LINCOLN COLLEGE
FARMERS' CONFERENCE
1979


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UNIVERSITY COLLEGE OF AGRICULTURE
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CARCASS PRODUCTION FOR THE CONSUMER

ARE WE PRODUCING THE MOST MARKETABLE PRODUCTS, AND IF NOT, WHAT ACTIONS SHOULD WE TAKE TO IMPROVE THEM?

A.R. Marshall
Member
New Zealand Meat Producers Board

The normal collective noun for all the people in all countries and situations, who buy our produce is 'the housewife'. This all-important being can be seen to speak very clearly on the questions of costs - and value for money spent. She therefore objects to excess fattiness and as a corollary looks for a joint which has a high muscle or lean meat ratio.

However, this housewife is sometimes cast in the role of a ventriloquist's dummy. She says things that other people want her to say. She is quoted more in relation to lamb marketing than to beef, not because the problems of excess fat and lack of lean are not present in our cattle, but because the problem in this case is one of costs at the processing stage - as fat is trimmed during the boning operation - rather than being a marketing problem as in the case of lamb.

We would be very unwise to disregard the message we are getting as far as fatness is concerned. The objection is partly because of waste - understandably people do not want to pay for something they cannot use. But it is also influenced by the advice of nutritionists and doctors advising against eating fat. At the same time, in respect to lamb, the increase in supermarket selling has made the
fat to lean proportions obvious and available for comparison when the joints are prepacked and displayed in chilled display bins. Recently, in the United Kingdom, I watched actual housewives - not just the mythical collective one - selecting meat in supermarkets. I asked them what they were looking for in making their choice, and every one said 'leanness'. I think that probably what they mean by leanness is relative meatiness, but an excess of external fat is not acceptable, regardless of the size of the joint.

LAMB

I would like, for the moment, to concentrate on lamb production and marketing. The Meat Board acted wisely several years ago when it decreed a maximum fat level; most farmers are familiar with the GR measurement, and initially this measurement was set at 18mm. It has been progressively reduced, until this season a maximum of 15mm only is allowed. The effect of this reduction has been very beneficial to our lamb marketing, and for the last two seasons there have been few complaints and some praise for our lambs exported to the United Kingdom.

Is this then as far as we need go in fat reduction? We believe not; market trends indicate that further reduction will be required. Up to this time, the main method of fat reduction has been management - lambs have been drafted earlier, more frequently, and some of the fatter ones have been held back or used for farm killers. From now on, in my view, we must depend on breeding rather than the achievement of further management changes. It has taken four years to reduce from the 18mm maximum to 15mm; it will take much longer to make further significant reductions if this is not to be achieved at the expense of average carcass weights.

The reasons for wanting further reductions are several. Buyers in the United Kingdom believe that our product would be a better seller if we could achieve a reduced fat cover without sacrificing joint size. Peter Wakelin, the General Manager of Devco, would like lambs with a 9mm maximum, and of course he would like us to keep the weights up, to an average of 14-14.5 kg., because of the economies this offers when cutting lambs for sale. Our markets in the Middle East all demand Y grade lambs. We believe that the trend will continue, and demand for leaner lambs will grow. We cannot change
our lamb at short notice, but we must keep an objective firmly in mind and make steady progress towards it. In this case, the objective is a progressive reduction in fat cover, together with an increase in average carcass weights by about one kilogram. If we could achieve this - and I am confident we could - we would have a more saleable and more valuable product and we would have an extra 24,000 tonnes of lamb without building any more works, or putting any more men on chains, or carrying any extra breeding ewes.

So far, I have said what I would like to achieve. I haven't said how it can be done. I believe that we face two problems in this field: the need to reduce average fat cover, and the need to increase average weights. Having gone almost as far as we can in the alteration of management techniques, we must now look at breeding methods and aims. I believe that breeders of our prime lamb sires have made progress in recent years. If we can develop the fat scanning technique to a point where it will be easily and quickly usable to check fat levels of rams and their progeny, I am sure we will make faster progress. However, as a breeder of rams (although not in the prime lamb field) I am very conscious of the amount of work that is asked and expected from breeders, for which there appears to be no financial reward. So I am suggesting that further improvement in our export lambs will come from not only penalties for doing the wrong thing - like having too great a fat level - but also from rewards for doing the right thing - like producing lambs of useful weight and an acceptable leanness.

Please do not mistake what I mean. I advocate a higher average lamb weight mainly because per kilogram production costs are lower and yield of red meat is higher. I am not suggesting that we attempt to produce great numbers of heavy weight lambs - our markets simply would not absorb these, and because we are dependent on grassland farming, any move to increase weights greatly would result in higher costs for wintering, or lower total carrying capacity, or both.

Furthermore, we have many good markets for light lambs - even 'alphas' although I am not advocating them. And in addition to this, many areas of New Zealand are better suited to the production of early light lambs - and I think particularly of areas of South Canterbury which dry out in early summer. So I am not disparaging the good,
well muscled light lamb. What I am going to say is that those parts of New Zealand which have good summer rainfall and have the ability to produce heavier, lean, meaty lambs should be encouraged by the schedule to do just that.

The Board has done considerable work on this question recently. It is apparent that the H grade is bearing more of the processing charges than is justified - this results from the method by which the charge is calculated - and this cannot continue. There are advantages to the processing companies in getting the kill started early, which helps to extend the season. Light lambs may be important in this context, but if the companies want them, they will pay a premium in the usual way. One grade cannot be used to subsidise another, without distorting the production pattern.

However, there has always been criticism of the H grade from the marketplace, and this criticism has been used to justify the low schedule price paid. The main problems have been too many overfats, and too wide a weight range. We have therefore done research this season, and as a result have decided that a more valuable grade could be produced if we restricted the weight variation and applied very strictly a GR measurement not exceeding 15mm. We have, within the last few days, sent a trial container of H lambs to the United Kingdom. These are in three categories: maximum GR 15mm, weight range 16.5 - 19.5 kg; the second sample with GR from 15mm - 17mm, weight range 16.5 - 19.5 kg, and the third sample with GR up to 20mm, and a weight range from 20 - 25.5 kg. The GR measurements of the second and third samples may surprise you - but fat levels are often relative to weight, and the purpose of sending these samples is to discover, or try to discover, whether buyers will accept more fat provided the joint or the eye of meat is larger.

The most encouraging lesson to be drawn so far is the exceptional quality and eye appeal - to us, at least - of the first sample, and also even more encouraging that the proportion of this presumably more valuable parcel was 65% of the total. This bore out our estimate that about two thirds of the present H grade would fall into this category, and obviously we hope for a good response from our customers.

What do we hope to achieve by this exercise? Just this - to give
some financial reward to those farmers who are willing to select rams that will sire well muscled, later maturing lambs (and that of course only means that they lay on fat later). Many of this type of lamb will grow into H's within the weight range of our first sample - 16.5 - 19.5 kg - but they are at present discouraged because they are worth no more, or only a little more, than if they had been under 16.5 kg. At present we are fostering the idea that it is bad farming policy to let any part of your lamb crop get into the H grade, so lines are often drafted earlier than they need be. If we give some encouragement to the breeders of these desirable, later maturing rams (and these come from among all our present meat breeds) then we believe that there will be a considerable advantage to the quality of the present M grade - which is without doubt the most important grade. We believe that, if a sharp price discount is applied the moment a lamb reaches 16.5 kg - as it is at present - then we will have continuing adverse effects on average carcass weights and on the leanness of the M grade. In order to reverse this trend, we must achieve a better price for H lambs - and we are attempting to do this in the two ways I have outlined to you.

