grade are also shown.
Figure 1: A Typical Killing Sheet for Cull Ewes Processed for Export

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>CARCASES</th>
<th>Kg</th>
<th>AVERAGE WEIGHT</th>
<th>PRICE</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ML1</td>
<td>31</td>
<td>622.0</td>
<td>20.06</td>
<td>48.00</td>
<td>298.56</td>
</tr>
<tr>
<td>ML2</td>
<td>23</td>
<td>550.0</td>
<td>23.91</td>
<td>51.00</td>
<td>280.50</td>
</tr>
<tr>
<td>MH1</td>
<td>7</td>
<td>194.5</td>
<td>27.79</td>
<td>50.00</td>
<td>97.25</td>
</tr>
<tr>
<td>MX</td>
<td>255</td>
<td>4511.5</td>
<td>17.69</td>
<td>36.00</td>
<td>1624.14</td>
</tr>
<tr>
<td>MM</td>
<td>64</td>
<td>968.5</td>
<td>15.13</td>
<td>23.00</td>
<td>222.76</td>
</tr>
<tr>
<td>MP1</td>
<td>7</td>
<td>124.5</td>
<td>17.79</td>
<td>7.00</td>
<td>8.72</td>
</tr>
<tr>
<td>MP2</td>
<td>52</td>
<td>899.0</td>
<td>17.29</td>
<td>4.00</td>
<td>35.96</td>
</tr>
<tr>
<td>COVIS 9 HEAD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Export</td>
<td>439</td>
<td>7870.0</td>
<td>17.93</td>
<td>32.63</td>
<td>2567.89</td>
</tr>
<tr>
<td>NZMPB Supp Payt</td>
<td>439</td>
<td>7870.0</td>
<td>17.93</td>
<td>7.00</td>
<td>550.90</td>
</tr>
<tr>
<td>CONDEMN</td>
<td>26</td>
<td>328.0</td>
<td>12.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total received</td>
<td>465</td>
<td></td>
<td>17.60</td>
<td></td>
<td>3118.79</td>
</tr>
<tr>
<td>SKINS</td>
<td>465</td>
<td>WOOL</td>
<td>0.55</td>
<td>0.98</td>
<td>455.70</td>
</tr>
</tbody>
</table>

FED. FRM 1C NZMPB 29C = 30.0C

<table>
<thead>
<tr>
<th>ARTH 8</th>
<th>PLUE 4</th>
<th>113.4 LESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSC 3</td>
<td>YELL 31</td>
<td>113.4 TRANSPORT</td>
</tr>
<tr>
<td>EMAC 10</td>
<td>OTHE 10</td>
<td></td>
</tr>
<tr>
<td>LYMPC 9</td>
<td>BRUI 5</td>
<td></td>
</tr>
<tr>
<td>SARC 5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GROSS PROCEEDS 131.70-

<table>
<thead>
<tr>
<th>465</th>
<th>C/S</th>
<th>7.40</th>
<th>3442.79</th>
</tr>
</thead>
</table>

NETT PROCEEDS $6.40 2975.46
For these grade names to be informative, one should be familiar with the NZMPS's export grading system for ewes.

The Export Grade names for ewes are shown from the Meat Board's Grading pamphlet (NZMPB, 1981) in Figure 2. There are four levels of fatness namely MM, MX, M and MF which are combined with one to four separate weight ranges and given the various grade names indicated in the grid.

Figure 2: New Zealand Meat Producers' Board Export Grades for Ewes.

<table>
<thead>
<tr>
<th>Carcase Weight (kg)</th>
<th>FATNESS</th>
<th>PROCESSING</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 22</td>
<td>MM</td>
<td>MP1</td>
</tr>
<tr>
<td>22.5-26.0</td>
<td>MX</td>
<td>MP2</td>
</tr>
<tr>
<td>26.5-30.0</td>
<td>MM</td>
<td>MP1</td>
</tr>
<tr>
<td>30.5-36.0</td>
<td>MF</td>
<td>MP2</td>
</tr>
</tbody>
</table>

The NZMPB is continuously supplied with details of the number of carcases in each grade for all processing plants. The annual total of carcases in each grade is published on a national basis in the Board's Annual Report and local figures can be obtained from the Board on request. The percent distribution by grade of all mutton carcases processed for export in Canterbury in the 1980-81 season is very similar to the national scene; two grades, the MM and ML 1 accommodate 50% of all ewe carcases.

Figure 3: % Distribution of Ewe Carcases to Export Grades (sample sheet in brackets).

<table>
<thead>
<tr>
<th>Carcase Weight (kg)</th>
<th>FATNESS</th>
<th>PROCESSING</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 22</td>
<td>MM</td>
<td>MP1</td>
</tr>
<tr>
<td>22.5-26.0</td>
<td>MX</td>
<td>MP2</td>
</tr>
<tr>
<td>26.5-30.0</td>
<td>MM</td>
<td>MP1</td>
</tr>
<tr>
<td>30.5-36.0</td>
<td>MF</td>
<td>MP2</td>
</tr>
</tbody>
</table>
MX and MM carcases are very lean but are light in weight with average carcase weights of 15 and 18 kg respectively. Many of these carcases are boned out and although there is little trimming of fat required to meet export requirements, the low carcase weight indicates a relatively poor ratio of meat to bone in the carcase. The lower yield of saleable meat in these light weight carcases tends to lower the exporter's schedule price.

Figure 4: Average weight of Ewe Carcases by Grade.

<table>
<thead>
<tr>
<th>Carcase Weight (kg)</th>
<th>FATNESS</th>
<th>PROCESSING</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 22</td>
<td>MM</td>
<td>MX</td>
</tr>
<tr>
<td>22.5-26.0</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td>26.5-30.0</td>
<td>15</td>
<td>24</td>
</tr>
<tr>
<td>30.5-36.0</td>
<td>28</td>
<td>24</td>
</tr>
</tbody>
</table>

Weighted average 20.0 kg

A further contribution to the lower schedule value of the lighter carcases is the relatively higher killing charge. At the 31 March 1981 killing and freezing charges in the average Canterbury processing plant were $8 per head plus 8c per kg carcase weight (NZMPB, 1981). These costs convert to 52c per kg for an 18 kg carcase and only 41c per kg for a 24 kg carcase.

Carcases in the ML1, ML2 and MH1 grades are most suitable for export in carcase form and if boned out have high yields of saleable meat. Ewe carcases in the MH2 grade tend to be too fat and are discounted for this excess fatness although not to the extent of MF carcases. Schedule prices (c/kg) for 20 May 1982 which include the SMP supplement are shown in Figure 5 for each grade.

On the sample killing sheet, the exporter's price is shown for each grade net of the SMP payment. The total SMP payment of 7c per kg is included further down the computer output.

On average 12% of all ewe carcases are graded MP1 and MP2. The sample sheet was therefore average in this statistic. MP1 carcases have received light trimming and MP2 have at least one major portion of the carcase (leg, shoulder, loin) removed from the carcase for reasons of disease or defects.

By multiplying the average carcase weight in each grade by the schedule price, the average value of carcases in each of the grades can be computed (Figure 6). The calculation shows very vividly that carcases which fall outside the ML1, ML2 and MH1 grades return significantly less to the producer. MM and MX return less due to their low carcase weights and very heavy carcases in the MH2 and MF...
Figure 5: Export Schedule Prices (c/kg carcaseweight) Including Supplementary Payments for ewe grades (20 May 1982).

<table>
<thead>
<tr>
<th>Carcase Weight (kg)</th>
<th>FATNESS</th>
<th>PROCESSING</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 22</td>
<td>MM</td>
<td>MX</td>
</tr>
<tr>
<td>22.5-26.0</td>
<td>30</td>
<td>43</td>
</tr>
<tr>
<td>26.5-30.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30.5-36.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Grades (32 and 31kg respectively) are severely penalised for their association with excess fat. Ideally ewes should be within a liveweight range of 40 to 56kg and they would then be graded in the optimum grades ML1, ML2 and MH1.

Figure 6: The Average Carcase Value ($ per carcase) for Ewe Carcases by Grade

<table>
<thead>
<tr>
<th>Carcase Weight (kg)</th>
<th>FATNESS</th>
<th>PROCESSING</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 22</td>
<td>MM</td>
<td>MX</td>
</tr>
<tr>
<td>22.5-26.0</td>
<td>4.5</td>
<td>7.7</td>
</tr>
<tr>
<td>26.5-30.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30.5-36.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Weighted AV price $9.00

The value of the average line of carcases can be calculated from the grade distribution and the average carcase value in each grade. Using the 1982 prices and 1981 grade distribution, the weighted average price is $9 for ewe carcases (bare meat price) killed for export in Canterbury. The average carcase value on the
sample killing sheet is $7.10 ($3118.79 for 439) which is about 20% below the average. This lower average value is a function of a higher proportion of carcases in the MM grade.

2. Meat Inspection Information

All carcases and their offal are inspected for defects and disease by Meat Inspectors employed by the Meat Division of MAF. Carcases identified as showing a defect or disease symptoms are condemned as unfit for human consumption if the condition is severe and the carcase rendered in meat and bone meal.

(a) Diseases

Reasons for the condemnation of carcases are noted on killing sheets and in national statistics. The 10 most important conditions leading to condemnation of ewe carcases are listed in Table 1. On average 3.3% of all ewe carcases are condemned.

Of the total condemnations one third are a result of emaciation. Emaciated carcases are extremely lean and wasted and are often suffering from other diseases in addition to the obvious nutrition. Neoplasms, or cancer contribute another 15% of condemnations. The cancer is usually in the digestive tract and although little is known about the potential human health hazard from the carcase they are condemned for safety. The third major cause of condemnation in Canterbury is CLA or 'lympho', a bacterial infection of the lymph glands. Where the infection is widespread and active the carcase will be condemned. The CLA bacterium enters the body through a wound. Cleanliness in the shearing shed and tailing pens will reduce the occurrence of lympho although no treatment of infected animals is feasible since the disease is difficult to identify in the live animal. The fourth and only other significant reason for the condemnations is large abscesses in the carcases.

Many of these conditions tend to be more severe and therefore more likely to lead to condemnations in sheep in poor body condition.

TABLE 1.
Prevalence of the Most Common Disease/Defect Condition in Ewes
(MAF, Meat Division, Annual Statistics)

<table>
<thead>
<tr>
<th>Disease/Defect</th>
<th>% prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleurisy</td>
<td>17</td>
</tr>
<tr>
<td>Contamination</td>
<td>12</td>
</tr>
<tr>
<td>Caseous lymphadenitis (Lympho)</td>
<td>9</td>
</tr>
<tr>
<td>Sarcosporidiosis (sarcocysts)</td>
<td>7</td>
</tr>
<tr>
<td>Cystercercus oviss (sheep measles)</td>
<td>4</td>
</tr>
<tr>
<td>Wounds and bruises</td>
<td>2</td>
</tr>
<tr>
<td>Arthitis</td>
<td>2</td>
</tr>
<tr>
<td>Disease/Defect</td>
<td>% Carcase condemned</td>
</tr>
<tr>
<td>------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Emaciation</td>
<td>1.0</td>
</tr>
<tr>
<td>Neoplasms (cancer)</td>
<td>0.5</td>
</tr>
<tr>
<td>Caseous lymphadenitis</td>
<td>0.4</td>
</tr>
<tr>
<td>Pyogenic lesions (abcesses)</td>
<td>0.3</td>
</tr>
<tr>
<td>Pleurisy</td>
<td>0.2</td>
</tr>
<tr>
<td>Sarcosporidiosis</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Figure 7: Major Cause for Detention and Condemnation of Lamb Carcases (from Glover and Davison, 1977).
(b) Condemnations  
By no means all carcases which show a disease or defect are condemned. Table 2 lists the prevalence or incidence of the major diseases in ewe carcases. Over 60% of all ewe carcases have a disease or show a defect but only 3.3% are condemned. Carcases with a disease or defect which does not cause condemnation are marshalled on the 'detain rail' where they have the diseased tissue or defect trimmed from the carcase. For contamination and bruising each contributed 30% to all lambs grading as cutters (equivalent to the Processing grade for ewes). In the absence of similar data for ewes, it can only be assumed that a similar situation exists.

Figure 8: Reconciliation of the Fate of 1000 Ewes Presented for Slaughter.

Delivered to works 1000
Dead on arrival/in yards 2
Processed 998
Defects Disease Total
130 500 630
Processed grades 368
Defects Disease Total
128 476 595
Detail Rail
Export grades 368 88 387 843
Processing grades 40 80 120
TOTAL

SUMMARY:  
Dead 2  
Condemned 35  
Processing 120  
Export grades 843  
Total 1000
(c) Deaths
A small additional source of ewes not appearing in the grades are those which die in the yards. This accounts for 0.2% on average.

Reconciliation of Ewes Grading

A reconciliation of the fate of 1,000 average ewes delivered to the works has been made. Although 63% of all carcases are identified as containing disease or defects, 84% of all carcases ultimately grade in the full export grades for which the producer is paid the full schedule.

3. Wool Pull and Transport
Below the fate and value of all carcases are details of the separate payment for pelt (skin) and wool on the pelt. The pelts on the sample sheet were assessed by the processors as carrying 0.55kg wool. This weight of wool is not strictly the same as could be shorn off the pelt since it represents the complete wool fibre pulled from the pelt, washed (not scoured) and dried.

A ewe pelt with 0.55kg was worth $0.98 on the pelt and wool schedule at the time of kill and the total value of the pelts is added to the carcase value to give the total gross return.

Deductions from the gross proceeds are made for the Federated Farmers’ levy of 1c per carcase and the NZMPB levy of 29c per head on the carcases exported.

Finally the transport costs are deducted to give the net return for the line. The actual cost of transport of this sample of ewes was $1.13 per head, but at present the producer is only charged the cost to his ‘nearest port works’, in this case $1.00 per head.

The net proceeds from this particular line of ewes was $2,975.45 or $6.40 per head.

Conclusion
Ewe killing sheets contain much more information than the net price for the line. This information can be used by producers to compare the performance of their own ewes in meeting export standard with others. Intelligent use of this information may allow producers to increase the return from cull ewes which already contributes 28% to the meat output from sheep farms.

References
Carcase processing
– how much is too much

J. M. Ryan, Assistant General Manager, Waitaki N.Z. Refrigerating Limited.

If we had a carcase with a much higher ratio of muscle to its total weight we could do a lot better with the bottom line in those sums. To be a little fictitious, who knows if at some stage in the future, genetic engineering gets us to the desirable state where we could have what we like to have with perhaps a lamb with two loins, about five hind legs, three front legs and about seven or eight rib cages. That is about the sort of mix we could desirably market to get better advantage out of a whole carcase.

Similarly the very high input costs in the processing sector are to a large extent necessary at the present time. Perhaps, in the future we will see a development of robot technology. We already have a field of study in our company opened up on that factor. The sort of robots referred to in manufacturing industries overseas, can now perceive dimensional variations in the subject they are dealing with. We envisage a robot that will be able to bone out in a very intricate way as is required for today's carcase of lamb. That sort of technology is not available to us at the present time, but that again is a very substantial factor in the arithmetic in this example.

Packaging technology whilst vastly improved in the last decade, still has deficiencies which in time will be eliminated.

When the product leaves our shores it is exposed to a very high costing in ocean freight and it is to be hoped that competition in this area will be permitted, not only
to reduce the actual costs but also to bring about a fairer way of computing the load in a container.

Now I'll just put up on the overhead projection and demonstrate what I mean the difficulty of (I think that's probably focused about as good as it can be) all of those cost areas that I mentioned earlier included in this calculation and this comes from a real life crystallisation of taking a thousand carcases of 'YM' grade lambs shipped in the left-hand column as in the figures column as full carcases, and I trust you can all read the figures, and as partially boned this is to an actual specification which we prepare for a particular supermarket in the United Kingdom, and in the extreme right-hand column as a simple fully boneless rolled side, which is used either for slicing into lamb steaks or in bigger pieces for roasting. The point I wish to make is, and it's pretty obvious it's not only in this type of operation you no doubt run into it in many areas of farming.

Figure 1:

![Figure 1](image)

When you have an increased input cost at the same time as a diminishing weight of product available, you get a certain inexorable arithmetical result. Figure 1 illustrates that whereas the cost we would have to recover at the point of wholesale delivery in the U.K. for a carcase would be $3.33 per kilogram, in the fully boneless...
side the cost required to be recovered is $7.15 per kilogram.

Perhaps the most important factor in recent history is the fact that inflation in this country continues to run at a higher level than that in most of the countries to whom we export. That of course means that we go backwards more and more all the time.

Retrospectively in the two world wars almost the entire production of New Zealand meat was acquired by the Government to support Britain in particular in her war effort. The second world war acquisition of products, which was referred to as 'bulk purchase', continued to feed an impoverished Britain until 1954. Throughout all that time New Zealand was denied both the need and the opportunity for sophisticated product and market development. As far as lamb was concerned we supplied one market in one form, and that was really all that was required. So it is really only since 1954 that the need and opportunity for product and market development was realistically there.

In 1957 the imminence of Britain's joining the EEC, led to a studied diversification of lamb away from the U.K. market and at the same time an effort to get more value added to the product before leaving New Zealand. Figure 1 simply recaptures the historical growth in lamb diversified outside the U.K. Figure 2 is our own companies growth of lamb exports in cut form.

Figure 2:

![Graph showing percentage of Carcase form and Cut form exports from 1967 to 1981. The graph indicates a decrease in Carcase form exports and an increase in Cut form exports over the years.](image-url)
We as a company approached the development of greater processing of the carcase in the manner demonstrated in that graph. First of all, marketing opportunities exist in two areas to fulfill a perceived need or to create a need. Our programmes thrust at both of these areas, with a much higher degree of risk and casualty in the second area.