**Omega Lambs**

Before I leave the subject of sheep, I must comment on the marketing and grading of Omegas. This has been a subject of much contention, since the introduction of the grade.

The Board has, this season, modified the criteria applied to this grade by allowing the less extreme lambs to be graded P if they have adequate muscling. This has resulted in a reduction of about fifty percent in the number of lambs being graded Omega.

The change seems to have met with the approval of farmers who have been affected. Reports from London have not mentioned any adverse reaction - many in fact have commented that conformation of this season's lambs has been good.

I doubt if the Board can go any further in liberalising grade criteria. There is an obligation on the part of farmers and breeders now to breed lambs which will fall within the present grade, or suffer a penalty. The Board appreciates that there are occasions when the shape of a sheep is less important than its usefulness to the farmer who owns it.
Survivability, wool production, high fertility and low labour input - these are all important to farmers, and our challenge is to breed sheep that will perform in these respects, but as well have a carcass that will be readily marketable.

Compared with some European breeds, our lambs do not always yield as high a percentage of lean meat. The European lambs are from meat breeds, and their dams are closely shepherded and often require assistance at lambing. We certainly have to accept that it is not so easy for us to produce what may be thought to be ideal lambs, because of our need for dual purpose meat and wool sheep. But so long as we maintain an efficient grading system we need not fear diversity in our lamb production - compared to the Europeans who supply little more than their home markets, we send lamb to over eighty countries, and fortunately they do not all want the same type of lamb - but they all want value for their money, and the maximum of usable meat on the joints they buy.

BEEF

Much of what I have said about lamb applies also to beef. We have fewer problems though - because nearly all our beef is boned out, and can therefore be trimmed more economically. It is however obviously silly to spend time and use good grass in putting on fat which must then be trimmed. The cost of growing fat is considerably more than that of growing lean, so we want animals that are not 'wasty', and management systems that ensure they are killed at the right time.

The message I have here is that there are markets for all types of beef - this was true even during the past four years - so you need not feel guilty if you are producing prime butcher steers or heifers, while your neighbour produces bull beef. There are markets for both. When selecting a bull, you will look for soundness, and I hope you will look for his beefplan record, and then you will buy one that suits the particular market you are aiming for.

The beef we supply to the United States market is mainly used in the hamburger trade, and this seems likely to continue. Other markets are opening for our beef exports - notably South Korea. At the same time it is important that we do not neglect markets that we were
pleased to have when our exports to the United States were restricted. The Board is taking an interest in this; it is particularly relevant now that it seems likely that counter cyclical legislation will be passed in the United States. It is possible that we will not again be quite so dependent on that country; that there will be another beef cycle is certain, but when it will be, and what its effects will be, is impossible to guess. Currently world cattle herds are slow to respond to the higher prices; rebuilding of herd numbers is not yet taking place, although the reduction phase has probably finished. Our own cattle numbers are likely to be influenced by the number of bobby calves reared and carried through to slaughter; we cannot afford to see these go off as wasted beef. There should be every encouragement now, with on the one hand, high beef prices and on the other, low barley prices. Perhaps both the beef men and the Canterbury barley growers could benefit. Before someone tells me, I know they drink milk too!

Thank you for inviting me to speak here - I feel it is a privilege to be asked, and the topic we are discussing is timely and I hope of interest to most livestock farmers.

Last week Mr Hilgendorf came on the minutes of the first Electoral College meeting in August 1923. He had this copied for Board members, and added a comment which I particularly liked, which I quote:

"A great many of the problems the first committee discussed are still with us today and are likely always to be so. Members usually prefaced their remarks by congratulating the Board but left the impression that they could have done rather better themselves."
CARCASS PRODUCTION FOR THE CONSUMER

THE CONSEQUENCE OF CHANGE

A.H. Kirton
Senior Scientist
Meat Section
Ruakura Animal Research Station

The title of this paper may suggest that someone has documented the type or types of lamb carcass that New Zealand farmers should be producing in the 1980's. Unfortunately, up till now that has not been the case. We really have no good specifications of the type and weight of lamb carcass we should be producing for the various overseas markets. We do not know what the problems are, if any, in trying to market ram lambs overseas although we do know that they are the basis for heavier lean lamb production on mainland Europe. We do not know how fat a lamb carcass must be before being judged overfat on various overseas markets. We do not know when a consumer judges a cut of lamb to be overfat, whether this judgement is based on some absolute thickness of the layer of fat covering the carcass or on the ratio of fat to lean or percentage fat in the carcass.

Having covered what is not known, it is fair to point out that the New Zealand Meat Board does know that too many of the lambs currently exported from this country to the United Kingdom are too fat for that market. In addition, carcasses judged to be acceptable in the United Kingdom are known to be overfat in many of the new markets New Zealand would like to develop.

OVERFAT LAMB GRADING

At this conference last year I described the GR measurement that the New Zealand Meat Producers Board is using to define the lower limit of the F (overfat) lamb grade. The GR measurement (mm) is the
depth of tissue between the surface of the carcass and the rib at a point 11 cm from the midline in the region of the 12th rib. I also showed some of the data in Table 1, now updated, which gives the relationship between the GR measurement and percentage of carcasses down-graded for overfatness.

**TABLE 1. PERCENTAGE LAMB CARCASSES GRADED F IN THE NATIONAL EXPORT LAMB KILL AND RELATIONSHIP TO GR MEASUREMENT AND CARCASS FAT**

<table>
<thead>
<tr>
<th>Season</th>
<th>F Grade %</th>
<th>GR (mm)</th>
<th>Lower Limit % Carcass Fat *</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971-72</td>
<td>0.2</td>
<td></td>
<td>43 ?</td>
</tr>
<tr>
<td>1972-73</td>
<td>0.2</td>
<td></td>
<td>43 ?</td>
</tr>
<tr>
<td>1973-74</td>
<td>0.4</td>
<td>18</td>
<td>43 ?</td>
</tr>
<tr>
<td>1974-75</td>
<td>0.4</td>
<td>16</td>
<td>43 ? new grades</td>
</tr>
<tr>
<td>1975-76</td>
<td>0.7</td>
<td>16</td>
<td>?</td>
</tr>
<tr>
<td>1976-77</td>
<td>0.5</td>
<td>16</td>
<td>?</td>
</tr>
<tr>
<td>1977-78</td>
<td>0.5</td>
<td>16</td>
<td>32 ?</td>
</tr>
<tr>
<td>1978-79</td>
<td>1.0 (?)</td>
<td>15</td>
<td>?</td>
</tr>
<tr>
<td>?</td>
<td>?</td>
<td>10 (?)</td>
<td>?</td>
</tr>
</tbody>
</table>

* A number of overfat carcasses are analysed in some years at Ruakura and the figure given is for the least fat overfat carcass found in the year in question. In each of these years many carcasses were analysed which did not grade overfat but had a carcass fatness in the same range as the F grade carcasses.

The figures in Table 1 show that the Meat Producers Board has one GR measurement each season to cover all weights of lamb carcass and this measurement has been reduced from 18 mm in the 1973-74 season to 15 mm in the present season and they have expressed a long term aim of reducing GR to 10 mm which they believe is just above the maximum fat thickness at the GR site which is readily acceptable to some
consumers in fat tolerant countries. Table 1 also suggests that overfatness is not a very important problem in lamb because with decreasing GR's there has been little increase in the number of carcasses grading F. Lastly, the figures in Table 1 show that in the past lamb carcasses have had an excessively high fat content before some are graded overfat. As mentioned last year, the British Meat & Livestock Commission believes that lamb carcasses with more than 29% fat are too fat for the United Kingdom.

The low percentage of carcasses graded F shown in Table 1 may give the audience a false sense of security. In fact Ruakura results in recent seasons show that graders are very inaccurate in picking F grade carcasses. In one trial in the 1977-78 season involving just under 600 lambs, where the grader knew we were measuring all carcasses to check his accuracy and he had plenty of time to take the measurement, he only picked 43% of the lamb carcasses he should have graded F. In the works situation I believe the percentage detection is far lower. This is because of the rapid rate that carcasses reach the grader along the slaughter chain and the inadequacy of the equipment currently available for taking the GR measurement.

This measurement problem is close to being solved. The Auckland Industrial Development Division of D.S.I.R. has developed a probe which makes the measurement of GR relatively easy at chain speed. If and when adopted, the use of the GR probe is likely to greatly increase the proportion of carcasses graded F. As mentioned last year, I have seen one estimate to suggest that if the GR measurement was reduced to 12 mm for the F grade and all carcasses that should be were detected, just under 20% of present day lamb carcasses could be graded as overfat. The 35-40% lower payment for the F grade than for similar weight P or Y carcasses which do not require trimming before export makes the production of F grade carcasses something to be avoided.

Having only one GR measurement covering all carcass weights has been satisfactory to date because so few carcasses have been downgraded for this defect. It provides a measurable cut off point.

Figure 1 shows the relationship between GR and carcass weight obtained on 590 Southdown X Romney lambs in the 1977-78 season.
This information is likely to be more reliable than that based on 72 lambs spread over three treatments reported at this conference last year. On average GR increases by one millimetre for each kilogram increase in carcass weight. Obviously, bigger carcasses have bigger GR measurements and any system using one GR which is reduced over the years must encourage farmers to produce lighter carcasses as a means of avoiding overfatness with its associated economic penalties. Reducing carcass weights would be an unfortunate response because it would lower the weight of lamb New Zealand has to export at a time that the Meat Producers Board is looking at advantages to be gained from increasing carcass weights. The aim of having a measurement for determining overfatness is to penalise the fatter than average carcasses and not those heavier than average. It was interesting to note that a Meat Producers Board Survey in the 1974-75 season at one works showed the overfat carcasses were 3.5 kg heavier than the average carcass weight for that works.

To overcome this problem it is desirable to have a series of GR
measurement to set the lower fatness bound for the overfat grade with heavier carcasses being allowed larger GR's without being judged overfat. As a first step there should at least be a smaller GR for the M(13.0 - 16.0 kg) and a larger GR for the H(16.5 - 25.5 kg) carcass weight ranges. Initially the difference should be at least two millimetres. In the longer term it may be desirable to have more GR's particularly within the H weight range. A method of eliminating overfat carcasses must be found which discriminates against fatness but is independent of carcass weight. The aim must be to encourage farmers to produce meatier lambs and to discourage the placement in the market place of lamb cuts that are overfat for the consumer who see them on display.

HOW TO PRODUCE MEATIER LAMBS?

Research to date suggests that this will not be easily achieved by any one simple change but that leaner lambs can be produced without reducing carcass weights by various combinations of several methods.

Better Muscling - Conformation - a myth?

It is commonly said that the meat trade would like carcasses with the conformation of a P grade carcass but the leanness of a Y grade carcass. It is also commonly said that Y grade carcasses are "poorly muscled". What are the facts? To answer this question we have to make clear what we mean by muscling and note that different people are often talking about different things under the cover of this word "muscling". Included under this term have been conformation or carcass shape, distribution of muscles within the carcass and also the relative size and shape of the eye muscle, the main piece of red meat in the chop. Others have suggested the muscle/bone ratio is an indicator of muscling. We will now examine these factors separately.

Conformation or carcass shape. Conformation was discussed in some detail at this conference in 1968. It is very widely known that carcass shape is very strongly influenced by breed and also carcass fatness. Breeds such as the Southdown produce very blocky carcasses of the type the traditional meat trade has tended to regard as meaty while other breeds such as those with Merino, Corriedale and Border Leicester blood produce leggy carcasses
which are regarded as less desirable. Extremely leggy carcasses may be placed in the O (Omega) grade at lowered prices. Cutting trials on these various types of carcass have shown little, if any, difference in the proportions of joints and cuts from the different types of carcass and have established that one of the main factors which give blocky carcasses their meaty appearance is a higher proportion of fat and not meat. Thus there seem to be great difficulties in using conformation or shape as an indicator of meatiness, especially within a breed.

Distribution of muscles. There has been a belief that animal breeders have been able to improve the distribution of muscles in the carcass of improved sheep and cattle breeds to give more red meat in the high priced areas. This belief has been examined in some detail for sheep in New Zealand and Australia where growth series of Southdown, Southdown X Romney, Romney and Merino carcasses were dissected out on a muscle by muscle basis so that each individual muscle was removed and weighed. When the muscles of the high priced regions of the carcass were expressed as a percentage of total muscle weight (Table 2) it can be seen there was essentially no difference between the breeds; a finding similar to that also obtained on cattle in New Zealand and Australia. Thus despite the wide range of animals investigated covering from wool to meat breeds, no improvement in muscle distribution has been achieved.

Size and shape of the eye muscle. Meat trade representatives commonly believe that lean Y grade carcasses are "poorly muscled" and fatter P grade carcasses are "well muscled" but may have too much fat. These comments are on occasion related to the size and shape of the eye muscle as seen on the cut surface of a chop. As a higher proportion of lambs from some breeds are more likely to be graded P than from others and as Y grade carcasses tend to be lighter than P's this matter was investigated more closely to establish the factors of importance. It is known that eye muscle measurements are strongly influenced by both carcass weight and ram breed.

Just under 2000 P or Y grade lamb carcasses from a ram breed comparison trial at Ruakura had been measured for eye muscle area and shape. On average the Y grade carcasses were lighter than the P's and had smaller flatter eye muscles. However, when eye muscle measurements were compared between grades for carcasses of the same
TABLE 2. PERCENTAGE HIGH PRICED MUSCLES IN LAMBS OF DIFFERENT BREEDS

<table>
<thead>
<tr>
<th>Muscle Groups</th>
<th>Breed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Southdown*</td>
</tr>
<tr>
<td>Rump</td>
<td>28.1</td>
</tr>
<tr>
<td>Surrounding spinal</td>
<td>17.0</td>
</tr>
<tr>
<td>column</td>
<td></td>
</tr>
<tr>
<td>Upper shoulder</td>
<td>10.9</td>
</tr>
<tr>
<td>Total high priced</td>
<td>56.0</td>
</tr>
<tr>
<td>Total low priced</td>
<td>44.0</td>
</tr>
<tr>
<td>Eye Muscle ***</td>
<td>9.9</td>
</tr>
</tbody>
</table>

* From New Zealand experiment (N.Z. Journal of Agricultural Research 20: 115, 1977) with muscle percentages from lambs with 8 kg carcass muscle.