We have had the most reliable progress in dealing direct with supermarket users in various countries, but particularly in the U.K. This has extended to carrying the risk in two particular cases right through to retail, and sharing in the risks through to that point. Specifications are developed in association with the supermarket users and at the present time we do have a great variety of individual specifications designed particularly for the end user. Up until quite recently we have found it prudent to ignore one of the intrinsic benefits of disassembly of the lamb carcase, and that is we have generally avoided sending individual cuts to different markets.

One of the advantages for cutting the lamb is that you can spread the one lamb over a variety of markets as the need is perceived. That can be an extremely risky and loss-producing business if not done with care. So, as a general rule, we have developed specifications with supermarket users which obliges them to take the whole animal in its natural proportions. Now that we are starting to see the opportunity to move away from this a little, but it will be done with considerable caution.

Similarly, we are moving more and more in our specifications to what we call edible totality. We believe that as meat prices continue to escalate at point of sale and as there is more and more competition from luxury and convenience goods, the consumer will be demanding that more than 70% of the meat purchased is edible.

So we are looking for both edible totality and absolute quality. The lambs that we do process are all exposed to accelerated conditioning generally further chilled for an additional two nights. Some of them are de-barked or portions of the carcase are de-barked. They are usually fresh boned in the chilled condition; they are then subjected to vacuum packaging for freezing. And depending upon the supermarket we are supplying they may or may not go with a particular advertising brand on them. The problem in all of this is to convince supermarket management and supermarket meat buyers that they should pay more per kilogram for their

Figure 3: Comparison of Cost Recovery Required on 1000 Carcases YM Grade Lambs Prepared in 3 Different Ways.

<table>
<thead>
<tr>
<th></th>
<th>As full carcases</th>
<th>As partially boned</th>
<th>As fully boneless</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total cost to</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>wholesale</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>delivery - UK</strong></td>
<td>$47 582</td>
<td>$56 492</td>
<td>$54 909</td>
</tr>
<tr>
<td><strong>Saleable kgs</strong></td>
<td>14 300</td>
<td>1 068</td>
<td>7 679</td>
</tr>
<tr>
<td><strong>Cost per kg</strong></td>
<td>$3.33</td>
<td>$5.10</td>
<td>$7.15</td>
</tr>
</tbody>
</table>
meat. Now that, you would think, is a pretty easy promotional task but I can assure you that it is not.

First of all supermarkets are frequently constructed with their own boning and packing rooms at the rear of the store. And they take some convincing having made that investment that they are better to turn that into retail shopping space and allow us to put the carton in the cabinet for them. We are making considerable progress but again meat buyers have a job to do. There is intense competition within supermarkets. There is either a certain square footage or a certain shelf area which is actually charged to the area of operations and they have to produce a profit out of it. So if somebody selling soft drinks or cereals or anything else is beating them then they are likely to have their space reduced until such time as they can produce a better square footage result for Management. And similarly as I said the Consumer sometimes cannot understand why he or she should pay more for meat.

To illustrate the point I did what some consumers have done for themselves. I purchased a leg of lamb weighing 82 ounces; after it was cooked it weighed 56 ounces and the amount actually eaten was 32 ounces. I then took 3 primals, which is one of the things we do with some legs of lamb for 2 particular markets which weighed 36 ounces and a cooked weight of 22 ounces and the amount able to be consumed was 22 ounces.

Now if the leg of lamb which had an actual cost of $8.30 to purchase, (or 10.13 cents per ounce), the real cost, that is, divided by the 32 ounces which was actually consumed rose to 26 cents an ounce. Now the point of course is that if the 26 cents, which the ordinary leg of lamb cost in terms of consumed material was applied to the consumed material of the 3 primals it would be 26x22 which is $5.72. And if the $5.72 were divided by the 36 ounces you get 16 cents an ounce which is what the consumer could have afforded to pay for the 36 ounces to break even with having bought the leg of lamb. In other words, she could have paid, I think it works out at 157% more on the apparent cost of buying these primals than if she had bought the leg. Now, that's pretty easy to understand when it's put up on a projection like that. So if you simply put a leg of lamb at that apparent cost in a cabinet alongside primals at a price 157% more you are not going to sell very many primals even though they are costing the same for the amount consumed. Furthermore primals are a much more attractive dish to prepare, and they avoid all the mess of disposal of the remnants afterwards.

First of all, there will continue to be a demand for both carcases and 'bone in' cuts for a considerable time yet. Indeed, 'bone in' requirements are a culinary requirement in many areas of the world and will continue to be so for the foreseeable future. However, at the same time the concept of edible totality in the preparation of meat will continue to rise and I would think at a slightly faster rate, than we have seen to date.

Technological progress will assist and we are already seeing developments on removing or at least containing the cost load on the carcass. We are already seeing significant progress with mechanical dressing systems. I think mechanical boning of carcases will take somewhat longer. I am sure that air freight of product and a coincident growth in the chilled shipment of lamb will be seen. Our two most recent lamb boning rooms have both been located close to international airports. However, it will not be easy to make the arithmetic work. There is much to be done, but I am confident that we can put it together.
New technology in the meat processing industry

B.B. Chrystall, Meat Industry Research Institute of New Zealand (Inc.)

'New technology in the meat industry' immediately brings to mind the visions of confrontations with unions, and fewer jobs. This is a wrong impression which I hope to dispel.

Failure to apply technology does not guarantee jobs just as the application of technology does not necessarily mean loss of jobs. In other countries there are many examples where failure to apply technological developments has led to a loss of competitiveness and the complete loss of whole industries. Application of the technological changes might have caused a temporary shift in job locations, but in the longer term viable industries would have remained.

The New Zealand meat industry is at the crossroads: technological developments await implementation; failure to carry them through may lead to a high-cost meat-processing industry incapable of providing support for the New Zealand economy.

Technology is introduced into industry for a variety of reasons, among them being:

- Increased productivity
- Added value by improved product quality
- Added value by further processing
- Satisfaction of regulatory or market requirement
- Survival against competition

The lamb and mutton processing lines provide many examples of new technology introduced or about to be introduced into New Zealand industry, and some of these examples should be considered in detail.
Electrical Stunning

In the past lambs were tipped on to their sides from a knocking box, their throats cut and necks broken before the legs were shackled and carcasses were sent swinging and bleeding up to the dressing floor. It was a noisy, bloody scene. Now, a visit to the slaughter area is impressive. Lambs are conveyed from the yards in a V-restrainer, which also holds them as they are electrically stunned. Various stunning procedures are used to satisfy different market requirements, but the aim of all techniques is to render the animal insensible to pain and ensure that the animal is immobile. The lamb is suspended from both front and hind legs, the oesophagus clipped or tied to prevent contamination, and the animal bled using a thoracic stick. With this technique most of the blood can be collected. The animal dies quickly, quietly and cleanly.

Although this slaughter system is accepted as ‘humane’ it was hygiene requirements rather than benevolence that largely forced its introduction. Traditional gash cutting made head skinning and identification of heads difficult, but with electrical stunning and altered sticking procedures, the head remains almost completely attached to the neck so that complete head skinning can be carried out mechanically.

Further changes are envisaged in this area. Manual electrical stunning is potentially a dangerous operation because the operator is armed with a device capable of killing an animal. Electrical supply authorities usually do not allow 400 V, (the voltage used with stunners), to be supplied in work areas without reasonable safeguards. However, the very nature of the stunning operation means that these safeguards cannot be given. Replacement of the hand-held stunner by automatic equipment can be justified on the basis of safety. Pacific Meats’ new processing plant at Oringi has lamb automatic stunners. A different type of automatic stunner is soon to be tested at Nelson.

Another innovation is the use of low voltage to immobilize the animals. Present head-to-back stunning actually electrocutes the lambs, stopping the heart and giving a very quiet, still animal. For some markets, notably Iran, electrocution of the animals is considered undesirable. Lambs for these markets will be lightly stunned, then be subjected to a low voltage stimulating current to prevent movement until the ritual cuts have been made and the animal slaughtered.

Dressing

Dressing changes have been occurring almost continuously. Over the past 10 years the number of men on the chain has doubled to improve hygiene and dressing standards without slowing processing speeds. To increase throughput, cut costs and improve quality, mechanical aids are needed.

Mechanical Pelting

A mechanical pelting machine has been developed by the industry and is now undergoing commercial trials at Nelson. This technological giant which has six separate heads on a carousel, is designed to handle the tally of a standard chain. After head skinning, the brisket and shoulders are cleared manually and the carcase is suspended from the forelegs and head. The skin is clamped, an internal ring is forced between the skin and the carcase, and the carcase is removed from the skin sock. After the sock is split, the pelt is dropped from the clamp and the pelting
head is sterilized before accepting its next carcase. The machine can give a consistent dressing standard with reduced contamination rates and has the potential to cut costs significantly by reducing chain manning. Several companies have already installed simpler American-made machines, which also have the potential to improve the quality of dressing, reduce contamination rates and slightly alter manning.

Evisceration, Weighing and Grading

Evisceration has remained relatively unchanged apart from more thorough inspection of all organs. There are suggestions that after mechanical pelting evisceration could be carried out while the carcase is hanging from the foreshanks instead of the present manner of inverting the carcase and then removing viscera. The techniques have been developed and look simple, but need to be proved to give less contamination than conventional systems before they will be accepted.

Dressed carcases are now commonly weighed automatically, and when grading information is keyed into a console, the information is fed directly to company computers for preparation of killing sheets. The weight and grade information is automatically printed onto a ticket, which is ejected for application to the carcase. The next logical development is to replace subjective grading with an objective grading system. Still some years away, automatic grading is an important development which will have far reaching implications for producers and consumers.

Accelerated Conditioning (AC)

After the scales comes the most significant change affecting meat quality the electrical stimulation tunnel. Most New Zealand lamb is now electrically stimulated as one step of the Accelerated Conditioning process which is designed to ensure the tenderness of our lamb and mutton.

Lamb is naturally tender, as can be shown by the tenderness of carcases processed under conditions that do not cause meat to toughen. Chilling of muscles below 10 deg.C during the early stages of post mortem metabolism causes the meat to toughen as a consequence of cold shortening of the muscles. Freezing before rigor is complete sets the scene for substantial shortening and toughening if the meat is thawed rapidly, such as might happen when frozen meat is cooked. Therefore, early and rapid chilling and freezing of lamb results in meat which, if thawed slowly before cooking, is tough, and which, if cooked from the frozen state, is almost inedibly tough. It was to overcome this processing-induced toughness that the AC process was developed. To process lamb or beef without inducing toughness, temperatures below 10 deg.C must be avoided while the meat is in a pre-rigor state; i.e., while the muscles are still alive. If the meat is to be frozen, it must be in rigor before freezing is complete.

Processing for tender meat before the advent of AC required carcases to be held for at least 24 hours before going into blast freezers. With AC the carcases are stimulated with alternating polarity pulses of high voltage electricity for a short time. This stimulation increases the rate at which the muscles die, so that lamb carcases can be frozen 90 minutes later without risk of cold shortening. Provided stimulation and freezing-rate specifications are met, the meat will be tender even if cooked from the frozen state. Carcases from cattle, deer and goats also can be electrically stimulated to ensure tender meat.
The cost of the AC process is a small fraction of a cent per carcase and the better quality product is potentially of considerable benefit to the industry. At least one major supermarket chain in the UK insists that any lambs they buy must be at least of AC tenderness. Considerable effort has been directed towards perfecting the AC process and quality assurance programs that go with it.

Shrinkwrapping

Another move toward improved quality is the proposed change from stockinet to shrink polythene as the wrapper for frozen lamb carcases.

Since the first successful shipment of frozen lamb carcases from New Zealand in the SS Dunedin 100 years ago, almost all have been wrapped in stockinet. Stockinet gives crude protection against gross soiling, but affords absolutely no protection against drying out. More recently some carcases have been bagged in loose polythene then in stockinet. This technique greatly reduces drying out but carcase appearance is not enhanced and the slippery polythene bag inside the stockinet causes stowage problems. A tightly fitting skin of polythene protects against drying out and maintains the carcase colour and appearance. But unless a suitably surfaced or coated plastic is used the carcases are extremely slippery. Recent developments in friction films have overcome this slipperiness so that shrinkwrapped carcases can be stacked and handled safely.

A shrinkwrapping system has been developed by the industry. Frozen carcases are automatically degambrelled and held by a vertical presentation conveyor so that shaped bags, suspended above the conveyor and inflated with an airjet, can be manually pulled down over the carcase. The bagged carcase is then picked up by a second conveyor system and conveyed through a sealing unit and a hot air tunnel to shrink the bag tightly around the carcase, thus completely sealing the carcase in moisture-impermeable plastic.

Besides being attractively presented, the shrinkwrapped carcase is protected against desiccation and soiling. Weight-loss savings as a result of shrinkwrapping are considerable. Stockinet wrapped carcases lose approximately 1% of their weight in the first month of storage and 0.5% in each subsequent month thus, a 14kg PM stockinet wrapped carcase loses about 500g during six months' storage, and losses are even greater in leaner carcases. As well as the weight loss, carcase appearance will have suffered because stockinet wrapped carcases become bleached and may discolour during storage. Shrinkwrapped carcases remain attractive for much longer periods of time without weight loss.

There are potential labour savings with the shrinkwrap system but, until final trials are complete and machines commercialized it is not possible to give the financial effect of shrinkwrapping. The greatly improved carcase appearance should assist sales in competition with stockinet wrapped product, and market forces will determine whether the shrinkwrapped product receives an increased return.

At present there is a 4.5 per cent deduction from hot carcase weight to allow for weight loss during subsequent freezing and storage. About 1% of carcase weight is lost during freezing and the rest during storage. With shrinkwrapping after freezing there is no storage loss. Shrinkwrapping of the carcase before freezing, although more difficult than the operation after freezing, would reduce weight loss even further cutting the freezing loss to about 0.6% of the carcase weight. The prefreeze wrapped carcass is slightly blotchy but some consider this is acceptable.
Further Processing

'Further processing' has been a catchcry thrown up over a number of years, generally with a lot of emotion but little fact. To many, further processing implies any processing beyond the carcase stage; others consider that further processing implies ending up with consumer-wrapped products. A recent survey of meat companies showed that most companies produce some further processed products for export. Seventy-five percent of this total volume is accounted for by lamb cuts, the majority of which are for sale in North America by Devco. Some companies, as well as cutting for Devco, undertake special cutting and boning to customers' specifications. The volumes of these special orders, although small on a national basis, are extremely important to individual companies.

There is an increasing chilled meat trade, both in lamb and beef, which provides another string to the marketing bow. The importance for the producer is that sometimes special stock is selected for the chilled trade. This selection may mean a premium over the schedule for well-finished stock. Stressed animals cannot be used for the chilled meat trade, because the meat from stressed animals spoils easily in vacuum packs and has a much reduced storage life.

Vacuum packaging is now being used for offals to such an extent that offals are emerging from the 'Plain Jane' class to be considered as a valuable product. The increased returns for 'variety meats' will help offset inflation's effects on processing charges.

Market information is vital in any further processing venture to ensure that the products prepared are those desired by the market, and not just those the company wants to produce. With accurate market information, further processing should give an increased return for the product. The producer should benefit from any moves by meat companies that increase the profitability of the entire operation.

Further processing may have other financial implications for the producer in that freight charges per lamb can be reduced through greater stowing density in containers. Any reduction in the total costs of getting meat to the market must also contribute to profitability.

There are many other technological changes that have not been discussed which can improve productivity. Some examples are:

- Automatic freezing rooms for lamb carcases
- Automatic engine rooms
- Mechanical deboning and meat recovery
- New rendering equipment such as MIRINZ's MLTR.

Other developments that could be considered under further processing and added value are recovery and initial processing of specialized products for pharmaceuticals, improved effluent treatment and recovery and use of waste products. The list could be extended further.

With the host of technological changes that could take place in the meat industry let us not be complacent producers. Look at a chop from a PM lamb. What do we see? Often a reasonably thick layer of fat over a small loin muscle and a large lump of bone. Consumers, unless they particularly want lamb, may be tempted to pass it by as poor value for money. People buying meat want to buy lean meat not bone, and definitely not fat.

If we want to advance lamb in the meat markets of the world, we need a leaner, heavier more muscled lamb. Many breeders are striving towards this goal, but they often must rely on very indirect assessments when making their selections.
Measurements of fat thickness and muscle size can be obtained on the live animal, and these measures could be added into the factors making up selection indices. The sheep producer does not have an easy role because there are so many factors that must be considered in any selection index for multipurpose animals. However, let us not be dismayed: consider new technology it may provide answers to otherwise impossible problems.
Is there a better deal for by-products?

L. R. Kingsbury, farmer, Dorie, Canterbury.

Over the past ten years, stock from our property have been killed at Alliance, CFM, Christchurch Abattoirs, NCF Kairapo, SFM and Waitaki NZR. They have been marketed by many of these companies, either on schedule or by pooling arrangements.

1982 is the centenary year of the frozen meat industry, and the theme of the conference acknowledges this important milestone. This technological change enabled rapid development of a British Colonial country. Changes in technology, processing and marketing have been made ever since.

One that has not changed, and it seems unlikely to change, is the method of determining the farmer's share of income from slaughtered stock. It is what is left of the market price after all costs of processing and marketing have been deducted. To stop further erosion of their share of profits, farmers have been increasingly questioning their own methods of production. They are also questioning many facets within the total chain from farm gate to ultimate sale.

Animal by-products is one such aspect that is receiving attention. The issue consists of three main parts:

The Proportion of By-products
Without going into small differences between cattle, sheep and lambs, the weight of components from ruminant animal looks something like this to a processing company:
- From the live animal nearly half is saleable carcase.
- Edible offals: these fancy or variety meats make up five per cent of the animal. They are the hearts, livers, brains, tripes etc.
- Non-edible offal: these parts are mainly rendered. They make up 18-22 per cent of the animal and include stomach structures and fats, heads and various other trimmings. This section also includes petfoods, blood and pharmaceutical products such as gall and lamb caps.
- Gut contents and various other wastes make up a further 14 per cent.
- To complete the animal, the part we see, the wool or hair and skin, is another 11-15 per cent.

For the rest of the paper by-products include the variety meats (edible offal) and those sold after further processing (non-edible offal), a total of about one quarter of a live animal.

Figure 1:

The Value of By-products
Total export receipts from the meat processing industry on an F.O.B. basis for the 1980-81 year ending June, amounted to $1,814 million.
TABLE 1
Figures 1980-81 Year Ended June 30

<table>
<thead>
<tr>
<th>Product</th>
<th>Value $ \times 1,000. F.O.B.</th>
<th>Percentage of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef and veal</td>
<td>593,955</td>
<td></td>
</tr>
<tr>
<td>Lamb</td>
<td>746,986</td>
<td></td>
</tr>
<tr>
<td>Sheep</td>
<td>107,858</td>
<td></td>
</tr>
<tr>
<td><strong>Total Meat</strong></td>
<td>1,448,799</td>
<td>79.8</td>
</tr>
<tr>
<td>Variety meats</td>
<td>71,746</td>
<td></td>
</tr>
<tr>
<td>Non-edible meats</td>
<td>68,575</td>
<td></td>
</tr>
<tr>
<td>Oils and fats</td>
<td>48,472</td>
<td></td>
</tr>
<tr>
<td><strong>Total Offal</strong></td>
<td>188,793</td>
<td>10.4</td>
</tr>
<tr>
<td>Hides, skins and pelts</td>
<td>129,810</td>
<td></td>
</tr>
<tr>
<td>Slipewool</td>
<td>47,006</td>
<td></td>
</tr>
<tr>
<td><strong>Total pelts etc.</strong></td>
<td>176,816</td>
<td>9.8</td>
</tr>
<tr>
<td></td>
<td>1,814,408</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Department of Statistics

- Sale of carcase meat or meat cut from carcases made up 79.8 per cent of total sales. Quite obviously this is proportionately the most valuable component as the carcase is 48% of the live animal by weight.
- Hides, pelts and slipewool, accounted for a further 9.8 per cent.
- The various offals made up the remaining $189 million or 10.4 per cent of the total. The variety meats account for nearly 40 per cent of the total by-products.

A couple of comparisons may be of use. First, the total value of all offals is greater than the total value of hides, pelts and slipewool. Second, the value of these offals is approximately equal to two-thirds of the total f.o.b. value of lamb sold to all Middle Eastern countries in the 1980-81 year.

Calculating Schedule Prices
Most freezing companies when calculating their charges for processing and storage of carcase meat include a charge per head as well as a separate charge per kilogram of carcase. The present charge by one South Island company is $8.87 for a 14 kg lamb. The net return from by-products is available as a credit from killing charge. These figures are not available, but for lambs it is around $3 per head.

Beef cattle are treated on a similar basis. Presently the direct killing charge for manufacturing cow in the same works is $126.48. The credit for by-products (excluding the hide) is understood to be as much as $70 per head.
The cost of processing a carcase (with the possibility of some credit from net sales of by-products), is deducted from the anticipated price (f.o.b.) of that grade of carcase. The most optimistic meat trader is supposed, on this basis, to set the schedule price for the week.

With cattle, the net credits for hides are included in the general carcase schedule. For lambs and sheep the skin credits are calculated separately. A net price for the pelt and the wool is given after having deducted the costs of handling and fellmongery. These costs presently are $2.64 for a lamb pelt with 1 kg wool.

THE ISSUES

With the facts now presented, what needs to be done is to discuss some of the problems which currently exist with by-products as well as some problems which may result from any changes.

Assessing Processing Costs

Until the 1981 Meat Act, when the establishment of processing companies was effectively delicensed, all increases in processing charges have had some degree of price surveillance imposed. This has been administered by MAF on a completely confidential basis. The extent to which credits from sales of by-products offset killing charges is unknown.

From 1974 to 1979, under the Price Stabilisation Regulations, an increased surplus from one year would have to be deducted from next year's admissable costs. This arrangement hardly encouraged efficiency in recovering and sale of offals. Indeed, many by-products then and now, are being sold on bulk orders at predetermined pricing arrangements.

Incidentally, while the meat trade has been diversified from the U.K. since 1950, this has not applied to by-products. During 1980-81, the proportion of our total lamb going to the U.K. was 44 per cent. For variety meats it was 63 per cent and inedible offal 97 per cent.

There are two other points that warrant mention. Increases in per head killing charges are generally expressed as a percentage increase over the previous per head charge. But this does not allow for any contribution from offals. Secondly, many by-products especially variety meats, qualify for Export Performance Taxation incentives, which means that from the f.o.b. value either a 7.7 or 9.1 per cent deduction can be made from the company's taxable profit.

Some New Marketing Demands

With markets for lamb and lamb products rapidly expanding in Middle Eastern Countries, an increased demand has been put on meat exporters to supply variety meats. Companies with only a Meat Exporters Licence have been at a disadvantage because they have not been given access to these offals. They have had to purchase these meats on an open market basis from the meat processing companies. The 1964 Meat Act technically did allow edible offals as part of the meat trade under the provisions of the 'open door policy'. The 1981 Act specifically precludes this.

Production and Marketing of By-Products

Freezing companies maintain confidentiality with regard to yields, rejection rates,
degree of processing, marketing arrangements, and net return for all by-products (both edible and inedible).

The Meat Producers' Board has statutory powers to monitor production and sale of carcase meats. However, the Board nor anyone else have any say on behalf of farmers with any of the by-products.

The Freezing Companies Association lobbied for this to remain so for the 1981 Meat Act. They knew they were going against farmer opinion as represented by the Meat Board and Federated Farmers. But at no time leading up to the enactment of the Bill, nor since have they attempted to placate farmer suspicions. About this time, the Hon. Duncan McIntyre said that offal represented the freezing companies' profit.

Further Processing

Some variety meats included, by-products offer a potentially wide source of industrial chemicals or pharmaceuticals. With exceptions, such as gall, most of these are presently rendered.

The Meat Industry Research Institute (MIRINZ) offers many services to freezing companies and does much basic research. As well as the potential for recovering more products they have developed a low temperature rendering system which offers improved efficiency to this whole operation. This has been incorporated into two New Zealand works. Many protein portions of by-products presently rendered are not fully exploited and more of the output from rendering could be processed for human consumption. MIRINZ also offers a completely confidential survey of many technical aspects of production to the freezing companies. The participating company is told its own position within the range of all other companies within the survey.

Historical Factors

By-products by implication are a second-rate product. A century ago this was true. This implication can now be seriously questioned.

The freezing industry has been preoccupied with upgrading hygiene regulations for carcase meat. Upgrading for by-product status, recovery and returns has been secondary.

For reasons of difficulty in apportioning costs to individual farmers the categories for which farmers have been paid for their stock have been kept to a minimum. Micro-processors now make this relatively easy.

In the past 10 - 15 years, freezing companies and meat exporters have been prepared to handle and process more grades of carcase from particular lines of animal. They have also been prepared, in the case of sheep and lambs, to recognize wool pulls of differing amounts. They have also been able to handle various penalties: e.g. seedy pelts, merino type riby pelts and black wool under the system.

Until recently, all sectors of the industry from farmer, through processor to various handlers of products were receiving an acceptable profit. This distribution of the total income is now changing.

As profit margins to the farmer decrease, elements of cross subsidisation within the processing industry itself and between farmers become less tolerable. As returns to the farmer decrease and on-farm costs increase at rates much higher than domestic inflation, farmers are questioning many inefficiencies within the freezing industry operation as it affects them.

Farmers view the confidentiality of all aspects of by-product recovery and sale
with some concern. The present debate for a separate or recognizable return for offal fits this rationale. Meat exporting companies wanting access to variety meats by way of the open-door policy fortuitously happens to coincide with farmer thinking.

THE FUTURE

A More Complex Schedule Payment for Stock Slaughtered
If each major part of an animal during processing is to have a schedule value placed on it, the whole schedule becomes more complex. There will be added complexity if variety meats are added to those available under the 'open-door policy'.

To take the most complex case as it would be with sheep and lambs, there would need to be the following schedule prices, each expressed on an f.o.b. basis.

- A separate schedule for different grades of carcase meat.
- A separate schedule for pelts and wool pull. This separate schedule was introduced about 15 years ago after producers applied pressure to have differing wool pulls recognised.
- A separate schedule anticipating average recovery of variety meats.
- A separate schedule for all remaining (non-edible) by-products.

Area Adjustments to these Schedules
These are presently made for grades of carcase where some factor of local competition exists. They are also made to reflect the values of lamb pelts from different parts of the country.

Schedules for by-products will have to be made against an average rate of rejection. If rejections are greater than this (such as animals from areas with facial exzema), alterations will need to be made.

The Producer Receives a Truer Value for His Stock
Most elements of cross subsidisation of good against poorer stock are now gone. If a producer sends stock that could be downgraded or rejected on any of the four aspects of the schedule he could receive several dollars less than he presently receives. Conversely, a supplier of ‘clean’ stock has the advantage. It would probably follow that all processing costs would have to be paid for all rejected or condemned stock. Some companies are presently doing this with ewes.

Influencing Type of Stock
On average, the schedule system reflects to the producer the type of product the market wants. If this is kept relatively simple, such as carcase type, and wool pull, a farmer can more easily assess aggregated market demands. If internal organs are added as separate variables the market prices for the main products could become slightly confused. This would be especially so if both yields and prices of by-products vary greatly either between years or from one part of the season to another.
Processing Company Profit

If the returns from offal minus their processing costs are to be made public with producers being rewarded accordingly, the last element of any degree of cross subsidisation of offal returns offsetting killing and freezing charges or adding directly to freezing company profits has gone. If the open door policy is to prevail for access sale of variety meats by anyone with a Meat Exporter's Licence, this part of traditional profit has also largely gone.

This does not mean to say that the processing companies are denied a profit - indeed, they must make a profit for their shareholders.

It does mean though, that their total charges for processing each type of stock are more readily known. It also means that the part of their business involving the Meat Processing Licence is more clearly separated from the other part of the business involving the Meat Exporter's Licence. It follows that companies with a higher cost structure will become known.

Thus several things are likely to happen:

- A more conscious effort to recover and process the better paying parts of the offal.
- A more conscious effort to efficiently market offals.
- A more conscious effort towards cost efficiency and rationalisation of processing inedible by-products.
- A greater willingness to use technology to produce a wider and possibly more refined range of products from the by-products.

Changes such as these would possibly mean centralised plants doing the processing for several slaughtering plants. The ownership of these plants need not necessarily remain with the freezing industry. In the intermediate stages of making these changes there is likely to be considerable debate between freezing companies and farmers. It is hoped that this can be done without acrimony. As each component of an animal has its own specific schedule value there could be a general weakening in setting these prices so that mistakes are covered or that an inefficient company is protected.

However the converse may also be true. Where the open door policy is fully implemented in a delicensed industry every effort will be made by each company to try and maintain a competitive edge over the others.

Changes such as these are the ultimate for an industry that is delicensed - where the forces of the market apply. Any company that makes a break in its technology of processing can share immediately these benefits with their suppliers.

If there is a will, even the present Meat Act need not necessarily be restrictive to bringing about changes so that the system of by-product recovery and returns is fair to all.

At the request of the Minister of Agriculture, the Meat Producers' Board is currently undertaking an extensive investigation into the whole area of by-product recovery. Processing and marketing as well as the right of access by other exporters. The investigation was requested by the Minister following submissions made on this subject at the time the Meat Act 1981 was under scrutiny.

Conclusion

The debate we are faced with is really one of trying to maintain a relative profitability between a farmer, a processor and a marketer in a long established industry. By-products represent a greater income to the country than hides, pelts and slipper wool, which have separate payments to the producer. Further, by-products remain as one portion of the animal that has been underestimated,
underexploited and undersold. Even a recent article by the N.Z. Freezing Companies Association alludes to this.

Present attitudes will change and there will be several consequential changes.

- A greater emphasis will be placed on further processing and marketing of many by-products.
- The open door policy for variety meats will be recognised.
- Freezing companies will be changed so that the processing part of their business is separated from the exporting part. Their service will become a more clearly identifiable, intermediary in the whole production and marketing chain.
- Individual farmers may get a shock if they have to stand all costs of processing especially where rejection is relatively heavy. This may make farmers more conscious of health of animals at the time of slaughter.
- In areas of the country where there is little competition between companies, farmers there may face more difficulties in sharing rewards of those changes.

It is now the second century of the meat industry. For the first 80-90 years, farmers as a group have either been shareholders or sympathizers with the meat processing industry. Shares of the local companies of 100 years ago have largely left rural hands. Company policy appears to have largely left their rural interests for that of the protected industrial sector of the country.
Resolution Passed Unanimously at
The Lincoln College Farmers' Conference on 18 May 1982

PROPOSER - Professor J.D. Steward, Principal, Lincoln College.

"This conference notes with concern the declining share of the international meat trade of sheepmeat and beef and urged the Meat Board and meat companies to redouble their efforts in marketing and promotional work".

"This conference is encouraged by the evidence of the technical progress in the processing sector and urged the Government and industry to continue vigorous research in this area".

"This conference urges management and unions in the processing industry to speed the technical advances essential to increased productivity and maintenance of a viable industry, recognising that the benefits of this must be reflected in farm gate prices if the industry were to grow and provide increased employment opportunities at all levels".

"This conference urges farmers to note the changing patterns of demand in the world marketplace and to be prepared to adapt their management and breeding systems accordingly to meet better needs of this market".

Part 2

BARLEY SYMPOSIUM
Barley symposium -
chairman's introduction

G. H. McFadden, Senior Advisory Officer, Ministry of Agriculture & Fisheries, Christchurch.

This review is very appropriate, not just because of the recent big upsurge in interest in barley, but also because some would suggest this crop has received less attention than wheat. However a lot of work has gone on quietly with barley over the years and the people directly involved are here today to lead us through the history of the crop and its management requirements.

One most important aspect of today's programme is that we see the marketing of the crop quite properly treated as a part of a technical session on growing barley. Too often in the past our consideration of crop production has stopped at the farm gate.

Nationally, we have seen barley come from 12,000 ha in 1900 to 20,000 ha in the 1950's (with up to 90% being for malt) and to 100,000 ha in 1982 (with 25% being for malt). These figures reflect the great upsurge in barley use in the stock food industry in the 1960's and early 1970's and more recently the export of appreciable quantities of feed barley. The export market has also seen the development of increased grower involvement in marketing.

So, there have been a lot of recent developments with the crop, but it now appears that any further expansion will have to be export orientated. In this we must continue to assess the agricultural policies of the U.S.A. since they dominate the world market for coarse grains.

Barley is a very responsive crop to management (or mismanagement). It is the dominant cereal in this particular district and has exceeded the wheat area for many
years. It is important to appreciate that a reservoir of skills has been built up over many years in growing this crop.

Consider these skills along with the present trends in arable farming, the increased specialisation in a narrower range of crops and the attention to detail in manipulating crops and their yield components. Consider also, the present pressures on the arable cropping industry, the cash flow problems which are arising, the costs of machinery replacement and the industry's sensitivity to our monetary exchange rate. Then, the barley crop, like arable farming itself, may well be at the cross-roads.

We have to make some clear decisions. I believe the New Zealand farmer and marketer must get together and both decide clearly what we can do best, what we can do most profitably and what is our niche (specialist or otherwise) on the world arable crop scene and then jointly set out to see that we deliver the goods in the best possible marketing package.
Problems of growing and harvesting

F. A. Bull, farmer, Waddington

The biggest single problem facing the New Zealand arable farmer today is the effect inflation is having on the replacement of his machinery.

Since 1975 there has been about a four-fold increase in nearly every item of plant and machinery right down to the humble plough-share as compared to an approximate two-fold increase in the value of barley over the same period. It has been suggested that the increase would have been considerably less if it had not been for the formation last year of the South Island Export Barley Society.

As a matter of interest, last year it took 10c of barley to make 1 gallon of beer. The last two years increase in the barley price to the grower has been 3c per gallon, while beer over the same period rose by $2.00 per gallon to the consumer. One wonders who received the other $1.97 and how they justified it.

If grain prices are going to continue to lag behind inflation then there must eventually come many changes in the cropping sector, because the capital value of machinery, especially headers, will simply make individual ownership uneconomic.

We are already witnessing a greater use of contractors and machinery syndicates. Syndicates work well in many cases, but for the independently minded farmer or the one who takes more pride in his equipment, there are many areas where relationships are likely to become a little strained.

However, it is quite clear that many farmers place too much emphasis on the convenience of private ownership and disregard the economics.

Six years ago I travelled to England, purchased a new header retail and landed it back in my yard for $41,000 - $32,000 below the New Zealand retail price.

That machine has now harvested about 3,500 hectares and has a market value of about $50,000. To replace it would cost an extra $80,000, plus about $18,000 per year in interest. Add another $14,000 per year as a replacement allowance on the $80,000 over six years and the total per year cost to change is $32,000.

How then can the average farmer justify the capital expense?
Cultivar and Seed Quality

Our ground is finally prepared to our individual satisfaction and it has cost us accordingly. Some time prior to this point we had another problem in choosing the variety we would grow. Crop Research Division and most of the grain firms publish lists to assist the grower. After making our choice we then have to actually get possession of the seed. Now with Breeders' Rights, Head Licensees and Royalties to contend with, one can run into certain snags. Most grain firms will prefer their clients to grow one of their own licensed varieties, and if financially committed to a particular firm then prefer may not be a strong enough term. If on the other hand a farmer decides to grow the barley free, or for the Barley Society, then the seed may suddenly become very scarce or rather more expensive.