** From Australian experiment (Animal Production 13: 117, 1971) with muscle percentages from 365 day lambs.

*** Muscle longissimus dorsi, in the case of the New Zealand lambs from carcasses with 12 kg total muscle.

These results suggest breed improvement has had no effect on improving carcass muscle distribution in the so called improved meat breeds.

weight and sired by the same ram breed these differences largely disappeared.

The ram breed effect was very interesting with lambs from Southdown or Dorset Horn/Poll Dorset having larger eye muscle areas than those in similar weight carcasses from the longer woolled breeds. This result does not appear to tie in with that given earlier indicating that the eye muscle seems to comprise approximately the same proportion of total carcass muscle irrespective of breed. The explanation seems to be that some breeds have shorter and fatter eye muscles (giving larger cross sectional measurements)
than others which are longer and thinner. Thus it seems that from some breeds you are getting apparently slightly larger in cross section but thinner chops and from others you are getting apparently slightly smaller but thicker chops and you are getting the same weight of meat per chop from both types if they come from similar weight carcasses.

These results indicate that the carcass characteristics usually taken to indicate better muscled carcasses do not do so and are likely to be of little assistance in attempting to overcome an overfatness problem. These characteristics seem to be unrelated to consumer requirements. Having isolated factors which do not appear very useful as indicators of carcass composition we will move onto more useful ones.

**Breed Effects**

**Between breed.** Trials in New Zealand and overseas have established that there are differences between ram breeds in the growth rate and rate of fattening of their lambs. Ram breeds that produce slower growing lambs will produce lambs that are leaner because they are smaller than those of faster growing breeds when compared at any given age. Slow growth, in itself, can be undesirable. Of greater importance is the observation that some early maturing ram breeds such as the Ryeland and Southdown produce lambs with a greater tendency to lay down fat in their carcass at any given weight than the faster growing lambs of later maturing sire breeds. In particular, the Suffolk, Hampshire, Dorset Horn/Polled Dorset, Border Leicester and the Dorset Down seem to have advantages in terms of producing less fat lambs. Some recent Australian work suggests the Dorset Horn is superior to the Border Leicester in this regard. Thus breed of ram is one of the factors to look at where overfatness is a problem, but the effect is relative and it is possible to get overfat lambs from all breeds.

**Within breed selection.** Up till now the only possible method of selecting for meatier sheep within a breed or flock has been by eye and there is no evidence, one way or another, to indicate whether any success has been achieved in removing fat by this method. In Denmark they have successfully selected leaner pigs on a nationwide basis through the use of an ultrasonic live animal probe for
breeding animal selection. Up to now no similar equipment designed for use on sheep has been available. However, in the last three to four years Dr A.D. Beach of D.S.I.R. has designed an ultrasonic probe specifically for use on unshorn sheep and experiments are now under way to test how useful this approach will be for producing leaner lambs. Genetic information suggests this method for removing fat from sheep should be successful. If this proves to be the case we can hope that the D.S.I.R. probe will become available commercially.

Sex Effects

Evidence from most countries where sheep are run shows that ewe lambs tend to grow slower and be fatter than wether lambs which in turn tend to grow slower and be fatter than ram lambs. On farms where overfatness has been a problem it could pay at weaning to sort the ewe lambs from the remainder and to draft them at lighter weights.

Much information is available to show that where adequate feed is available for growth, ram lambs gain faster than wethers and produce leaner carcasses. In fact, a recent survey of the apparently superior meaty lambs found on mainland Europe suggested the carcasses came from uncastrated males. Given the apparent advantages of ram lambs where meaty carcasses are required, a strong case can be made for the meat industry as a whole (drafters, graders, slaughtermen, meat companies as well as farmers) to look closely at the benefits to be derived from the encouragement of ram lamb production where suitable.

This should initially only be considered on fat lamb farms where all lambs are drafted for slaughter before the end of the season. Farmers trying out this system for the first time should only leave the larger ram lambs entire to see how the method works on their particular farm. A small group of undrafted ram lambs at the end of the season can be an embarrassment to dispose of.

The most encouraging sign in recent years on this front is the fact that the Meat Producers Board is becoming interested in the possibility of promoting ram lamb production and have run a promising trial involving a comparison of ewe, wether and ram lambs this past season.
Management

Two of the important management factors under a farmers control, namely age at weaning and overall nutrition of the lamb and their effects on lamb composition will be covered by Dr Jagusch in his paper. This leaves two additional matters to be covered.

Weaned versus unweaned lambs. Suggestions have come from the meat trade that there tends to be two waves of overfat lambs during the season - one occurring with the first draft of "milk" lambs at weaning and a second wave in the late autumn. It was suggested that weaning and holding lambs for a period before drafting might overcome the first draft problem. There is a possible alternative explanation for the two wave theory. As on average overfat lamb carcasses were 3.5 kg heavier than the remaining grades on an occasion when measured and practically no F grade carcasses weighed less than 13 kg (a weight very close to the New Zealand average for lamb carcasses) it can be argued that the overfat are the very few very heavy lambs found in a first draft or the heavy lambs in the late drafts when drafting is delayed until there are enough heavy lambs to make up a truckload.

The Meat Producers Board requested Ruakura to test whether weaning and holding lambs before drafting reduced their fat content compared with that in unweaned lambs drafted off their mothers. This experiment was carried out (for details see 1978 Proc. Ruakura Farmers' Conference, FPP 126 by A.H. Kirton) involving three groups of 30 lambs. One group was drafted at weaning and the remaining two were held for three weeks before slaughter with one of the two being better fed than the other. Surprisingly, the carcasses from the unweaned lambs were relatively fatter than those from the two weaned groups; the two groups of weaned lambs grazed for an additional three weeks had heavier carcasses with similar mean GR values to those in the lighter carcasses of the unweaned lambs drafted earlier. Thus weaning and holding the lambs did not solve any fatness problem; it did allow an increase in carcass weight without making the problem any worse.

Set stocking versus rotational grazing. Reports from Canterbury and elsewhere have suggested that set stocked lambs are more likely to be overfat than rotationally grazed ones. An explanation
for this observation, if correct, is not obvious apart from the fact that rotationally grazed lambs may be relatively lighter, and lighter lambs would be expected to be less fat.

An experiment was carried out this last season to test the effect of grazing method on fatness. Ewes with lambs that were born at the Manutuke Research Station were placed on grazing treatments (set stocked or rotationally grazed at the same stocking rate) on 18 September and lambs from each of the two grazing treatments were allocated to two slaughter groups, all slaughter groups having the same mean liveweight at the end of October.

One group from each of the rotationally grazed and set stocked treatments was slaughtered on 21 November and a second group from each treatment on 18 January. The results are shown in Table 3.