Now that we have finally acquired our seed, it is advisable to have a look at the quality. The Malting Company do not want barley with more than 5% skinned because it affects the germination. But how often does one find up to 30% skinned in the seed we are expected to sow, or perhaps an equivalent percentage of screenings. Seed barley should be threshed to malting standard, and clearly much of it is not.

If a grower really wants a challenge, he should try getting a copy of the Purity and Germination Certificate before he actually sows the seed.

Harvest

In New Zealand, unless we have a drier, it is unlikely that we will start threshing until the grain moisture drops to 14% or very close to it. Although I have found from experience that barley stores quite safely at 16%. However, storage must be fumigated before filling regardless of moisture content. Last year, many thousands of tons of grain in Canterbury became infested with insects and in most cases a few dollars of housework prior to harvest would have prevented the problems.

It would be interesting to know how much barley has been lost in Canterbury in recent years because it sat for days on end at 16% and was then caught by a nor-west blow and lost for the sake of 2%.

In England, grain is traded at 16% moisture and many of the larger properties have a machine to bring the moisture back up to the legal limit. As an example, one English farmer sold his 9,000 tons of grain at 15% moisture instead of 16%. This represented a loss in weight of 90 tons or at the 1976 English malting price of $2,000 per ton, a drop in income of $18,000. Used on that scale, the machine pays for itself in its first year. We may not have New Zealand grain growers who harvest 9,000 tons but in 1982 in Canterbury a lot of grain was harvested at 11% or less and so many farmers missed out on 3% of income. If our grain is to be rejected or docked in value when over 14%, why not a corresponding increase when it is under the limit, as is usually the case.

Our moisture has finally come right and now to the harvesting. A header operates best if treated like a baby - "keep the front end full, the back end clean, and don't feed in anything that can't be digested."

We grow barley for two end uses - the malting trade and the feed trade but all too often, some grain intended for the former is suitable only for the latter. Feed barley can be abused by the operator and his machine during the threshing process and remain feed barley although the throughput would suffer. However malting barley will rarely stand abuse and survive the experience. Setting the header for practically all barley can be likened to a bloated cow - tight, slow and
plenty of wind.

It is advisable not to remove the clover plates from the concave when threshing barley whether feed or malting. Rarely is it necessary to exceed a 3/16 inch concave clearance and in the case of malting barley drum revs should be between 400 & 500. Those settings normally give between 0% and 2% skinning. Under most conditions those settings will also produce a clean whisker free feed sample. A barley grain has a better chance of surviving a hard slow rub than a soft fast smack although to the amateur that may appear somewhat contradictory. Many operators would get better results by using filler plates and slower drum speeds, which in turn give cleaner removal of whiskers and less breakage of straw.

A header rapidly losses its capacity when the sieves are loaded with hairy barley and chopped up straw and the grain loss on walkers and sieves increases markedly when the whisker is not removed. A good example is in the threshing of wheat. Some of the best throughputs and cleanest samples can be achieved when the tyres are wet with dew because the husk then stays on the head. As long as there is plenty of power and tight belts the rest is easy.

Too many operators seem reluctant to use maximum air to obtain maximum sieve capacity. A higher air flow requires a wider sieve opening and this of course, will result in a rougher sample if the machine is then allowed to run light.

No two machines or people are identical so best results will be achieved if a header has one operator whenever possible. Purists usually do not class a driver listening to a stereo as an operator. One’s ears and feet will tell of any problem or change in the running of a machine. Something as simple as a build up of barley whisker in one straw walker should be felt by a good operator and rectified before it stresses bearings and cranks.

Some varieties of barley are prone to lodging under good growing conditions and where this is the case it is very important that the ground be reasonably level but also free from rocks and other objects if knife loss is going to be kept to a minimum. The width of the fronts on many of todays big machines makes them very difficult to operate safely close to the ground on rough paddocks.
Making money from barley

J. P. Malcolm, Seed Production Specialist, DSIR, Lincoln.

On this subject no hard and fast rules can be given because variable seasonal conditions prove foresight may be in vain according to the Burns' lines:

"The best laid schemes o' Mice an' Men,
Gang aft agley."

However, guidelines to achieve optimal results can be presented in the hope that the most appropriate methods will be employed.

The obvious way to make barley productive, in terms of money, is to produce the highest possible yield of saleable grain. Figure 1 shows gross margins for barley in September 1981 grown on Temuka silt loam on the lower plains area of Central Canterbury. In this case, the crop was direct drilled into desicated white clover/green-feed oats and overhead irrigation was available.

Using this recent gross margin analysis as a model, a table was constructed to show gross margins at various yield levels up to 8 tonnes per hectare. The top yield is not a pipe dream because on a field scale an Ashburton farmer produced 7.574 t/ha with Mata barley in the 1980 Ammo-Phos competition. In the table a yield level of 3.5 t/ha is included because this is the average barley yield for New Zealand during the five seasons 1975/76 to 1979/80. Another figure included is 1.12 t/ha which shows the break-even point in this case to cover growing, heading, cartage to silo and cartage to delivery point. The cost of growing the crop is taken as $171.10 per hectare, and heading and cartage is $18.80 per tonne.
Barley Gross Margins at Various Yield Levels

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<tr>
<td>0</td>
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<td>171</td>
<td>-171</td>
</tr>
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<td>172</td>
<td>190</td>
<td>-18</td>
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The point obvious to everyone is that below average yielding crops show a low or non-profitable gross margin. Better than average crops not only improve the 'whole farm gross margin' but they put barley into a better position to compete with other farm activities. For instance, in the case used, spring wheat yields about 5.4 tonnes per hectare. With the wheat at $195 per tonne (gross margin $800 per hectare) barley needs to produce at least 6.2 t/ha at $172/t to compete.

How can we achieve profitability from barley? An exact blueprint cannot be presented, but some longstanding practices are still viable. These are not necessarily too old-fashioned and some good lessons can be learned from the chronological graph of barley yields in New Zealand covering 1870 to 1980.

Guidelines to Consider

Place in Rotation
Choice of Cultivar
Sowing Time
Sowing Rate
Fertilisers
Weed Control
Disease Control
Harvesting
Storage

Place in Rotation
As an adaptable crop, barley is found in a variety of positions in the cropping pattern of mixed farming. In four cases out of five, barley follows a crop rather than pasture which makes seed bed cultivation a cheaper operation.

On the other hand, barley after pasture with reasonable clover content and having
carried good stocking numbers has restored fertility which reduces the necessity for fertilisers. This applies especially to nitrogen which, if added, will not give a yield response; it may even give a yield reduction with a crop of thin grain under these circumstances. Other restorative crops are swedes, turnips, rape, kale, green feed, crop aftermath heavily grazed and the legumes, lucerne, peas, beans, lupins, seed clover stands when all plant residues are retained.

Depletive crops before barley are wheat, barley, oats for grain or chaff, linseed, potatoes, annual ryegrass seed crops, processing peas with vines removed, and also fodder beet and kale when removed and fed elsewhere. Poor grass pasture which carried low stock numbers is of little help to fertility.

Barley after a restorative crop will give a better yield and may require a lower fertiliser input.

Choice of Cultivar
There are now 19 barley cultivars eligible for seed certification by the Ministry of Agriculture and Fisheries. Two of these are barleys for winter sowing for which there are no official trial yield data, and 1 cultivar, Rupe, which is now outclassed in performance.

This leaves 16 cultivars which are described and ranked for yield, according to district, in Aglink FPP 162, Barley Cultivars, Recommended List for 1981. This publication is a 'must' for every barley grower to pick a good performer in such a large field of contenders.

When making a selection do not consider relative yield alone, because other characteristics determine the best usage of a cultivar according to farm circumstances.

For the Canterbury-North Otago region, Hassan and Mata are the trial standard cultivars and their yield is expressed as 100. In the following yield ranking, differences of three points or less may not be significant:

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Yield</th>
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<tbody>
<tr>
<td>Gwylan</td>
<td>107</td>
</tr>
<tr>
<td>Goldmarker</td>
<td>106</td>
</tr>
<tr>
<td>Magnum</td>
<td>106</td>
</tr>
<tr>
<td>Ark Royal</td>
<td>104</td>
</tr>
<tr>
<td>Georgie</td>
<td>104</td>
</tr>
<tr>
<td>Kaniere</td>
<td>102</td>
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<tr>
<td>Manapou</td>
<td>102 (m)</td>
</tr>
<tr>
<td>Makareta</td>
<td>102</td>
</tr>
<tr>
<td>Hassan</td>
<td>100</td>
</tr>
<tr>
<td>Mata</td>
<td>100 (m)</td>
</tr>
<tr>
<td>Julia</td>
<td>97</td>
</tr>
<tr>
<td>Zephyr</td>
<td>96 (m)</td>
</tr>
<tr>
<td>Pirouette</td>
<td>92</td>
</tr>
</tbody>
</table>

(m), cultivars contracted for malting.
Starting from the top of the ranking list, do not necessarily select Gwylan because it produces thin grain and very high screenings under moisture stress. It’s high yield potential (only in this region of New Zealand) is expressed with adequate irrigation or on good soils which provide sufficient moisture.

Goldmarker is another top yield ranker, but it inherently has smallish grain which may give high screenings unless well grown. The straw can lodge a little compared with Gwylan which has very short strong straw.

The other top yielder is Magnum which normally produces plump grain with low screenings. It’s late maturing habit may be a disadvantage in some circumstances.

In the second yield grouping, Ark Royal can be a high yielder, but is not recommended for light land. It is also a later maturing cultivar and often produces high screenings unless irrigated.

Georgie is a consistently good yielder of plump grain with no really bad defects. In the same category is Kaniere with consistent yields of plump grain. Manapou is mainly a barley for this region because it maintains a good yield in dry seasons when other cultivars have a greater yield depression without water.

For consistency, Makareta is like Kaniere for yield and plump grain. Hassan and Mata are both well tried, consistently good barleys for yield, plump grain, maturity and most other important characteristics.

Our main trusty friend since 1965, Zephyr, is gradually being replaced by the newer cultivars although it still occupied 54% of the New Zealand barley area in the 1979-80 season.

Of the remainder, Julia gives inconsistent yields mainly because of loss of heads in windy conditions. Pirouette has not yielded relatively at all well in Canterbury–North Otago.

Because the next season is an uncertain event, my selections for consideration on the tote would be from Georgie, Kaniere, Hassan and Mata for all-round general performances, Manapou for a dry event, and Gwylan, Goldmarker, Magnum and Ark Royal with extra special treatment to give their top performance.

Sowing Time
This may extend from late August on warm free-draining soils near the coast to early November on poorly drained soils or in higher altitude inland districts with colder soil in the spring. A late catch crop may even be sown in December. The general rule is to drill when soil temperatures are high enough to initiate the spring flush of pasture growth and a suitable seed bed has been prepared.

Within these limits, the earlier the sowing the better the result to get barley established and through the vital growth and development stages before summer moisture stress. The more widespread availability of irrigation allows for more successful later sowing if required. This will allow the barley area to be utilised longer for early spring feed, and spread the spring work load. It will also buffer the crop against summer moisture deficiency, and utilise irrigation water and plant when they are more available after other water needs have been met.

To illustrate the adverse effect of late sowing most of us should remember the 1974-75 season when sowing was delayed at least 5 to 6 weeks and seedbeds even then were less than ideal. In 1974, July rainfall at Lincoln was 66 mm, August 98 mm, September 77 mm, October 66 mm. Except for very free draining soils there was no chance of preparing a seedbed or sowing spring crops. Soil dried out during a very dry November. December was dry, the overall late-sown barley did not tiller well, leaf diseases were bad, the critical grain-filling stage received no rain.
until mid-January which only benefited the very late sown crops. This resulted in the most disappointing of barley crops in memory, with the first-sown crops having low yield and high screenings and the later crops sprouted in the head with the follow-up very humid February weather.

The 1974-75 result was 2.52 t/ha, which explains the dip in the graph of yields. Comparable yields for adjacent seasons were 3.5 t in 1972-73, 2.77 t in 73-74 (a dry season), 3.37 t in 1975-76.

The message is clear. If possible do not unduly delay sowing unless the crop can be irrigated as necessary. However, extra irrigation costs extra money and later sowing requires a higher seeding rate which costs extra money.

Sowing Rates
Rates vary between 80-170 kg/ha depending on time of sowing and soil type.

Early sown crops have more time during early growth and development stages to produce more tillers per plant. Therefore, the lower seeding rate is employed. Similarly a low rate is employed on very light land which cannot support a very dense crop especially through the grain developing and filling stages.

On the other hand, late sowing in November, or even December, hurry through their early development stages and produce only one or two tillers per plant. The extra seed at the higher rate compensates for this to produce enough ears per unit area.

Fertilisers
Barley does best on soils that do not have too low a pH.

Extensive fertiliser trials many years ago showed that 120 kg/ha of superphosphate, or equivalent, gave a payable yield increase. Soils with a high yield potential for barley may show economic yield responses with up to 250 kg/ha of superphosphate.

No reliable evidence is available to show any advantage in applying potassic fertiliser as an extra.

Contrary to English experience, nitrogenous fertilisers do not give regular yield increases in New Zealand because of the unreliable spring and early summer rainfall. Also the nitrogen status of the soil is usually adequate for barley when it is sown after pasture (with clover) or other good resorative crops.

Weed Control
Spraying for weed control is now standard practice to reduce the competition of weeds for moisture and light. Reductions of 25% in grain yield have been recorded with only a moderate infestation of fathen in a dry season.

Harvesting
Barley is an easy crop to thresh if grain and straw are in fit condition. The grain should be undamaged, rubbed entirely from the head and the awns rubbed off.

To avoid grain damage, always opt for the slowest drum speed that will do the job. Set the concave close enough to the drum to achieve a slow firm rubbing action similar to threshing a head with the heel of one hand in the palm of the other as we
sometimes do to assess fitness of a crop.

In marginally fit cases, headers should be set with the slowest possible drum speed (pea speed) and the drum-concave clearance as close as possible (clover clearance) to achieve clean threshing with no grain damage.

Correctly harvested grain at correct moisture is storable and marketable at the most advantageous price.

Storage

Damaged or moist grain encourages the development of moulds and any residual storage pests.

Rubbishy grain or grain still with a lot of adhering awn is difficult to handle through conveying systems and takes up costly extra space in storage.

Summary

Manipulate these guidelines to advantage to get into the top sector of the gross margin graph.
Getting the best yield

J. P. Milner, Ministry of Agriculture and Fisheries, Palmerston North.

Cultivation

Of the total time required to produce a barley crop (or any cereal), the time spent cultivating probably accounts for the bulk. Ploughing is normally the first step in cultivation and its principal function is to facilitate a good fertile, weed-free, seedbed. There are a great variety of implements used after ploughing to produce the seedbed but whichever we use, the aim should be to achieve what we're after with as few passes possible. Some implements can produce a seedbed with a single pass. The best I've seen are P.T.O. driven rotary harrows and crumbler. They're best suited to lighter textured soils but will still perform well in heavier soils as long as the ground is not too wet. Ploughing should be done as early in the spring as possible to ensure a reasonable fallow. If coming out of pasture, 4 weeks should elapse before sowing. This ensures good organic breakdown and reduces pest numbers, such as Argentine Stem Weevil.

There is much interest in direct drilling as an alternative to conventional cultivation techniques. In the past one of the biggest factors causing apprehension among farmers was the cost of the systemic herbicide, glyphosate. The chemical remains expensive but has been married off to C.D.A. spraying.

Consequently, application rates have dropped substantially without a decrease in effectiveness. There is no doubt that the technique is beneficial to labour and energy efficiency, as well as soil structure. One man can establish one hectare of crop 4 times faster using direct drilling compared to conventional cultivation. This undoubtedly means savings on manpower and diesel with longer tractor life. However, costs are incurred with the spraying rig required, glyphosate, extra nitrogenous fertiliser, and insecticides.

The question of which method is the most cost effective or easiest method of establishment is not the most important. Whether or not yields and overall reliability
are the same are two very important considerations. Under ideal soil conditions, in terms of moisture and soil-seed contact, direct drilling has proven reliable and capable of producing yields as high as conventional cultivation. However, when conditions are less than ideal as with soil that is too wet or too dry or compacted, yields often become much reduced because of poor emergence. A problem surfacing in the North Island is the difficulty of obtaining a good burn after direct drilled crops. The presence of weeds, particularly summer grass, is making this almost impossible in some cases. To quote John Lay, a farmer from Irwell, "There are ideal conditions for the establishment of direct drilled crops. The further one strays from these ideals, the more you reduce your chance of success."

Sowing

Barley should be sown early enough so as to allow the crop to grow under adequate moisture conditions for as long as possible. Researchers have found that October-sown crops yield better than November-sown crops which in turn yield far better than December-sown crops. September sowings offer little benefit from October sowings and may even result in less yield. Presumably low soil temperatures are likely to affect the crop with September sowings.

The most important factor determining yield in barley is head numbers, and generally, the more heads the greater the yield. The question of screenings and its relationship to the price farmers receive is also very important, however head numbers affect the screenings too through their effect on 1000 grain weight. So we want a lot of heads to give us a good yield but not too many so as to produce small grain and therefore high screenings. Light land will not support as many heads as heavy land or where irrigation is available. The best farmers can do is attempt to establish a plant population which is most likely to result in the ideal head numbers desired.

For light land a plant population of 200 plants/m² and for heavier land - 250 plants/m² are the most economic sowing rates to use. By finding out the 1000 grain wt of the seed we're using and assuming a likely seedling emergence we can calculate the required sowing rate. The following formula is what is used:

\[
\text{Sowing rate (kg/ha)} = \frac{\% \text{ establishment} \times 1000 \text{ grain wt}}{\text{Plant no.} \times 100 \times 100}
\]

For example assume a 1000 grain wt. of 45 g and an emergence of 85% - typical for spring sown cereals.

Say we want to establish 200 plants/m²

\[
\frac{85}{100} \times \frac{45}{100} = 200 \div .85 \times .45 = 106 \text{ kg/ha}
\]

Using 250 plants/m²

\[
\frac{85}{100} \times \frac{45}{100} = 250 \div .85 \times .45 = 132 \text{ kg/ha}
\]
You may not achieve exactly the plant populations desired because the establishment % will vary from year to year around the 85% average value. If we sowed 132 kg/ha of seed, aiming to establish 250 plants/m², and establishment varied 10% above and below 85% then plant numbers would vary by 30/m² above and below 250. Compare this to sowing by weight alone. Assume we sowed 132 kg/ha again. We get variation not only from differing establishments but also from varying grain weights.

To calculate the plant numbers established just reverse the procedure for calculating sowing rate.

\[
e.g. \quad \text{132 kg/ha} \quad \text{1000 seed wt} = 40 \text{ g}, \text{ establishment } = 95% \\
\quad \frac{45 \times 95}{100} = 132 \div \frac{.40 \times 95}{100} = 313 \text{ plants/m}^2
\]

\[
e.g. \quad \text{132 kg/ha} \quad \text{1000 seed wt} = 50 \text{ g}, \text{ establishment } \times 75% \\
\quad 132 \div .50 \times 75 = 198 \text{ plants/m}^2
\]

By simply sowing by weight alone we introduce much more variation. Plant numbers which are too low will produce less yield while those too high mean we've wasted seed and could produce a line of grain with high screenings.

**Fertilisers**

Nitrogen and phosphorus are the two nutrients most involved in fertiliser applications to barley crops. Potassic fertiliser has not been shown to be beneficial to barley yields in New Zealand. Most soils have large natural reserves of this element which are being continually and slowly released. The recommendation for phosphorus is that as 15 - 20 kg of phosphorus/ha are removed with a barley crop, then this amount should be applied simply to maintain soil reserves. If your soil test figures for phosphorus are below 10, then you could expect a yield increase to added phosphorus. Above 10, responses are less likely and above 20 they are unlikely. You could utilise high soil phosphorus reserves by not applying any when soil test figures are this high. Yields would not be affected but soil reserves would decline.

The amount of nitrogen to apply is a more difficult question to answer. We know that about 25 kg N/ha is required to produce 1 tonne of barley. After pasture, there will be ample nitrogen releasing organic matter, to supply the needs of the crop. It's in subsequent years when this organic matter has declined that there needs to be nitrogen supplementation. The decline in barley yields with each subsequent crop is well documented.

Small shortages of nitrogen will be tolerated by a barley crop and will be reflected in lower nitrogen levels in the grain - considered desirable by maltsters. Yield potential is set soon after sowing through tillering and the formation of spikelets at the
growing points of each tiller. This will ultimately decide how many heads the crop will have and how big they are. Nitrogen deficiency will restrict tillering, decrease tiller survival and reduce head size, therefore reducing yield. Phosphorus has also been shown to benefit tillering. Because all this occurs from growth stage 2 to 5 the most convenient time to apply any fertiliser will be at sowing, through the drill. The fertiliser will then become available at about the time the barley plants start to require it.

The benefits of nitrogen are often closely related to the amount of moisture available to the crop during grain fill. The more reliable the moisture supply the more reliable the response to nitrogen. Total yield may not necessarily be affected however there will almost certainly be a large proportion of screenings in those crops receiving nitrogen and suffering from dryness later on. It has been shown that on dry soils irrigating can nearly double yield. If nitrogen is not used then irrigating at 10% available soil moisture gives the best results. However, when nitrogen is applied then to obtain the full value of the nitrogen, irrigation needs to be at 15% available soil moisture.

There is hope for a soil test being developed at Winchmore Research Station which will indicate exactly how much nitrogen a particular paddock needs. Researchers in Canterbury have obtained economic yield increases from adding up to 50 kg N/ha, even on drought prone soils. Winchmore has obtained good yield increases to adding 50 kg N/ha but only with irrigation. Farmers need to be applying up to this amount once they have gone past the first year out of grass.

The best fertiliser is the cheapest. For phosphatic fertilisers, the cheapest source of phosphorus alone will be superphosphate. The following is a price list of various fertilisers quoted from Ravensdown (Hornby) this autumn:

<table>
<thead>
<tr>
<th>Fertiliser</th>
<th>Price (per tonne)</th>
<th>Price (per kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Super - bags (7.5% citric soluble P)</td>
<td>$136.85</td>
<td>$1.82</td>
</tr>
<tr>
<td>D.A.P. (18:20)</td>
<td>$424</td>
<td></td>
</tr>
<tr>
<td>Urea (46% N)</td>
<td>$438.35</td>
<td>$1.05</td>
</tr>
<tr>
<td>Ammonium Sulphate (21% N)</td>
<td>$216.65</td>
<td>$1.03</td>
</tr>
<tr>
<td>Crop Mix (6:6:5:13)</td>
<td>$165.15</td>
<td></td>
</tr>
</tbody>
</table>

D.A.P. becomes very economical if you require both N and P which are present in about the same quantity. It would be useful for applying your 15 - 20 kg P/ha plus a small dressing of 15 - 20 kg N/ha the second year out of grass. If the cost of phosphorus at $1.82/kg is subtracted then the nitrogen is costing 33 cents/kg compared with over $1/kg for straight nitrogenous fertilisers. What is required is a fertiliser with say a 3:1 ratio of nitrogen to phosphorus. None of these fertilisers fit into this category. We can mix various fertilisers to get what's required. The following are two examples with costings:

1. 50:50 mix of Super + Ammonium Sulphate
   100 kg of this mix will contain -
   50 kg of Super @ 7.5% P = 3.75 kg P
   50 kg of Ammonium Sulphate @ 21% N = 10.5 kg N.
   So the analysis will be 10.5:3.75 or approx. 11:4. One tonne of this mix will cost
   .5 x $136.85 = $68.43
   .5 x $216.65 = $108.33
   By applying 400 kg/ha we are supplying -
   400 x 20 kg = 8000 kg
   400 x 15 kg = 6000 kg
   cost = $70/ha.
2. 40:60 mix of D.A.P. + Ammonium Sulphate

100 kg of this mix will contain
40 kg of D.A.P. @ 18% N = 7.2 kg N
@ 20% P = 8.0 kg P

60 kg of Ammonium Sulphate A 21% N = 12.6 kg N

So the analysis will be 12.6 + 7.2 : 8
= 19.8 : 8 or approx 20 : 8

One tonne of the mix will cost
.4 x $424 plus
.6 x $216.65 = $299.20/tonne

By applying 200 kg/ha we supply -
40 kg N/ha
16 kg P/ha

cost = $60/ha

The second mixture has the advantage of being both cheaper and lighter. When thinking about fertilisers, first decide what's required, how much of each element is required and which fertilisers supply them. Finally, the best value for money, based on the cost per kg of nutrient to be applied, should determine which fertiliser or mix is used. There is little benefit from taking account of sundry elements which may be present in some fertilisers e.g. potassium or sulphur.

Weed Control

Spraying for weeds is now a standard procedure in nearly all barley (or cereal) crops. The commonly used broadleaf sprays do a good job. Many paddocks are being sprayed automatically whether they require it or not. Many first year crops don’t require herbicides.

There were many reports last season, from both the North and South Islands, of herbicide damage. Most of the effects were temporary, but those crops sprayed too late suffered quite severely. Plants were stunted, the heads often failed to emerge and the flag leaf was twisted around the stem. Obviously it’s vital to spray at the correct time, especially in dry years when the plants are likely to take in more chemical.

Summary

By establishing a suitable plant population into a well prepared seedbed with fertiliser requirements met, a farmer has done just about all he can do in trying to secure maximum economic returns. Once the crop is established and the weeds are controlled, it’s up to the sunshine and rain to decide if the year will be good or bad for him. If irrigation is available, then good results are more likely.

There are still large gains to be made through the breeding of new cultivars in New Zealand. Only a small proportion of the barley cultivars available in New Zealand were bred here. This is in contrast to wheat where almost all cultivars are locally bred. It seems reasonable to assume that cultivars bred in New Zealand should perform better than imported cultivars.

An example of what can be achieved through plant breeding is a barley bred specifically for the semi-arid areas of the U.S.A. It will yield up to 4.5 t/ha without
the use of nitrogenous fertilisers and with only a single 6 inch irrigation after planting. No extra rain or irrigation is required to guarantee yield. There is no reason why New Zealand can't breed cultivars similarly adapted to various environments existing in New Zealand.

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McLeod, C. C. Long-term Barley Fertiliser Trial (8th year).

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Martin, R. J. Effect of Irrigation and Sowing Date on Cereals, 1980. Annual Report of Agricultural Research Division of the MAF.

Seed Trade News (USA), Jan. 6, 1982.
Protecting the barley crop

R. C. Close, Microbiology Department, Lincoln College.

In order for barley growing to be profitable there must be low inputs with relatively high outputs in the form of harvested grain. With foresight and good management: the cost of protecting this crop against the yield-reducing effects of weeds, insects and diseases, should be kept as low as possible. Decisions as to the overall plant protection programme for barley can be made some time before sowing, at sowing, during crop growth, and after harvest.

Cultivars

There are many barley cultivars now available and most have resistance to one or more diseases. Thus resistance must be considered when selecting a cultivar as well as potential yield, grain size and end use.

Table 1 lists the main cultivars and their reaction to powdery mildew, leaf rust and scald. These reactions have been derived from data in Anon. (1982), Thaine & Malcolm 1981, and supplied by the companies concerned. A brief description of and key to these and other diseases is contained in the Appendix a modification of that produced by Sanderson (1973).

Seed Treatment

Grain for sowing can be saved from your own crop or can be obtained as one of three grades of certified seed from agricultural merchants. All seed barley should be treated with a fungicide. Seed from merchants will be treated. Farm-saved seed may be sent to merchants for treatment, be treated by mobile operators, or by
TABLE 1.

Resistance of Barley Cultivars to Some Leaf Diseases

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Powdery Mildew</th>
<th>Leaf Rust</th>
<th>Scald</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ark Royal</td>
<td>MR</td>
<td>MR</td>
<td>S</td>
</tr>
<tr>
<td>Georgie</td>
<td>MR</td>
<td>MR</td>
<td>S</td>
</tr>
<tr>
<td>Goldmarker</td>
<td>MR</td>
<td>MR</td>
<td>MR</td>
</tr>
<tr>
<td>Gwylan</td>
<td>MR</td>
<td>MR</td>
<td>R</td>
</tr>
<tr>
<td>Hassan</td>
<td>MR</td>
<td>MR</td>
<td>MR</td>
</tr>
<tr>
<td>Julia</td>
<td>MR</td>
<td>MR</td>
<td>MR</td>
</tr>
<tr>
<td>Kaniere</td>
<td>S</td>
<td>S</td>
<td>S to MR</td>
</tr>
<tr>
<td>Koru</td>
<td>MR</td>
<td>MR</td>
<td>R</td>
</tr>
<tr>
<td>Kym</td>
<td>R</td>
<td>MR</td>
<td>R</td>
</tr>
<tr>
<td>Magnum</td>
<td>S</td>
<td>MR</td>
<td>R</td>
</tr>
<tr>
<td>Makareta</td>
<td>R</td>
<td>R</td>
<td>MR</td>
</tr>
<tr>
<td>Manapou</td>
<td>S</td>
<td>S</td>
<td>MR</td>
</tr>
<tr>
<td>Mata</td>
<td>S</td>
<td>S</td>
<td>MR</td>
</tr>
<tr>
<td>Triumph</td>
<td>R</td>
<td>R</td>
<td>MR</td>
</tr>
<tr>
<td>Zephyr</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
</tbody>
</table>

S - susceptible
MR - moderate resistance
R - resistant

Some farmers have used untreated seed saved from a crop grown the previous year from certified seed. This practice certainly should not be done more than once with any line of seed.

Three seed treatment chemicals are commercially available. Dithane M45 SD (80% mancozeb) will control covered smut and protect the plants against some soil-borne disease organisms. Vitaflo 200 (contains 20% carboxin and 20% thiram) and Baytan F17 (15% triadimenol and 2% fuberidazole) will do the same but also control loose smut, an infection that can be present in the seed.

TABLE 2.

Seed Treatments for Control of Barley Diseases

<table>
<thead>
<tr>
<th>Disease</th>
<th>Dithane M45 SD</th>
<th>Vitaflo 200</th>
<th>Baytan F17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covered Smut</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Loose Smut</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Net Blotch</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Spot Blotch</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Powdery Mildew</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Leaf Rust</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>
controls some leaf diseases such as powdery mildew and leaf rust, when these are present in young crops arising from late-sowing (November-December). Table 2 sets out the spectrum of activity of the three products.

It should be noted from Table 2 that the two seed-borne diseases, net blotch and spot blotch, are kept in check by these products though often the effectiveness varies in relation to the climate and the cultivar (Sheridan, 1982). However, net blotch can be present also on the stubble and air-borne spores from that source can spread into new-sown crops. In many cases, however, the seed-borne inoculum is more important and must be totally eradicated. Hence research continues in order to obtain cheap but highly effective chemcals for control of this and other diseases. The life cycle of net blotch is shown in Fig. 1.

Figure 1: Life cycle of Net Blotch of barley showing that primary spread into spring-sown barley crops can occur from two sources, infected seed-seedlings and spores from infected volunteer barley. Spread within such crops (secondary spread) is by spores produced on the surface of net blotch infected parts of barley leaves.

### TABLE 3.

<table>
<thead>
<tr>
<th></th>
<th>Take-all</th>
<th>Eyespot</th>
<th>Fusarium</th>
<th>Net Blotch</th>
<th>Spot Blotch</th>
<th>Scald</th>
<th>Leaf Rust</th>
<th>Powdery Mildew</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barley Stubble</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Volunteer Barley</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

TABLE 3.
Barley Stubble and Volunteer (Self sown) Barley as a Source of Many Diseases.
Rotations

Many of the disease-causing organisms (pathogens) can survive on barley stubble and volunteer (self-sown) barley (see Table 3).

There is therefore a strong recommendation to burn the stubble, and to avoid growing barley after barley wherever possible. Even where a good burn is obtained, disease inoculum may persist in the headlands, where diseased straw has been ploughed in to form a firebreak. It is possible to grow two barley crops in succession or wheat then barley but there can be an increase in amount of take-all and eyespot leading to some yield losses in second and subsequent cereal crops. The break between barley crops in a rotation should be at least two years without wheat or barley, because take-all and eyespot also survive on wheat residue. Barley is less severely affected by these diseases. Many farms are becoming more and more crop-oriented, so such a break is difficult to achieve. Take-all can also survive on couch (or twitch). Areas with severe couch problems should be avoided for barley cropping as couch is often infected with take-all. Killing the couch by spraying just before sowing does not solve the problem, as take-all can survive on dead couch roots for some 6 to 12 months.

Volunteer Barley

These are self-sown plants, which may grow from seed that has shaken from the ears or fallen from the header and then been incorporated into the soil during the cultivation for early autumn-sown pastures or crops. Table 3 shows that these plants can be an important source of powdery mildew and leaf rust spores, as well as of other diseases and of aphids. Thus these plants allow many barley diseases to survive, over the winter, from one cropping season to the next. Such plants should be removed by grazing before emergence of spring-sown crops.

Time of Sowing

Most barley crops are sown in September-October. If sown in November-December there is a greater risk from infection by diseases such as leaf rust and powdery mildew, with spores coming from earlier-sown crops.

There has been some discussion about winter barley. Overseas experience indicates that the growing of winter barley leads to an increase in leaf diseases in spring barley. The winter barley crops, like volunteer barley, provide an excellent overwintering source of many diseases. Thus the more winter barley is grown, the more disease will increase in spring barley, incurring greater costs in protecting those crops.

DISEASE PROBLEMS

Barley Yellow Dwarf Virus

In spring-sown crops yellow (infected) plants may be seen scattered through crops but the disease generally does not cause severe damage. There have been some reports (Close, 1969) of yield responses arising from treatments for control of cereal aphids and virus. The overall crop losses from the virus may be about 5%.
The best prospects for control lie in the development of resistant cultivars. All present cultivars are equally susceptible but the D.S.I.R. (P.A. Burnett, pers. comm.) has identified lines of barley with good resistance. These lines have been included in the barley breeding programme.

**Leaf Diseases**

As many new cultivars have good resistance to leaf diseases (Table 1), cultivar selection can minimize the yield-reducing effects of such diseases. Differences between cultivars, as a result of resistance, are shown by the disease severity data of Lim and Gaunt (1981) with respect to the effects of powdery mildew and leaf rust on Georgie, Hassan, Manapou and Zephyr.

**Leaf Rust**

The pathogen that causes leaf rust of barley does not infect other cereals or grasses.

**Life Cycle of Leaf Rust**

<table>
<thead>
<tr>
<th>Trial Sown</th>
<th>Per Cent Leaf Rust at G.S. 11.1 on leaf 2</th>
<th>Yield Tonnes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Untreated</td>
<td>Sprayed</td>
</tr>
<tr>
<td>22 Oct.</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>5 Nov.</td>
<td>30</td>
<td>1</td>
</tr>
<tr>
<td>2 Dec.</td>
<td>51</td>
<td>0</td>
</tr>
<tr>
<td>15 Dec.</td>
<td>97</td>
<td>0</td>
</tr>
</tbody>
</table>

*figures in brackets are the 1000 grain weights (in grams).*
When severe leaf rust infection of the upper leaves occurs, this can affect grain filling. The net effect is to reduce the total yield and grain size (Table 4). The infected plants are weaker as a result of the rust attack, and, prior to harvest, an increased amount of stem break often can be seen.

Leaf rust is generally more severe in late-sown crops, i.e. sown from early November to mid-December (Table 4). Hence it is these crops that could need spraying with Bayleton, Tilt or other effective chemicals.

It is difficult to set threshold levels for action on diseases. As a guide, sprays could be applied when 50% of the leaves at the leaf 2 position (one below the flag or top leaf) are found to be infected with leaf rust.