**TABLE 3. EFFECT OF GRAZING METHOD ON FATNESS IN LAMBS**

<table>
<thead>
<tr>
<th>Item</th>
<th>First Slaughter</th>
<th>Second Slaughter</th>
<th>Diff.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of lambs**</td>
<td>36</td>
<td>35</td>
<td>-</td>
</tr>
<tr>
<td>Empty live weight(kg)</td>
<td>24.6</td>
<td>24.4</td>
<td>0.2</td>
</tr>
<tr>
<td>Hot carcass (kg)</td>
<td>12.22</td>
<td>11.78</td>
<td>0.44</td>
</tr>
<tr>
<td>GR (mm)</td>
<td>7.5</td>
<td>6.0</td>
<td>1.5</td>
</tr>
<tr>
<td>F grade carcasses</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

* Set stocked minus rotationally grazed
** 36 lambs allocated to each group but due to deaths etc. less available for slaughter

Although these results have not yet been statistically analysed, they do give some pointers as to the effect of grazing method on overfatness. At the time of the first slaughter the sample of lambs from the two grazing treatments were not greatly different in weight as planned, but the GR measurement indicated some reduction in fatness for the rotationally grazed group. By the time of the second slaughter there was a marked increase in F grade carcasses in the set stocked animals when compared with those rotationally
grazed which in part was attributable to their better growth and hence heavier carcass weights.

I do not wish to draw too much from this experiment, which I am sure will bear repeating, other than to say that in practice it seems that it is easier to produce overfat lambs in a set stocked situation than under rotational grazing. Obviously, in the practical farming situation the problem would not have been as obvious as in the experimental situation because the set stocked lambs would probably have been drafted earlier at lighter weights.

CONCLUSIONS

Lamb overfatness is likely to become a problem of increasing economic importance to the New Zealand farming community as GR standards are tightened and as graders become more efficient at detecting carcasses not meeting the prescribed standard. Resulting changes in carcass production should bring lamb cuts more into line with future consumer requirements.

It is obvious that there is not one simple management change that can be applied to overcome the lamb overfatness problem if present on any farm. Some traditionally used indicators of meatiness appear to be unrelated to the lean content of lamb carcasses.

Between and within breed selection is likely to reduce the fat content of lamb carcasses. Slaughter of ewe lambs at lighter weights and the non-castration of ram lambs will result in leaner carcasses. Rotational grazing can result in leaner carcass production partly through the slower growth of lambs grazed in this manner resulting in their slaughter at lighter weights. The effect of nutrition and nutritionally related effects such as age at weaning will be discussed in the following paper.

Acknowledgement

The staff of the Manutuke Research Station for running the set stocking versus rotational grazing trial.
CARCASS PRODUCTION FOR THE CONSUMER

NUTRITIONAL MANIPULATION OF CARCASS COMPOSITION OF LAMBS GROWN IN NEW ZEALAND

K.T. Jagusch and P.V. Rattray
Senior Scientists
Ruakura Animal Research Station

The emphasis on visual grading of fat cover, the measurement of fat depth, and the perennial increasing problem of overfat lambs, recognises fat as the most variable proportion of the lamb carcass. Manipulation of carcass composition by nutritional means therefore, largely refers to possibilities of changing the quantity of fat and/or altering the visual impact of the degree of fatness. It is virtually impossible to manipulate the lean content of the carcass by nutritional means, although carcasses can look leaner because action has been taken to reduce fat content. One physiological fact, which we cannot get away from, is that as the carcass increases in weight or size the proportion of fat also increases. A new-born lamb carcass can have two percent fat but by slaughter it can contain twenty five percent fat; the amount and timing of fat deposition relative to carcass weight, varying largely with genotype which determines rate of maturing and mature body size.

PLANE OF NUTRITION

All pertinent work examined for this paper showed plane of nutrition exerts its most potent effect on carcass composition by determining rate of growth and hence carcass weight. For example, Table 1 shows mean values from five years' data for
TABLE 1. MEAN VALUES FOR EWE PLUS LAMB INTAKE, CARCASS WEIGHT AND FAT COVER

<table>
<thead>
<tr>
<th>Breed</th>
<th>Stocking Rate (Sheep/ha)</th>
<th>Annual Intake Dry Matter (kg)</th>
<th>Hot Carcass Weight (kg)</th>
<th>Fat Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coopworth</td>
<td>26</td>
<td>620</td>
<td>12.3</td>
<td>1.34</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>710</td>
<td>13.3</td>
<td>1.48</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>820</td>
<td>14.3</td>
<td>1.77</td>
</tr>
<tr>
<td>Perendale</td>
<td>26</td>
<td>630</td>
<td>12.1</td>
<td>1.21</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>650</td>
<td>12.5</td>
<td>1.12</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>710</td>
<td>14.7</td>
<td>1.56</td>
</tr>
<tr>
<td>Romney</td>
<td>26</td>
<td>600</td>
<td>11.0</td>
<td>0.98</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>635</td>
<td>11.9</td>
<td>1.04</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>670</td>
<td>13.3</td>
<td>1.44</td>
</tr>
</tbody>
</table>

Fat cover and carcass weight of lambs produced in self contained flocks, but reared under three distinct nutritional climates as determined by stocking rate. Lambs in this experiment were killed over a wide range of weights and ages each year so there were tremendous overlaps between nutritional treatments. It was found that irrespective of age at slaughter, and whether lambs were single or twins; at the same carcass weight lambs had the same fat cover.

The within-breed difference shown in Table 1 are due therefore to differences in carcass weight and leanness is associated with reduced carcass size. Similar results have been obtained both with suckled lambs and those artificially reared on milk replacer diets when they have been grown at different rates. Final carcass weight determined composition.

UNDER NUTRITION

Restricted nutrition of lambs can occur when overfats are confined for underfeeding, when pasture shortages occur in most sheep growing
areas, such as in summer, and when lambs are early weaned at five to six weeks of age or less and their rumens are not fully adapted for an adequate intake of pasture as their sole diet.

Reducing intake such that young growing animals only maintain body weight can result in the mobilisation of fat and deposition of muscle although the situation is not so clear with more mature animals. Of course severely restricted lambs losing weight mobilise both fat and protein and this may or may not affect the relationship between carcass weight and carcass fat.

SEASONAL EFFECTS

Fat mobilisation due to nutritional or seasonal origin occurred in one of our experiments when Suffolk cross lambs were carried through to carcass weights of 25 kg. The lambs were grown under three planes of nutrition, as shown by growth curves in Figure 1, with groups being serially slaughtered from summer through to the following spring (cf. arrows). Figure 2 shows no effects on carcass composition were noted until carcass weights of 18-20 kg, which occurred in winter and spring, when at given carcass weights the lambs suddenly became leaner. Table 2 shows that fat cover declined most with low and medium plane animals and least with high plane lambs, suggesting a nutrition x season interaction. This might account for reports on the relative leanness of hoggets.

EARLY WEANING

Table 3 shows early weaned lambs which suffer a post-weaning check do not replace the fat mobilised at weaning by the time lambs reach body weights of 27 kg or carcass weights of 12 kg. Growth rates of early weaned lambs are best when fed legumes after weaning. Late weaning does not appear to have the same effect on carcass composition when lambs are well fed.