**Powdery Mildew**

This can survive on stubble as well as on volunteer barley. The wheat and barley powdery mildews are distinct strains, thus they do not cross-infect.

Control is achieved largely through burning stubble, destroying volunteer barley and by the use of resistant cultivars. Fungicide sprays for leaf rust on late-sown crops will also control powdery mildew.

For powdery mildew, sprays could be applied when 5% of the leaf area of the oldest fully-green leaf is infected with this disease. With late-sown crops, mildew may be found to be more severe in early crop growth than in late crop development. On the other hand, even in these crops, mildew may not be present.

**Net Blotch**

This leaf disease is important in the North Island and in the higher rainfall areas of the South Island. As can be seen from Fig. 1, the disease can spread into crops from two sources (a) from infected seed and (b) from barley stubble. Once infection is in a crop, then spread within the crop can occur by spores produced on the surface of the dark-brown flecks and stripes on the leaves. When severe in crops, yield losses of 10-15% have been reported.

Control must be by destroying stubble before sowing crops in the spring, and by eradicating the seed-borne infection by the use of effective seed treatments. Even with these measures, infection still seems to develop in North Island crops and further research is required on the value of new systemic chemical sprays for control. Although most barley cultivars seem to be susceptible to net blotch, there appears to be scope for further work on selection for resistance.

**Spot Blotch**

This disease is common on North Island barley crops and can cause yield losses if not adequately controlled (Hampton, 1979). Destruction of stubble, rotation of crops, and effective seed treatments are required.

**Scald**

Severe epidemics of scald can occur in barley greenfeed crops sown in autumn or early winter. In spring-sown crops this disease is not generally important.
INSECT, NEMATODE and WEED PROBLEMS

Insects

The following insects can occur on barley: cereal aphids, grain aphids, armyworms, wireworms, Hessian fly, wheat sheath miner, and Argentine stem weevil (this one can be controlled by fallowing the area for six weeks). In general, insects are not a problem in barley, though sometimes cereal aphids can be important because of their ability to spread barley yellow dwarf virus.

Nematodes

Cereal cyst nematode has been recorded on barley. This nematode is limited in its distribution within New Zealand and is not expected to be a significant problem.

Weeds

Because spring-sown barley is fast-growing, it is a crop which generally can suppress the growth of many annual weeds. If annual weeds do appear to be a problem, then they can be readily controlled by the use of a number of herbicides (applied at the correct time of application) for maximum weed kill and to avoid damage to barley.

Wild oats can be a potential problem, but less so in barley than in wheat. Inspect the crop for wild oats and use a specific herbicide at the right time of application.

Perennial weeds (such as couch) need to be controlled well in advance of drilling, preferably in the summer-autumn period.

STRATEGIES FOR THE PROTECTION OF SPRING BARLEY FROM DISEASES

Cultural Controls

- Immediately after harvest burn stubble or plough under stubble.
- Destroy volunteer (self sown) barley by grazing, especially in late winter (before sowing any spring barley). Do not grow winter barley.
- Use cultivars that have resistance to the major leaf diseases.

Chemical Controls

For crops sown September-October

- Use any one of the three seed treatments
- Chemical sprays should not be required

For crops sown November-December

- Use Baytan F17 as seed treatment
- Spray when leaf rust and powdery mildew are present with Bayleton, Tilt or other effective fungicides.
References


II. Effect on barley seed germination, emergence and seedling vigour. Ibid 7: 787-90.
III. Effect on grain yield. Ibid 7: 391-3.
IV. Chemical control and cultivar susceptibility. Ibid 7: 395-8.


DESCRIPTION AND KEY OF BARLEY DISEASES IN NEW ZEALAND

(after Sanderson 1977)

LEAF DISEASES

1. Small superficial lesions of white, grey or buff mycelium scattered over the
surface of the leaf.

Powdery Mildew (*Erysiphe graminis* DC)

2. Numerous small (1-2mm) orange-yellow pustules occasionally in concentric rings. Associated with black pustules on the leaf sheath at maturity of the plant. More severe in late-sown barley crops.

Leaf Rust (*Puccinia hordei* Öth.)

3. Water-soaked areas soon becoming lens-shaped in outline, greyish green with distinct brown margins. Old lesions assume a bleached straw colour while retaining the distinct brown margin.

Scald (*Rhynchosporium secalis* (Oudem) J. J. Davis)

4. Striping of the leaves and leaf sheaths. Initially yellow though soon turning brown. Not common, can be present on plants derived from imported seed.

Stripe (*Pyrenophora graminea* (Died) Ito & Kurib.) (conidial state Drechslera (*Helminthosporium*) graminea Rabh. ex Schlecht.


6. Lesions occur at heading dark-brown in centre fading into green tissue, 0.5-3mm wide by 3-20mm long. Fungus present on glumes and seed. Seedlings may show distortion, stunting and basal browning. Spot blotch and common root rot (*Cochliobus sativus* (Ito & Kurib) Dastur, conidial state Drechslera sorokiniana (Sacc.) Subram. and Jain).

7. Lesions, small (3-8mm) round with buff centre and dark-brown margins, often with chlorotic halos. Mostly on upper leaves but can occur on glumes. Black fruiting bodies develop within lesions. Present in North Island but not common.

Halo spot (*Selenophora donacis*) (Pass.) Sprague & Johnson

8. Brown stripe forming an inverted ‘V’ or ‘W’ on the leaves, with a mosaic pattern of chlorosis within the ‘V’ or ‘W’. Leaf area on the back of the leaf remaining green. Not common, above symptoms only in susceptible cultivars.

Barley Stripe Mosaic Virus

9. Basal leaves a distinct golden-yellow with yellowing of leaves extending up the plant. In general only scattered infected plants seen within field, but sometimes many plants show symptoms.

Barley Yellow Dwarf Virus

STEM DISEASES

A. Leaf Sheath Infection

10. Small superficial lesions of powdery white mycelium later fusing and containing numerous black fruiting bodies (cleistocarps).

Powdery Mildew (*Erysiphe graminis*)

11. Scattered brown or yellow rust pustules turning black with maturation of the plant.

(i) Small (1 to 2mm) circular orange-yellow pustules.

Leaf Rust (*Puccinia hordei*)
(ii) Elongated red-brown pustules, partially covered by epidermal flakes. Not common.

Stem Rust (*Puccinia graminis* Pers.)

(iii) Numerous small yellow pustules arranged in distinct stripes on the leaves. May occur only on seedling plants.

Stripe Rust (*Puccinia striiformis* West)

12. Water soaked areas soon becoming lens shaped in outline greyish green with distinct brown margins. Old lesions assume a bleached straw colour while still retaining the distinct brown margin.

Scald (*Rhynchosporium secalis*)

B. Stem Base

13. Lens-shaped areas of bleached tissue surrounded by darker margins. Often associated with grey mycelium in the internal cavity of the stem. Stem weakened and some lodging. Common in areas like Southland, especially in second cereal crops.

Eyespot (*Pseudocercosporella herpotrichoides* (Fron) Deighton.


(i) Rapid bleaching of the whole plant at maturation. Infected plants often occur in patches. Mat of coarse, dark-brown mycelium around the stem base, and over main roots.

Take-all (*Gaeumannomyces graminis* (Sacc) v Arx & Olivier) (Syn. *Ophiobolus graminis*)

(ii) No coarse dark brown hyphae. Scattered small brown lesions on the roots, usually near the stem base. Pink spore masses sometimes present.

Fusarium Foot-Rot (*Fusarium Lavenaceum* (Sacc.; culmomen (W. E. Sm.) Sacc.; *F. gramineamen* Schw.; *F. nivale* (Fr.) Ces.)

15. White-heads

(i) Browning of stem base associated with dark-brown mycelium.

Take-all (*Gaeumannomyces graminis*)

(ii) Browning of stem base. No dark-brown mycelium.

Fusarium Foot-Rot (*Fusarium spp.*)

(iii) Associated with eyespot lesions at the base of the plant.

Eyespot (*Pseudocercosporella herpotrichoides*)

(iv) No discolouration of the stem base. Severe drought.

16. Head blight

Bleached to grey lesions on the flag leaf sheath, later infecting the head where cottony white to pink mycelium may be seen together with powdery pink spore masses.

Fusarium Head Blight (*Fusarium culmorum* (W. E. Small) Sacc.)

17. Black spore masses replacing the floral parts. Most conspicuous at flowering.

(i) Spore masses retained inside an outer membrane. Awns usually remain attached and erect. Spread occurs during harvest when smut spores contaminate healthy grain.

Covered Smut (*Ustilago hordei* (Pers.) Lagerh.)

(ii) Black powdery spore mass at flowering, not retained within an outer membrane. Awns become lost.

Loose Smut (*Ustilago nuda* (Jens.) Rostr.)

HEAD DISEASES
Growing barley for malting

E. G. Drewitt, Winchmore Irrigation Research Station

The yield and quality of barley is to a large extent determined by the agronomic or cultural practices applied. The first decision to be made concerns the cultivar to be grown. We have to make up our minds if we are going to grow barley for malting or for feed purposes and choose our cultivar accordingly.

For the feed trade there is a wide range of cultivars to choose from. Not a great deal is known about agronomic effects on feed barley quality, especially of the finer ingredients, digestibility and so on which have varying degrees of importance depending on which animals are going to eat it. We know we can produce grain with either high starch or high protein content and that is important to the feed trade.

For malting barley there is currently a choice of three cultivars, Zephyr, Manapou and Mata. Zephyr has been a reliable standard for several years but it could be superseded by a new cultivar, Triumph, in the near future. The quality characteristics of malting barley are well known and it is possible to control quality by the management practices adopted. However, the only quality characteristic that is recognised in the price when the farmer sells his barley is the percentage of screenings. Of the other desirable characteristics, low grain nitrogen content and high malt extract are the most important and perhaps it may be not too far in the future when these attributes command a premium.

In dry seasons the screenings percentage will be high and the malster knows that quality will be low in these years. There is a strong correlation between grain size, grain nitrogen content and malt extract; large grains have low nitrogen content and high malt extract. Screenings are also generally higher in barley grown under high soil nitrogen conditions.

Moisture and nitrogen then are two very important factors governing barley
quality, and of course, they also have a large influence on grain yield. The research results presented are confined to work with Zephyr barley grown on the light soils under irrigation, but the same general principles apply to both light and heavy soils.

**Nitrogen Fertilisers and Irrigation Effects**

In a series of trials carried out at Winchmore (Drewitt and Swart, 1981) nitrogen fertiliser was applied at 50 and 100kg/ha at drilling and at tillering or split between drilling and tillering. The irrigation treatments were nil, at 10% soil moisture (1 - 2 irrigations) and 15% soil moisture (2 - 4 irrigations). Two of the trials followed pasture and two followed a nitrogen-depleting crop. The barley was sown at 145-150kg/ha and all sowings were carried out in October. As there was little or no difference in yield, screenings or malting quality with time of nitrogen application or with splitting the nitrogen, only the drilling applications are considered.

**Yield**

In the first year, following oilseed rape, there was a large yield response to the low level of irrigation and a further response to heavier irrigation, but only when nitrogen fertiliser had been added, (Fig. 1). The following season was very wet and on this occasion the trial followed a period in permanent pasture. There was a smaller response to irrigation and no response to nitrogen fertiliser. Two trials were carried out in the following season, one following pasture, the other following a previous barley crop. There was a good response to irrigation in both trials but again no response to nitrogen following pasture. On the ex-crop trials the effect of nitrogen promoting an additional response to the heavier irrigation treatment, as in the first trial, is again evident.

**Figure 1:**

![Graph showing grain yield in kg/ha for different treatments over three years.]
Screenings

The means of the two ex-pasture and two ex-crop trials are shown in (Fig. 2). Screenings were generally higher in the ex-pasture trials. The application of nitrogen fertiliser increased the screenings, especially following pasture. In the ex-pasture trials, in the presence of nitrogen fertiliser, irrigation at the low level increased the screenings (mainly because of inopportune timing in one trial) while the heavier irrigation reduced screenings. In the lower fertility trials both irrigated reduced the screenings and nitrogen fertiliser increased screenings only in the absence of irrigation.

Figure 2: Screenings %

Malt Extract Percent

Malt extract was higher in the trials following a previous crop. Irrigation increased malt extract in all trials while nitrogen fertiliser reduced malt extract, especially on the higher fertility sites.

In summary, there was no yield benefit from the addition of nitrogen fertiliser to crops following a period in pasture and malting quality was reduced. Where there was a yield response to added nitrogen following a nitrogen-depleting crop the malting quality was not seriously impaired. Irrigation increased the yield and improved malting quality irrespective of previous land use. The beneficial effects of heavy irrigation were greater in the presence of adequate nitrogen.

Time of Sowing and Irrigation

Time of sowing has a large influence on barley yield and quality. In a series of trials at Winchmore, Carter and Stokes (1982) examined the effects of sowing time and irrigation on the yield and quality of wheat and barley and I am grateful to them for permission to use their data here. Zephyr barley was sown at monthly intervals from mid-September to mid-December and irrigation was applied when soil moisture fell to 10 and 15%.
Yield

There was no advantage in sowing before October, but later sowings showed a sharp decline, (Fig. 3). December sowing was too late, even under irrigation, and November sowing in the absence of irrigation was also unrewarding. The mean difference between the irrigated treatments was quite small but in individual years the response to irrigation frequency did vary depending on fertility, as discussed in the previous section. The number of irrigations required to maintain soil moisture levels increased as sowing date was delayed.

Figure 3: Barley Grain Yield, kg/ha, at Four Sowing Times and Three Irrigation Levels

Screenings

The screenings percentage increased with later sowing, (Fig. 4). In the absence of irrigation only September sowing generally graded satisfactorily for malting while both September and October sowing with irrigation were below the 15% maximum allowed.

Malt Extract Percent

Early sowing and irrigation are essential for good malting quality barley, (Fig. 5). There was little difference in malt extract between September and October sowing but a sharp decline thereafter. Unirrigated barley gave very poor extract.

Briefly summarising the time of sowing and irrigation effects it would appear that October was the optimum sowing time later sowing reduced both yield and quality. Irrigation increased the yield, improved malting quality and extended the sowing season.
Sowing at the right time, and correct management of irrigation and nitrogen fertiliser are essential for high-yielding, good quality barley; we have seen that high yield and good quality can be achieved simultaneously. There is currently a large increase in the number of irrigation plants operating in Canterbury so much of the barley grown will in future have the benefit of that facility. A reliable means of

Figure 5: Malt Extract %
The first point that must be realised in discussing export of New Zealand's barley
determining the correct amount of nitrogen to be applied, and when, is still the most urgent requirement of cereal growers today. Armed with that information we should be able to produce good quality barley as well as considerably increasing the efficiency of nitrogen fertiliser use. A technique under examination at Winchmore involves the measurement of the amount of nitrogen that will become available from the soil nitrogen reserves during the life of the plant. This information is coupled with the known nitrogen requirement of the crop and the deficit is corrected by applying bagged nitrogen.

While it is true that not very much barley is grown on the lighter soils, perhaps we should be growing much more, provided of course, we have irrigation. With access to irrigation we have control of screenings and some of the best malting barley in Canterbury comes from these light soils under irrigation (Smart 1982). It appears that the best prospects for exporting barley are in good malting barleys. An expansion of barley growing on the light soils is feasible and I suggest the area available is big enough to produce large quantities of one cultivar of top quality barley for export.
Marketing

A. C. Zwart, Senior Lecturer Department of Agricultural Economics and Marketing, Lincoln College.

Introduction
Over the past ten years New Zealand has become increasingly involved in the export of barley. In some years this export trade has been worth over $10 million to New Zealand, and with further increases in production, it is likely to become increasingly important. This paper assesses New Zealand's role in the international market for barley, and the potential for expansion of this trade in the near future. Our involvement has arisen largely from changing internal circumstances rather than from any major increase in international demand for feed grains. It is important, in this situation, to ensure that producers in New Zealand are aware of the conditions in the international market, and also that we design institutions which are appropriate to handle this trade. The following sections of this paper discuss the general structure of the international feed grains markets, the projections for growth in this trade as a whole, and also the likely market conditions in the near future. The final section discusses the relevance and efficiency of the current marketing institutions for New Zealand's future involvement in this activity.

The International Grain Market
The first point that must be realised in discussing exports of New Zealand barley is that this product is only one of a large number of products which make up the world trade in feed grains, or as they are more commonly called, coarse grains. These grains are widely traded throughout the world with the major purpose of
TABLE 1.
Major Coarse Grain Producers

<table>
<thead>
<tr>
<th>Country</th>
<th>1979</th>
<th>1980(^{2})</th>
<th>1981(^{3})</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Million metric tons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.S.</td>
<td>238.7</td>
<td>198.4</td>
<td>248.9</td>
</tr>
<tr>
<td>USSR</td>
<td>81.2</td>
<td>80.5</td>
<td>77.0</td>
</tr>
<tr>
<td>Western Europe</td>
<td>91.1</td>
<td>94.8</td>
<td>88.2</td>
</tr>
<tr>
<td>China</td>
<td>83.0</td>
<td>82.5</td>
<td>82.0</td>
</tr>
<tr>
<td>Eastern Europe</td>
<td>63.3</td>
<td>61.6</td>
<td>62.5</td>
</tr>
<tr>
<td>Canada</td>
<td>18.6</td>
<td>21.8</td>
<td>25.7</td>
</tr>
<tr>
<td>Argentina</td>
<td>10.6</td>
<td>21.1</td>
<td>18.6</td>
</tr>
<tr>
<td>South Africa</td>
<td>11.7</td>
<td>14.9</td>
<td>11.8</td>
</tr>
<tr>
<td>Australia</td>
<td>6.2</td>
<td>5.1</td>
<td>6.7</td>
</tr>
<tr>
<td>Thailand</td>
<td>3.6</td>
<td>3.5</td>
<td>4.2</td>
</tr>
<tr>
<td>Other</td>
<td>133.4</td>
<td>142.7</td>
<td>144.0</td>
</tr>
<tr>
<td>Total</td>
<td>741.4</td>
<td>726.9</td>
<td>769.6</td>
</tr>
</tbody>
</table>

1 Coarse grains are corn, oats, sorghum, barley, rye, millet, and mixed grains.
2 Preliminary.
3 Estimated as of 16th February 1982.