COMPENSATORY GROWTH

The suggestion that lambs re-fed after a period of undernutrition deposit less fat during the recovery phase is still subject to experimental verification. Older but still growing lambs are more
FIGURE 1. GROWTH CURVES FOR SUFFOLK CROSS LAMBS GIVEN HIGH (H), MEDIUM (M) AND LOW (L) PLANES OF NUTRITION

FIGURE 2. RELATIONSHIP BETWEEN WEIGHT OF FAT AND CARCASS WEIGHT FOR SUFFOLK LAMBS FED HIGH (H), MEDIUM (M) AND LOW (L) PLANES OF NUTRITION
TABLE 2. CARCASS WEIGHTS AND FAT COVER OF SUFFOLK CROSS LAMBS FED DIFFERENT PLANES OF NUTRITION

<table>
<thead>
<tr>
<th>Date</th>
<th>Cold Carcass Weight (kg)</th>
<th>Fat Thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L</td>
<td>M</td>
</tr>
<tr>
<td>January 21</td>
<td>11.1</td>
<td>11.0</td>
</tr>
<tr>
<td>March 17</td>
<td>13.3</td>
<td>14.7</td>
</tr>
<tr>
<td>May 14</td>
<td>16.8</td>
<td>18.8</td>
</tr>
<tr>
<td>August 5</td>
<td>18.0</td>
<td>20.0</td>
</tr>
<tr>
<td>October 1</td>
<td>21.4</td>
<td>23.6</td>
</tr>
</tbody>
</table>

TABLE 3. BODY OR CARCASS FAT (KG) AT FINISHED WEIGHTS FROM THREE EXPERIMENTS

<table>
<thead>
<tr>
<th>Experiment</th>
<th>1971 (body)</th>
<th>1972 (body)</th>
<th>1973 (carcass)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suckled</td>
<td>5.0</td>
<td>4.7</td>
<td>3.1</td>
</tr>
<tr>
<td>Early Weaned (4-5 weeks)</td>
<td>3.0</td>
<td>3.8</td>
<td>2.2</td>
</tr>
</tbody>
</table>
likely to be leaner on re-feeding compared with younger lambs given restricted nutrition and then re-fed. It is doubtful whether any purpose is gained by this practice or whether it would be profitable at present prices. Dr Kirton's results suggest it makes little difference.

**PASTURE ALLOWANCE**

Since nutrition exerts its major effect on carcass composition by producing carcasses of different weight it seems important that we consider one of the most important factors affecting liveweight gain, namely pasture allowance (kg DM offered/lamb/day).

Figure 3 shows the relationship between pasture allowance and liveweight gain for lambs given ryegrass-white clover during summer in the Waikato. Three years trials have shown that little of the differences are due to year effects, digestibility differences ranging from 70-78, and yield differences of between 2,000 - 5,000 kg OM/hectare and thereby different accessibility to herbage. A similar relationship based on one year's data has been found by Limbo Thompson at Woodlands in Southland. The carcass

**FIGURE 3. RELATIONSHIP BETWEEN PASTURE ALLOWANCE (kgDM/LAMB/DAY) AND LIVE WEIGHT GAIN (g/LAMB/DAY)**
TABLE 4. PASTURE ALLOWANCE, CARCASS WEIGHT, AND FAT COVER OF SUFFOLK AND DORSET CROSS LAMBS

<table>
<thead>
<tr>
<th>Allowance (kg DM/Head/day)</th>
<th>Hot Carcass Weight (mg)</th>
<th>Fat Cover (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.7</td>
<td>10.9</td>
<td>0.90</td>
</tr>
<tr>
<td>3.5</td>
<td>13.0</td>
<td>1.39</td>
</tr>
<tr>
<td>5.3</td>
<td>14.0</td>
<td>2.05</td>
</tr>
</tbody>
</table>

Composition data for the Ruakura trials (Table 4) shows differences in body fat content reflect differences in carcass weight brought about by altering pasture allowance.

PASTURE TYPE AND CROPS

Similar relationships have been derived for legumes and whilst they show more rapid liveweight gains at a given allowance compared with ryegrass-white clover swards, compositional studies on the carcass have shown no differences due to pasture type. Finishing on crops, such as turnips and medium stemmed kale, also has no differential effect on carcass composition compared with lambs fed ryegrass-white clover.

GRAZING MANAGEMENT

Dr Kirton alluded to grazing management as a factor affecting fatness. Indeed we too have found that continuously grazed lambs finished on the same area as those rotationally grazed are bigger and therefore fatter particularly during periods when pasture regrowth is high. Our results in Table 5 with lambs given ryegrass-white clover show the reason for the growth rate advantage to such lambs is through access to a larger area of pasture regrowth at any
TABLE 5. EFFECT OF GRAZING MANAGEMENT ON PASTURE ALLOWANCE, GROWTH, AND FAT COVER

<table>
<thead>
<tr>
<th></th>
<th>Continuous</th>
<th>Rotational</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcass kg</td>
<td>13.7</td>
<td>12.5</td>
</tr>
<tr>
<td>Fat cover (mm)</td>
<td>2.6</td>
<td>2.1</td>
</tr>
<tr>
<td>Gain (1) (g/day)</td>
<td>236</td>
<td>184</td>
</tr>
<tr>
<td>Allowance (1) (kgDM/l/day)</td>
<td>4.1</td>
<td>3.2</td>
</tr>
<tr>
<td>Gain (2) (g/day)</td>
<td>177</td>
<td>153</td>
</tr>
<tr>
<td>Allowance (2) (kgDM/l/day)</td>
<td>2.9</td>
<td>2.7</td>
</tr>
</tbody>
</table>

1 = Period 1
2 = Period 2

one time and therefore greater pasture allowances. It is noteworthy that during the latter part of this experiment when grass growth had slowed, pasture allowance and liveweight gain diverged less. With lucerne too we have shown that stabilisation of allowance eliminated compositional differences due to grazing management because groups had similar liveweight gains and similar carcass weights.

ARTIFICIAL REARING

High capital, labour, and milk replacer costs negate artificial rearing units for lambs of the type shown in Plate 1. However, feeding milk diets containing different quantities of protein is the easiest way to manipulate carcass composition of lambs. It can be seen in Table 6 that fat synthesis is limited by the protein in the diet and that substantial compositional changes occur (cf. underlined values) until protein sufficiency is reached. There also appeared to be further fat mobilisation with the 35% protein diet. Less changes in composition are the result of post rumen gut digestion; milk being propelled directly to the abomasum through
PLATE 1. AN ARTIFICIAL REARING UNIT FOR LAMBS GIVEN MILK REPLACER DIETS
TABLE 6. WEIGHT OF FAT AND PROTEIN IN THE CARCASS OF LAMBS FED MILK DIETS CONTAINING DIFFERENT LEVELS OF PROTEIN

<table>
<thead>
<tr>
<th>Protein Intake (%)</th>
<th>Fat (kg)</th>
<th>Protein (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1.01</td>
<td>0.61</td>
</tr>
<tr>
<td>10</td>
<td>0.51</td>
<td>0.69</td>
</tr>
<tr>
<td>15</td>
<td>0.36</td>
<td>1.05</td>
</tr>
<tr>
<td>20</td>
<td>0.33</td>
<td>1.04</td>
</tr>
<tr>
<td>25</td>
<td>0.30</td>
<td>1.05</td>
</tr>
<tr>
<td>30</td>
<td>0.27</td>
<td>1.05</td>
</tr>
<tr>
<td>35</td>
<td>0.08</td>
<td>1.07</td>
</tr>
</tbody>
</table>

suckling reflex control of the oesophageal groove. Unfortunately, the system is of no practical use to us.

In a feedlot situation it is also possible to similarly alter carcass composition by protecting protein in dry feed from digestion in the rumen. Again the system is of no practical use to us.

PHYSIOLOGICAL SUBSTANCES

Physiological substances such as 'ralgro' and various anabolic sex hormone mimics implanted in the growing lamb have resulted in leaner carcasses. Unfortunately, legislative and practical difficulties, together with costs limit their use at this time.

CONCLUSION

An examination of the literature together with a summary of our own work leads us to the conclusion that carcass composition of lambs grown under the grassland situation is to all intents and purposes
independent of the nutritional environment; carcass weight being the prime determinant of fat and lean content. Perhaps therefore we should concentrate on areas of agricultural production that when manipulated resound throughout the system. In the case of lean meat production these include grass growth, stock numbers, selection of lean animals, and changing both sire and dam breeds. Of course the latter must be seen in light of an appropriate grading system and an accommodating payout per kilogram of carcass.
AIMS AND OBJECTIVES

A clearly defined objective is fundamental to any improvement plan: the aim of the National Beef Cattle Improvement Council is increased production for beef farmers through the use of genetically superior cattle.

There are many avenues by which beef cattle improvement can be approached. Beefplan, the National Beef Recording Scheme, concentrates on improving the genetic worth of animals, by providing a recording scheme which enables a breeder to rank the animals in his own herd for at least some of the genetic traits which are important in beef production, and by providing a back-up extension service to help breeders use this information as fully as possible.

Why only some and not all such characters? For several good reasons:

* The more characters we select for, the slower the improvement in each. Indices can be constructed to overcome this disadvantage; but, while these are probably the apex in genetic selection, they are frequently difficult to construct and fail to receive breeder acceptance.
Only those traits which can be measured in some way can be recorded. For example - until recently we could not measure fat cover on the live animals, therefore it could not be recorded.

The characters recorded must have a reasonable degree of heritability; that is, superiority for a trait measured in a parent must be passed on to a reasonable extent to its progeny. For example, fertility in cows is probably the most important single factor influencing beef production whether on a farm or on the national scale; unfortunately it is of low heritability in beef cattle.

So most genetic improvement schemes throughout the world select from among the characters which meet the second and third criteria above.

To balance these limitations, genetic improvement has some important advantages. Firstly, it is comparatively cheap; secondly it is permanent unless removed by deliberate or careless breeding in subsequent generations; and thirdly it is additional to, and largely independent of, improvements which may or may not be made in other aspects of production, such as feeding or management.

Profitable beef production - from mating to meat - involves many factors including:

- fertility and reproductive performance
- mothering ability
- pre- and post- weaning gain
- carcass merit
- efficiency of conversion of feed to meat
- conformation as it relates to carcass quality and structural soundness
- temperament
- longevity

Beefplan concentrates on only a few of these; those we consider the most important and which meet the other criteria outlined above. These are fertility and reproductive efficiency, mothering ability in the dam and liveweight gain.
In this paper, technical aspects of the scheme will not be discussed except to say that these are soundly based, although, as with all such schemes, the accumulation of data under New Zealand conditions has shown the need for some technical improvements. These have now been introduced. Such improvements and additions will continue to be made as they become necessary and possible.

Nor will the levels of improvement to be obtained by recording these characteristics and using the information to select male and female replacements - the parents of future generations - be discussed. There is considerable overseas evidence to demonstrate these, and in recent years work by Ruakura geneticists has shown similar results.

Rather I will outline the present position of Beefplan, mention where acceptance of the scheme has been disappointing, suggest some reasons for this and put forward some ideas for improving progress in the future.

THE PRESENT POSITION

As far as recording is concerned, Beefplan has much to commend it. It is true that only some 30% of pedigree breeders record their animals; but based on South Island data, this means about 60% of pedigree cows (for the traditional breeds). Though disappointing, this must be kept in perspective by remembering that, as in the United States of America, New Zealand stud breeders control only about two to four percent of all cattle in their breed; but they still determine the type of animal found in the commercial herds of that breed. Moreover, within the pedigree structure, a few of the top breeders are all-important in determining the sort of animal produced.

What worries me is that so very few breeders are actually using the information they get from Beefplan to select their replacements.

I believe that few stud breeders now buy a herd sire without studying his performance records; but far too few - especially among those with 50 or more cows - are selecting one or two top recorded yearling bulls bred in their own herd to use in comparison
with the bull they buy. Yet Dr Baker's paper (see elsewhere in this publication) will show that not all bulls from "name" studs are top producers; nor are all from lesser known breeders below average.

So it would seem that Beefplan has failed as an extension service. I believe this is so, partly because prior to the last 15 months Beefplan lacked sufficient manpower to carry out this duty. But that is not the whole story; there are two other aspects which add to the problem. First, difficulties arise in transferring the genetic approach in its entirety from the research situation to the real world of beef cattle breeding for financial gain; and this remains a problem even when genetic progress has been demonstrated as fully as has that of the Ruakura workers. Secondly, resistance is encountered because many breeders feel that Beefplan is a scheme imposed from above - that it lacks a "grass-roots" origin. In many ways the effects of these two are interwoven.

GENETIC THEORY AND STUD BREEDING

Population genetics is based on large numbers of animals but most stud herds contain few animals - only 30% have over 50 cows. Not only does this limit the rate of progress possible but it can also have serious effects on individual breeders. For example, in a large population study, a bull "well below average" is just that; but if the selected herd sire happens to fall in that category, the results can be disastrous to the herd and its owner.

In genetic studies every effort is made to avoid bias by standardising the environment for all animals; but studs vary tremendously in their environments especially as these are influenced by the stud master's management. Again in experimental work improvement of the whole population is the aim; but in the fragmented bull-breeding world, improvement of the individual herd must come first with advancement of the breed secondary.

Then there are the costs. In my opinion the cost/benefit ratio for recording is relatively too high to recommend it for anyone who is not breeding bulls for sale. And even for these, the high price of individual animals especially stud bulls makes their rapid turnover very costly. Rapid turnover in females, necessary for a short
generation interval has the problem compounded by the lower production of immature dams. Finally, when conducting genetic studies costs can be readily discounted against future benefits; but bank managers and other controllers of budgets, not being trained geneticists, are notably sceptical in this context.

Next there is phenotypic appearance, which can be ignored in trials. But in the sale-ring or paddock a bull will only sell well if he looks the part. Indeed it is still true that to reach a high price a bull need not be genetically superior provided his appearance suggests that he is. And then there are shows. It is claimed that these enable a breed society to exhibit samples of their breed and a breeder to display the best of his stock and to compare these with those of other breeders. No-one can deny that some magnificent looking animals are seen and they are a joy to behold. But winning at the show is a pretty poor indication of an animal's breeding value. In my opinion the prizes at shows are awarded to the wrong species of animal. They should be awarded among the exhibitors, as rewards for merit in the stockman's skill and art - for his ability to select, feed, train and care for his beasts.