Source: United States Department of Agriculture

Feeding livestock under intensive production systems. The grains which are generally included in this trade include maize or corn, oats, sorghum, barley, rye, millet, and "mixed grain." As can be imagined, the market is extremely large.

In 1982 the total world production of coarse grains is estimated to be around 770 million tonnes. Of this, 100 million tonnes is expected to enter world trade, and total world stocks at the end of the year may be around 108 million tonnes. Tables 1 and 2 show the major producers of feed grains and also the major traders in this product. The United States is by far the largest producer of feed grains and is also the major exporter. The USSR is the second largest producer, but it is also in many years the single largest importer. Other less important exporters include Argentina, Western Europe, Canada and Australia. As would be expected, these countries are also involved in the international wheat trade. The major importers of feed grain, however, are largely western countries that support high levels of livestock production. These include areas such as Western and Eastern Europe, as well as Japan. Many much smaller countries are also involved.

Because the grains are used to provide the carbohydrate component of livestock feeds they are fairly readily substitutable. Of the total production of coarse grains, approximately half is maize. Barley is the second most important, at approximately 22 per cent. Some of the less important grains such as sorghum, oats, and rye have specialised uses, but are also substitutes for barley or corn.

In marked contrast to the trade in many other agricultural products, trade in feed...
grains is relatively unhindered by trade barriers and domestic agricultural policies. This is not surprising, as in most countries feed grains are an input into agricultural production, and thus the EEC and countries such as Japan, which have highly protected agricultural industries, provide free access for feed grains. This lack of trade intervention is another factor which adds to the highly competitive nature of the feed grain market.

The competitive nature of this market is clearly seen in the way prices are determined. As most people are aware, the major grain markets are in the United States. The Chicago Board of Trade is probably the best known, for the role it plays in determining both cash and futures prices for all types of grain. The linkages which exist in this market can be clearly seen in Figure 2, which shows the close correlation between prices for different types of feed grain in the United States and Canada. It is also important to note that there are often strong linkages between wheat and feed grain prices. These linkages are caused by two factors: the partial substitution of wheat for feed grains, and the fact that the United States is the major exporter in both markets, and production is related through growing conditions in North America.

International grain markets are often very unstable, and respond rapidly to weather conditions or political disruptions. While this would appear to be an unsatisfactory situation, there is fortunately a certain amount of stability provided by the domestic agricultural policies of the United States and Canada.

Figure 2: International Grain Prices

![International Grain Prices Graph]

Source: F.A.O.
Long-Term Outlook for Trade in Feed Grain

Because of the importance of the feed grain trade in the agriculture of most countries in the world there is considerable interest in the long-term supply and demand of these products. Exporters are naturally concerned about the long-term viability of their markets while importers are equally concerned about long-term access to suppliers. Many institutions are involved in evaluating the long-term outlook. For example, there is a recent study published by a private research organisation in the United States (Wheeler et al.), attempting to forecast levels of world livestock production and the associated feed and grain requirements.

It is not a simple task to project feed grain requirements, as they depend entirely on changing livestock production around the world. Thus the first part of such an exercise must be to project world meat and milk production, assuming the availability of sufficient feed grains. Table 3 shows the changes in feed requirements necessary to meet the estimated 1985 consumption of livestock products. The major areas which are going to increase their demand for grains include the U.S., Canada, Japan, the USSR, and higher income countries in the Middle East and Asia. In overall terms this study showed that by 1985 the total use of feed grains around the world would be 30 per cent higher than in 1978 (a growth rate of approximately 4 per cent per annum). Although this increase may appear substantial, the study also showed that feed grain production would increase at the same time, with the result that price increases would probably be modest.

An alternative analysis of the long-term outlook for the livestock and grain sectors has been presented by the USDA (Rojko et al. 1978). This study projects the supply and demand situation for both grain and livestock in 1985. The major difference in this analysis is that it incorporates more explicitly the likely effects of the changing supply and demand situation on prices. The study concluded that: "under most of the alternatives tested, the world has sufficient capacity, whether measured in terms of physical potential or economic feasibility, to meet the grain and overall food needs of an expanding more affluent population at real prices somewhat above 1970 levels, but below 1972-75 highs." In fact, this study suggests that in real terms prices would probably stay at levels somewhat similar to the present, but there is likely to be considerable fluctuation in prices due to climatic fluctuations.

The study also points out that under the existing policy situation: "the exporters as a group would probably face problems of restraining production, given the assumption that the major exporters continue to adapt their production policies to changing global supply and demand conditions. Production in the United States and Canada, in particular, is assumed to adjust downward so as to prevent the accumulation of large, price-dampening stocks and upward so as to take advantage of growth in world input demand, be it either long-term growth related to population and income changes, or short-term growth related to production shortfalls." These conclusions realistically suggest the important role that domestic agricultural policies, especially in the United States and Canada, are likely to play in the future of this industry.

In order to understand the importance of these policies and their potential impact on the industry, it is necessary to look at the history of their development. The major mechanisms which are currently used in controlling agricultural production in the United States were mainly developed in the 1960's.

During this period, increases in the production of grain outstripped the growth in demand, leading to an accumulation of large surpluses. A policy evolved under
which the farmers were paid a reserve price for the grain, and the surplus produc-
tion was owned by the Commodity Credit Corporation (C.C.C.). These government
stocks were burdensome, and in some years the stock exceeded one year's export
supply. As can be imagined, the stocks had a large depressing effect on world
prices, and towards the end of the 1960's concerted efforts were made to run these
stocks down through concessionary sales for food aid to developing countries.
Throughout this period the support prices in the United States, and in Canada,
which had adopted a similar strategy, were essentially setting the base level of
prices in the world market.

With considerably lower levels of stocks in the early '70's, prices increased
dramatically when the USSR entered the grain market in 1972. Since that time
prices have remained higher than they were in the 1960's, but production has gradu-
ally increased and prices have fallen to lower real levels than they were in the
1972/73 period. Stocks have accumulated to significant levels in some years, but
they have not been allowed to reach the levels of the 1960's. This has mainly been
brought about by the decreased use of Commodity Credit Corporation stocks and
an increased use of farmer-owned stocks. Under this scheme farmers are paid to
hold grain on their farm for a minimum period of three years, or until prices have
increased to a satisfactory level.

Although the policy mechanism is quite different, the Canadian grain industry als
operates a system which accumulates stocks and provides a floor price. The cre-
ation of these policies has had an important effect on both stability and level of grain
prices in the last decade, by providing a base price below which market prices
cannot fall. The manner in which these agricultural policies operate to stabilise the
coarse grain market can best be appreciated by considering the current market
conditions and recent policy changes.

The Current Market Situation

World coarse grain production in the 1981/82 season is estimated to be around
770 million metric tons, which is an increase of about 6 per cent over the previous
year, and a record level of production. This increase in production has come
primarily from the United States where production has increased 25 per cent,
largely due to yield increases, but estimates are also up in other major exporting
countries, including Canada and Australia. While production levels are expected to
increase substantially, the most recent United States Department of Agriculture
estimates suggest that the level of world trade will be approximately the same, or
possibly even down on the previous year (see Table 2). These projections show
that imports in Europe are expected to decrease slightly this year, even though
imports from the USSR are likely to increase; it is anticipated that world stocks of
grains will increase.

Because the United States is the largest holder of grain stocks in the world, with
the largest commitment to maintaining world price levels, it would be expected that
most of the increase in stocks will occur in the United States. This can be seen in
the projected reduction in exports from the United States in Table 2. The
adjustments which are likely to take place in the United States are shown in more
detail in Table 4. This table shows the supply and disappearance of the United
States feed grain crops and the substantial increase in stocks which is expected by
the middle of 1982. There is some concern over the level of exports this year,
particularly as estimates of the stock levels increased from 50 million metric tons to
**TABLE 2.**  
Major Coarse Grain Exporters and Importers

<table>
<thead>
<tr>
<th>Year Beginning July</th>
<th>1979</th>
<th>1980</th>
<th>1981</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Major Exporters:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.S.</td>
<td>71.6</td>
<td>72.4</td>
<td>63.5</td>
</tr>
<tr>
<td>Argentina</td>
<td>6.6</td>
<td>9.9</td>
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<td>7.3</td>
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<td>4.8</td>
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<td>2.2</td>
<td>3.1</td>
</tr>
<tr>
<td>Thailand</td>
<td>2.3</td>
<td>2.2</td>
<td>2.6</td>
</tr>
<tr>
<td>Other</td>
<td>3.2</td>
<td>3.4</td>
<td>3.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>101.0</td>
<td>105.6</td>
<td>103.3</td>
</tr>
</tbody>
</table>

| **Major Importers:** | | | |
| Western Europe      | 23.2 | 21.0 | 22.9 |
| Japan               | 18.9 | 18.9 | 18.8 |
| Eastern Europe      | 11.4 | 10.6 | 8.6  |
| USSR                | 18.4 | 16.0 | 22.0 |
| China               | 2.0  | 0.9  | 0.8  |
| Other               | 27.1 | 38.2 | 30.2 |
| **Total**           | 101.0| 105.6| 103.3|

1-3 See Table 1

65 million metric tons between November and February. Anticipation of this production increase and decline in export possibilities appear to have led to the decrease in price over most of 1981 and into 1982. The current situation has led to some concern in the United States, and appropriate policy changes have been made.

The United States grain policies are somewhat complex, but are very important in the manner in which they influence world grain markets. Basically, they are made up of four major components:

- The target price is announced each year for each type of grain and provides a basic price which is met by a deficiency payment from the Government.
- The loan rate is also announced for each grain and is lower than or equal to the target price. The loan rate provides a floor for the grain market, in that a farmer is able to take a loan from the Commodity Credit Corporation at harvest time equal to the loan rate times his production of grain. When the producer comes to sell the grain he has two options. He can either sell the grain on the open market and pay back the loan, or he can if he wishes relinquish the grain to the Commodity Credit...
TABLE 3.
Marginal Adjustments in Feed Use to Balance Projected 1985 Production with Projected Consumption

(thousand metric tons)

<table>
<thead>
<tr>
<th>REGIONS</th>
<th>Total Adjustment²</th>
<th>Grain</th>
<th>P. Meal By-Products</th>
<th>Forage</th>
<th>Other</th>
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<tbody>
<tr>
<td>United States</td>
<td></td>
<td>7935.3</td>
<td>2246.9</td>
<td>1181.0</td>
<td>7533.9</td>
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<tr>
<td>Canada</td>
<td></td>
<td>3173.1</td>
<td>369.3</td>
<td>525.2</td>
<td>6343.1</td>
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<tr>
<td>EC-6</td>
<td></td>
<td>647.3</td>
<td>243.2</td>
<td>1050.2</td>
<td>25855.5</td>
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<tr>
<td>EC-3</td>
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<td>951.7</td>
<td>242.7</td>
<td>1046.2</td>
<td>24048.7</td>
</tr>
<tr>
<td>Other W/Europe</td>
<td></td>
<td>203.1</td>
<td>(27.7)</td>
<td>113.6</td>
<td>3933.2</td>
</tr>
<tr>
<td>Japan</td>
<td></td>
<td>2946.5</td>
<td>636.7</td>
<td>307.5</td>
<td>1647.8</td>
</tr>
<tr>
<td>Oceania</td>
<td></td>
<td>51.9</td>
<td>(3.4)</td>
<td>35.5</td>
<td>98486.3</td>
</tr>
<tr>
<td>South Africa</td>
<td></td>
<td>396.6</td>
<td>12.8</td>
<td>1034.3</td>
<td>11872.2</td>
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<tr>
<td>Eastern Europe</td>
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<td>520.8</td>
<td>10659.0</td>
<td>119360.4</td>
</tr>
<tr>
<td>Soviet Union</td>
<td></td>
<td>468.3</td>
<td>(60.8)</td>
<td>8583.8</td>
<td>(17476.2)</td>
</tr>
<tr>
<td>China</td>
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<td>405.8</td>
<td>69.6</td>
<td>57.7</td>
<td>226.6</td>
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<tr>
<td>Middle America</td>
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<td>526.5</td>
<td>10.6</td>
<td>95.3</td>
<td>29840.9</td>
</tr>
<tr>
<td>Argentina</td>
<td></td>
<td>203.1</td>
<td>(27.7)</td>
<td>113.6</td>
<td>3933.2</td>
</tr>
<tr>
<td>Brazil</td>
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<td>2686.3</td>
<td>411.0</td>
<td>3761.4</td>
<td>61643.6</td>
</tr>
<tr>
<td>Venezuela</td>
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<td>27.2</td>
<td>7.1</td>
<td>2.5</td>
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</tr>
<tr>
<td>Other South America</td>
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<td>94.0</td>
<td>22.2</td>
<td>17.0</td>
<td>30866.7</td>
</tr>
<tr>
<td>H. Income N. Africa</td>
<td></td>
<td>2136.9</td>
<td>169.8</td>
<td>1699.0</td>
<td>32095.0</td>
</tr>
<tr>
<td>L. Income N. Africa</td>
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<td>3655.8</td>
<td>660.3</td>
<td>3432.5</td>
<td>90036.7</td>
</tr>
<tr>
<td>East Africa</td>
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<td>76.1</td>
<td>129.6</td>
<td>623.8</td>
<td>87504.5</td>
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<td>Central Africa</td>
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<td>2136.9</td>
<td>169.8</td>
<td>1699.0</td>
<td>32095.0</td>
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<tr>
<td>India</td>
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<td>76.1</td>
<td>129.6</td>
<td>623.8</td>
<td>87504.5</td>
</tr>
<tr>
<td>Other S. Asia</td>
<td></td>
<td>76.1</td>
<td>129.6</td>
<td>623.8</td>
<td>87504.5</td>
</tr>
<tr>
<td>Thailand</td>
<td></td>
<td>2136.9</td>
<td>169.8</td>
<td>1699.0</td>
<td>32095.0</td>
</tr>
<tr>
<td>Indonesia</td>
<td></td>
<td>76.1</td>
<td>129.6</td>
<td>623.8</td>
<td>87504.5</td>
</tr>
<tr>
<td>High Income E. Asia</td>
<td></td>
<td>2136.9</td>
<td>169.8</td>
<td>1699.0</td>
<td>32095.0</td>
</tr>
<tr>
<td>Low Income E. Asia</td>
<td></td>
<td>2136.9</td>
<td>169.8</td>
<td>1699.0</td>
<td>32095.0</td>
</tr>
<tr>
<td>Rest of the World</td>
<td></td>
<td>2136.9</td>
<td>169.8</td>
<td>1699.0</td>
<td>32095.0</td>
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<tr>
<td>World</td>
<td></td>
<td>2136.9</td>
<td>169.8</td>
<td>1699.0</td>
<td>32095.0</td>
</tr>
</tbody>
</table>

1 Part of the production of beef, poultry meat, and sheep and goat meat includes by-products of milk, eggs, and draft animal production.  ² Grain, protein meal, by-products and other feeds are assumed to be 89 percent dry matter as fed. 2 Forage is 20 percent dry matter as fed. The livestock-product adjustments are added to the projected 1985 production to balance with projected 1985 consumption levels.

Source: Wheeler et/al.
Corporation as re-payment of the loan. The grain which is passed to the Corporation is held in reserve until prices increase to pre-determined levels.

- A farmer-owned reserve scheme allows farmers to receive a loan rate higher than the regular loan if they agree to hold their grain in storage for three years or until market prices rise to a satisfactory level.

- Average reduction and diversion programmes have the aim of directly limiting the area which is planted to grain. In years when these restrictions are in operation farmers are required to take land out of grain production in order to be eligible to receive deficiency payments and make use of loans. To comply with the restrictions the land removed from production must not be mechanically harvested, but may be used for grazing in certain months of the year.

### Table 4

**Feed Grains: Marketing Year Supply, Disappearance, Area and Prices, 1977-81**

<table>
<thead>
<tr>
<th></th>
<th>Supply</th>
<th>Disappearance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beginning stocks</td>
<td>Production</td>
</tr>
<tr>
<td>1977/78</td>
<td>29.9</td>
<td>205.3</td>
</tr>
<tr>
<td>1978/79</td>
<td>41.4</td>
<td>221.5</td>
</tr>
<tr>
<td>1979/80</td>
<td>46.2</td>
<td>238.2</td>
</tr>
<tr>
<td>1980/81</td>
<td>52.4</td>
<td>198.0</td>
</tr>
<tr>
<td>1981/82</td>
<td>34.6</td>
<td>248.4</td>
</tr>
</tbody>
</table>

### Area, Yield and Index Government support program

<table>
<thead>
<tr>
<th></th>
<th>Harvested for grain</th>
<th>Million hectares</th>
<th>Metric tons</th>
<th>1977=100</th>
<th>Total payments to participants</th>
<th>Million dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977/78</td>
<td>36.0</td>
<td>52.4</td>
<td>43.9</td>
<td>4.68</td>
<td>102</td>
<td>570</td>
</tr>
<tr>
<td>1978/79</td>
<td>39.4</td>
<td>50.3</td>
<td>42.7</td>
<td>5.19</td>
<td>113</td>
<td>1023</td>
</tr>
<tr>
<td>1979/80</td>
<td>44.3</td>
<td>48.1</td>
<td>41.5</td>
<td>5.74</td>
<td>125</td>
<td>247</td>
</tr>
<tr>
<td>1980/81</td>
<td>42.7</td>
<td>49.1</td>
<td>41.1</td>
<td>4.82</td>
<td>154</td>
<td>404</td>
</tr>
<tr>
<td>1981/82</td>
<td>42.5</td>
<td>50.0</td>
<td>43.3</td>
<td>5.74</td>
<td>363</td>
<td></td>
</tr>
</tbody>
</table>

---

1 The marketing year for corn and sorghum begins October 1; June 1 for oats and barley.  
2 Estimated.  
3 Reflects CRB estimate of root mean square error for production and comparable estimates of variability for other items. Chances are about 2 out of 3 the final outcome would fall within the ranges.  
4 Excludes support payments.

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This policy system is reviewed every four years, and the latest agricultural and food act was signed into law in December 1982. While the new act guarantees that target prices will increase by approximately 6 per cent per year for the next four years, no such guarantee is made about the minimum loan rates, except that they can only vary between years by a maximum of 10 per cent. The level of loan rate is by far the most critical parameter in this system, as it fixes a series of floor prices for these products in the free market below which the farmers will not sell their grain. It effectively means that the United States is prepared to accumulate stocks of any product which cannot sell on the world markets at those prices. However, when the new policies were announced in January of this year, the United States Secretary of Agriculture also announced that an acreage reduction programme would be used for the first time in several years. Under this programme all participating farmers are required to reduce their feed grain production in the 1982 harvest by 10 per cent. This should mean that overall production will decrease and prices should stabilise for the 1982/83 season.

Prospects for New Zealand Exports

Early in 1982 New Zealand exporters were able to capitalise on the relatively high world prices, but in recent months prices have been falling and it is only the decline in New Zealand’s exchange rate relative to the United States dollar which will keep New Zealand prices at a reasonable level for our current crop. Because of the increases in stocks of grains it is likely that world trade prices will stay at around their present level, or perhaps drop even further in the 1983 season.

In some ways this becomes an extremely critical period for New Zealand barley exports. If New Zealand can continue to export barley profitably at the current prices, then there is a very good long-term future in this trade. It could well become a very important part of New Zealand’s diversification away from our traditional agricultural products.

It is generally accepted that consumption of meat products will increase faster than consumption of many other agricultural products as income increases. Although New Zealand is a major exporter of meat products, there are some difficulties that may reduce New Zealand’s participation in this increased consumption. The first of these is that a considerable amount of the increased consumption is in poultry meat, which tends to be a domestic industry in each country, and not a major part of world meat trade. A second, and possibly more important, difficulty is that many of the countries which are enjoying high income growth also have highly protected livestock producing industries. The EEC and Japan are very clear examples of this. Thus, while production of livestock is increasing dramatically in many countries, the demands are being met to a large extent by local production. This growth of livestock production has led to increased trade in feed grain, especially in Asia and in several European countries where there are severe limitations on the land available for the production of feed grains.

Therefore, increased exports of feed grains from New Zealand could be complementary to the level of livestock production and exports. It is also important that many of the smaller countries which have rapidly increasing rates of income, such as in the Middle East and Asia, and Japan, are reasonably accessible to exports from New Zealand, and New Zealand’s greatest prospects for increased feed exports lie in this area. The major difficulty will be that New Zealand’s area of land for
feed production is somewhat limited, which causes difficulties with economies of scale in handling and shipping, especially in comparison with countries such as Australia, the United States, and Canada.

It appears best for New Zealand to specialise in small shipments of products for small markets, or alternatively to develop more sophisticated products, which are generally required in smaller lines and which fulfill more specialised needs. New Zealand exports currently seem to be meeting the needs for relatively small lines of product, but very little has been done in terms of product development. An obvious move in this direction would be to attempt to sell barley either for malting or as malt, or alternatively to develop markets for compounded feed. Several countries, such as Japan, import a wide range of feed products from a wide range of countries. It appears that the current growth in Japanese dairy and beef herds is likely to continue and there is no reason why New Zealand could not participate in this market. Our success will depend on the suitability of our institutions for developing this trade.

Institutions for Export Marketing

Although it is probably too early to judge, barley has provided one of the few successful recent exercises in developing an export trade in feed or oilseed products from New Zealand. A major part of this success has probably been due to the acknowledgement by farmers of the fact that prices in these international markets are very unstable. In the past, before a trade such as this could develop, it was generally considered necessary for farmers to be paid a contract price for producing the product. Notable examples include the lucerne feed and linseed industries.

The readiness of farmers to accept greater price risk has also been noticeable in industries such as meat exporting and domestic wheat production. This is a very important factor because it will also make it easier and more likely that firms will become involved in marketing and trading the products. Under a contract system the price risk is probably forced unnecessarily onto the exporting firms with the result that they are unduly conservative in setting contract prices to producers. In this situation, conservative pricing can become a double-edged sword for the firm involved in exporting, because decreased production also results in decreasing economies of scale for handling these products. The growth of the Barley Export Society in a manner very similar to the creation of meat exporting cooperatives has shown that producers are prepared to accept a considerable proportion of the marketing risk, and that they still consider that exporters' offers are conservative.

If market prices continue to fall, however, this could become an extremely critical period. At present, prices remain reasonable, at least in comparison to wheat prices, and production appears to be increasing. In this situation exporting can become even more efficient, and it has been noted that barley shipments leaving New Zealand this year have been of record size. A critical situation will occur when market prices fall and the volumes to be exported decrease substantially. At this stage, it is important that the institutions involved in the exporting of barley reconsider their marketing strategies. The fact that New Zealand wheat and barley prices are now more closely related to world market prices may help to some extent, particularly as the relative prices should remain fairly stable.

With the likely increased movements in both wheat and barley prices, it becomes extremely important that a wider range of product options become available to the New Zealand arable farmer. So long as both farmers and exporters are prepared to
accept flexible pricing there would appear to be no reason why they could not work together in developing profitable exporting of a wide range of feed, grain, and oilseed products. To do this, it is imperative that arable farmers become better informed on the current international situation and opportunities for their products. At the same time, exporting firms must realise that farmers are increasingly prepared to share a proportion of the marketing risk in developing new export products. In order to foster the confidence which is necessary in an industry such as this, it is important that full and complete price information be provided to farmers to allow them to make their own decisions about levels of output. A lack of confidence had developed in the past, possibly because exporting firms were too conservative in pricing, but also because farmers were not prepared to understand the marketing situation. If these difficulties can be overcome, then it is likely that New Zealand will become increasingly involved in exporting, not only barley but other similar products.

References


Some agronomic effects on barley quality
E.G. Drewitt, Winchmore Irrigation Research Station.

Introduction

There are two interpretations of the term "barley quality", depending on the purpose for which the barley crop is grown. Barley is, or should be, produced specifically for either the liquid refreshment of man or as a solid supplementary food for animals. But all too often some grain intended for the former is suitable only for the latter.

In the first instance the raw material, the grain, should have a low nitrogen content, while in the latter, high nitrogen grain is preferred. Both industries require sound, uniform grain with a low proportion of shrivelled grain in the sample. Feed barley interests tolerate a higher proportion of screenings and if the grain has a high nitrogen content, that is, high protein, it is something of a bonus, although not financially rewarded at the present time.

To the maltster, malt extract is the most important quality characteristic. Malt extract and grain nitrogen content are significantly correlated and both are related to grain size; generally the larger the grain, the lower the nitrogen content, and the higher the malt extract. Any agronomic practice which alters grain size will automatically affect malting quality. As these quality parameters are also closely related to grain yield, any discussion on barley quality without considering grain yield would be incomplete.

The grower's objective is to obtain the highest return on investment and this is generally achieved by producing a high grain yield. High yields are only attainable under good fertility conditions and as such crops normally have high grain nitrogen content it would appear that the quality of these crops would be more suited to the
feed barley trade. However, with skilful management high yields with acceptable screenings and grain nitrogen levels, and good malt extract are possible.

There are surprisingly few published reports on the large amount of experimental work carried out on the effects of agronomic practices on the yield and quality of barley in New Zealand. Winchmore based staff, in co-operation with the Canterbury Malting Company, have carried out and reported studies on light stony soil under irrigation (Thompson et al 1974; Drewitt and Smart 1981). Otherwise, the most significant contribution to our understanding of agronomic effects on the barley crop comes from a survey of a large number of commercial crops in Canterbury carried out by Malcolm and Thompson (1968). The only other recent work of note is that of Wauchop and Field-Ddogson (1978) who examined the effects of phosphorus and nitrogen on the yield and malting quality of barley in the South of the North Island. There have been other experiments using nitrogen fertiliser but the value of them has been reduced because of inadequate moisture. Some commercial firms other than the Canterbury Malting Company have carried out numerous experiments and surveys, and in making their results available, have stimulated an interest in quality as well as quantity.

Agronomic practices which have the greatest effect on yield and quality of barley include seed-bed preparation, seed rate, time of sowing, nitrogen fertilisation and irrigation. Early preparation of a good seed-bed is essential for the rapid development and even establishment of barley and should be commenced as soon as weather conditions allow. The effects of sowing time, nitrogen fertilisation and irrigation are inter-related; they form the basis of this discussion and are dealt with under appropriate headings.

### Time of Sowing and Irrigation

A series of experiments examining the effects of sowing time and irrigation frequency on the yield and quality of wheat and barley was carried out by Carter and Stoker on Lismore stony silt loam at Winchmore in the four year period 1977-78 to 1980-81. Their work was an extension of that reported by Drewitt and Muscroft-Taylor (1978) who found that barley yields did not vary with sowing time from late August to late October. December sowing was included to examine the feasibility of double cropping, for example, an early crop of peas followed by a late crop of barley. Late sowing was also investigated as an irrigation scheduling device for easing the pressure of the heavy irrigation demand of all farm crops in November and December. The cultivar Zephyr was sown at approximately 150 kg/ha with 240 kg/ha super-phosphate and 120 kg/ha ammonium sulphate (20%N) at four sowing times, mid-month from September to December. There were three irrigation treatments, nil, and irrigation applied by the border-strip method when soil moisture in the top 150mm fell to 10% and 15%.

### Grain Yield

The mean of four year’s results are shown in Fig 1; results of individual years are given in the associated paper by Carter and Stoker. There is probably no yield advantage in sowing before October but yields were greatly reduced when sowing was delayed until mid November. December sowing was clearly unsatisfactory even at the heavy irrigation level, not only because of its very poor yield but also the difficulties encountered when harvesting too late in the season. Both irrigated treatments were considerably higher yielding than the unirrigated and although there appears to be very little difference between the two irrigated treatments, yield
Figure 1: Barley Grain Yield, kg/ha, at Four Sowing Times and Three Irrigation Levels

Figure 2: Barley Grain Screenings Percentage: Four Sowing Times and Three Irrigation Levels
responses to irrigation frequency vary according to nitrogen availability and this aspect will be discussed later. Yields from September and October sowings without irrigation were comparable to November sowing in the presence of irrigation. The number of irrigations required to maintain soil moisture levels increased with later sowing until November, then decreased with December sowing.

Quality

The screenings percentage increased as sowing date was delayed, Fig 2. In the absence of irrigation only September sowing generally graded satisfactorily for malting while both September and October with irrigation met the required standard. November sowing under irrigation was suitable for the barley market.

Early sowing and irrigation are essential for good quality malting barley, Fig 3. In both grain nitrogen content and malt extract there was little difference between September and October sowing but a sharp decline in malting quality thereafter. Unirrigated barley gave very poor malt extract.

Briefly summarised, delayed sowing reduced the yield and malting quality, while irrigation increased the yield, extended the sowing season and improved the malting quality of barley.

The optimum sowing date for both yield and quality will vary from season to season depending on weather conditions permitting the preparation of a good seed-bed and quick establishment. Malcolm and Thompson (1968) and Hunter (1962) have stressed the importance of good seed-bed condition and vigorous development, but as Hunter also pointed out, early sowing is 'only one factor in a series of complex biological reactions contributing to high yield and low grain nitrogen.'

Figure 3: Effect of Sowing Time and Three Irrigation Levels on Grain N% (a) and Malt Extract % (b)
Nitrogen Fertiliser and Irrigation

In another series of experiments carried out in the same period at Winchmore (Drewitt and Smart 1981) nitrogen fertiliser was applied at 50 and 100 kg/ha N at drilling and at tillering or split between drilling and tillering. The irrigation treatments were again nil, 10% and 15%. Two of the experiments followed pasture and two followed an nitrogen-depleting crop. Zephyr barley was sown at 145-150 kg/ha and all sowings were carried out in October. There was little or no difference in yield, screenings or malting quality with time of nitrogen application or with splitting the nitrogen and in the following discussion only the drilling applications will be considered. Results of the two ex-pasture experiments have been combined as are the two ex-crop experiments.

Grain Yield

The patterns of irrigation response at three nitrogen levels on ex-pasture and ex-crop sites are shown in Fig 4. Under the high nitrogen fertility conditions following pasture there was no response to nitrogen fertiliser but a good response to irrigation where the increase in yield from 10% to 15% irrigation was equal to that between nil and 10%. Where nitrogen was depleted by previous cropping there was no response to nitrogen fertiliser in the absence of irrigation, a small response to nitrogen with irrigation at 10% and a much larger response to nitrogen with irrigation at 15%. There was no difference between 50 and 100 kg/ha N at any irrigation level. Irrigation at 10% increased the yield by 2 - 2.5t/ha and on the nitrogen treated plots irrigation at 15% gave a further response of approximately 1t/ha. However, when no nitrogen was applied there was no further response to the heavier irrigation treatment. This trend of additional yield response to more frequent irrigation under more fertile conditions was also evident in the time of
sowing experiments described above. Thompson et al (1974) found that yields from two irrigations (at 10% s.m.) were only marginally below those from more frequent irrigations but their experiments followed nitrogen-depleting crops and no nitrogen fertiliser was added.

Quality

On the more fertile sites the screenings were higher and were increased more by the addition of nitrogen fertiliser, Fig 5. In the presence of added nitrogen, irrigation at 10% increased the screenings while irrigation at the higher level decreased screenings. The adverse effect of the low level of irrigation was due to inopportune timing in one particular season which allowed the plants to be stressed for too long in the milk/soft dough stage. On the ex-cropped sites nitrogen fertiliser increased the screenings in the absence of irrigation, while both irrigated treatments reduced screenings in the presence of nitrogen fertiliser. Irrigation had little effect on screenings in the absence of nitrogen fertilisers in any of the experiments. Wauchop and Field-Dodgson (1978) also found that the screenings percentage increased (and malting quality decreased) with added nitrogen, a result they attributed to moisture stress in the grain filling stage.

Malt extract decreased with added nitrogen and increased with irrigation on both high and low fertility sites, Fig 6. After pasture, all irrigation treatments without added nitrogen gave good malting quality but when nitrogen was added, only the 50 kg/ha N rate, with heavy irrigation was of satisfactory quality. Malt extract was generally higher on the ex-cropped sites and only the unirrigated treatments were poor in quality. In the Malcolm and Thompson (1968) survey of Canterbury crops,

Figure 5: Barley Grain Screenings Percentage: Effect of N Fertiliser and Irrigation Following Pasture and a Previous N-depleting Crop
malting quality was also higher when the barley was preceded by a nitrogen depleting crop.

In nitrogen-responsive conditions and in the presence of adequate moisture nitrogen fertiliser applied up until the end of tillering will contribute to increased yield without greatly affecting grain nitrogen content, while nitrogen applied later will have much less effect on yield but will lead to higher concentration of nitrogen in the grain (Hunter, 1962). In our experiments nitrogen was applied only up to the tillering stage. On the low fertility sites the nitrogen requirement was fulfilled by 50kg/ha N; this rate increased the yield but the nitrogen content of the grain remained unchanged. The 100kg/ha N rate was in excess of requirement and although it gave the same yield increase it also increased grain nitrogen content and reduced malt extract. Under the more fertile conditions of the ex-pasture experiments nitrogen supplied from soil nitrogen reserves was sufficient, and continued to become available throughout plant growth, resulting in high grain nitrogen content. The addition of nitrogen fertiliser in these conditions only compounded the problem of high screenings and low malting quality without contributing to the yield.

In summary, there was no yield benefit from the addition of nitrogen fertiliser to crops following a period in pasture and quality was reduced. Where there was a yield response to added nitrogen following a nitrogen-depleting crop the malting quality was not seriously impaired. Irrigation increased the yield and improved malting quality irrespective of previous land use. The beneficial effects of heavier irrigation were greater in the presence of adequate nitrogen.

The effects of agronomic inputs on the individual characteristics of barley yield and quality are less important than their inter-relationships. A sample with high
malting quality is unrewarding to the grower if it comes from a two or three tonne crop, and a high yielding crop with high screenings and low quality due to mismanagement may be equally unprofitable, even allowing for the greater tolerance of screenings in the feed trade. Fortunately, those practices which increase yield usually also increase quality. Correct management of irrigation, and, to a greater extent, nitrogen fertiliser, is essential for high yielding, good quality barley. With the present proliferation of irrigation plants it is probable that much of the barley grown in future will have the benefit of that facility.

A reliable means of determining the correct amount of nitrogen to be applied, and when, is still the most urgent requirement of cereal growers to-day. Armed with that information we should be able to produce good quality barley as well as considerably increasing the efficiency of nitrogen fertiliser use. A technique under examination at Winchmore involves the measurement of the amount of nitrogen that will become available from the soil nitrogen reserves during the life of the plant. This information is coupled with the known nitrogen requirement of the crop and the deficit is corrected by applying nitrogen from the bag. It is anticipated that the test will be available on a small scale next season. In the meantime, there is the 'Ludeke'/Ravensdown test which measures the level of nitrate in the soil in spring, and this coupled with previous cropping history is a useful guide to the nitrogen requirement.

Finally, high yields of good malting quality barley can be achieved by sowing early, irrigating to maintain soil moisture at a minimum of 15%, and applying the correct amount of nitrogen fertiliser.

References