Finally there is the time-lag inherent in genetic improvement of beef cattle. First there is the wait of at least one generation before improvement can be expected in the pedigree herd undertaking such a programme. But stud breeders sell relatively few animals, so it is not until the first generation of calves, sired by the improved bulls, are marketed that financial returns can be expected - a minimum of five and a half or six years.

This is in direct contrast with recording in the dairy industry where information from testing can be used in the following season (sometimes before that) to cull low producers or in the sheep industry where improvement in wool weight can be seen by the time the progeny are one year old. It is this rapid and obvious response that largely explains why the demand for testing in the dairy industry came from the commercial farmers.

From the above I might seem about to advocate the replacement of all these small breeders by a few very large national breeding groups; but I believe such a step to be neither necessary nor desirable. Working with small numbers slows down but does not preclude genetic
change. I understand that reasonable progress can be made with herds of above 100 cows and better in herds of 200 plus. Surely it will be possible for breeders to co-operate to the extent that effectively selection is being applied to such numbers, and for geneticists and advisers to devise means to extend genetic progress to even smaller groups. Sire referencing is one such scheme. Beefplan is, and will remain, a service for bull breeders. Stud breeders, who have supported Beefplan in the past, have performed an act of faith, few of them have had a financial reward. I would like to pay a heartfelt tribute to them.

Moreover, I believe that we should not let the number of beef breeds decline; superior purebred bulls are essential if straight-bred and cross-breeding commercial herds are to progress. However, for a beef breed to survive in the future it will be necessary for its Breed Society to support genetic improvement for production enthusiastically. I am sure that the combined pedigree and performance scheme which Beefplan has developed will help both breeders and their societies to produce superior breeding stock.

In a closed herd over 80% of the genes present will have come from the last three sires used. Cost restricts female selection to the stud sector and even here it is minor. Genetic improvement will result only if the sire selected is superior in breeding value to the cows with which he is mated and/or to the sire which he replaces. Maximum improvement means accurate identification of genetically superior sires, and their use at the highest level in the breeding pyramid at which they are superior. If buyers want only superior sires, a higher level of culling will be necessary in many studs. Breeders will look to better prices for compensation.

In addition to the extension problems of encouraging stud breeders to use Beefplan fully and convincing commercial breeders to seek out and pay good prices for superior bulls, this highlights the urgent need for a system of "across-studs" assessment.

This is essential to ensure that a bull from any stud can be identified and used at the level to which he is best suited.
POLICY DIRECTION

For the past 18 months this has been vested in the National Beef Cattle Improvement Council - a body with a majority of members elected by Beefplan users and additional members appointed by the government, the Meat Board and Federated Farmers. The Council has done an excellent job in maintaining user morale, despite the severely depressed state of the industry, and in implementing several long-discussed recording improvements.

FIELD OPERATION

For the same period this has been carried out by the Ministry of Agriculture and Fisheries. I am certain that only the Ministry's active acceptance of this role and the ability of those officers responsible for its execution have arrested the further decline of beef recording.

SUGGESTIONS FOR THE FUTURE

Association of Council members and geneticists on an active technical committee has led to a greater involvement of both groups and directly to the implementation of the improvements mentioned above. Next season will see the introduction of a combined pedigree/performance recording option. This development eliminates the need for a breeder to complete two sets of very similar data, one for his breed society and one for Beefplan. In addition to this saving in paperwork the new system will result in considerable advantages to co-operating breed societies by enabling their herd books to be prepared by computer.

The potential for increased membership from this development is so great that I believe the time is opportune for the National Beef Cattle Improvement Council to assume full responsibility for the control and operation of Beefplan. This could be done by:-

* Appointment of its own staff of a geneticist, a computer expert and 2-3 field staff.

* Obtaining its own computer or adequate direct access to this facility.
Staff

The beneficial result of direct contact between Council members and scientists has been mentioned; I believe these will be greatly enhanced by close continuous staff/employer contact. Moreover such a move must improve Beefplan's image in the eyes of the breeders.

**Computer Analyst and Geneticist.** In the past Beefplan has had excellent co-operation from able people in both these disciplines; but short-term liaison cannot substitute for full and constant co-operation among computer analyst, geneticist, field staff and breeders. Adequate planning by such a group would avoid many of the problems, which now do not emerge until our programmes are running. Though usually minor, these cause considerable irritation among breeders. The corrections are costly to the system.

**Computer.** To maximise these benefits needs direct access to a computer. Operationally computer runs could be better timed and minor delays avoided. The quicker turn-round of records would increase breeder satisfaction. Costs to the system would be reduced.

A further possibility would be the development of small programmes to cover limited aspects of beef production which cannot be incorporated in the present large programme.

By computer standards Beefplan calculations are relatively simple and the number of animals involved not large. Thus, as a layman, I cannot see the need for the tremendous output and storage capacity of a very large computer.

**Field Staff.** Suggesting that Beefplan should have its own small staff does not mean that those officers of the Ministry of Agriculture and Fisheries, who have added this task to their many commitments, have been found wanting. But beef breeders are independent by nature and inclined to view with suspicion any government involvement. I believe they will accept Beefplan more readily when dealing with extension staff whom they see as working for them. Building such trust will be especially important with the imminent introduction of Beefplan's combined pedigree/performance
scheme.

As the Council's extension arm, field staff would help breeders with recording, check performance inputs and print-outs and aid those breeders who want to use the breeding plans, which Beefplan will soon put out to encourage fuller utilization of performance records. Beefplan staff would work in with Ministry advisers, who, I am sure, will continue to advocate genetic improvement as part of their overall approach to increased beef production.

Financing the Changes

Routine Recording Cost. As at present these would be met by users' fees. I believe that greater efficiency would counteract rising costs in this sector.

The Costs of Development. At present these are met by an annual grant from the New Zealand Meat Producers' Board and a matching sum from Government. Involvement of its geneticists in this sector means that the Ministry also makes an additional substantial contribution. In the proposed set-up, the expenses of a geneticist would have to be met by the Council.

As regards the proposed computational changes, I believe that the cost of these would not greatly exceed the present over-all computer charges for programming, scrutinizing and operation. Again I am sure that greater efficiency would off-set some of these costs.

Cost of Field Staff. At present all extension services are provided by the Ministry of Agriculture and Fisheries. Although the work of its own field staff would lead to considerable over-all savings, employing this staff would mean a considerable increase in expenditure by the Council; and additional finance would be necessary.

Source of Funds. The long-term result of genetic improvement will be increased production by the industry as a whole. Ruakura results suggest that a cumulative improvement of one percent per annum in carcass weight is possible with full dedication to improvement; but to allow for a lower level of selection and for less than 100% of beef cattle being involved, a level of one tenth of this
might be realistic.

However, even this means approximately 300,000 kg/year of additional meat for sale. Although this increase would not be attained for some years, it is cumulative, for example, the next year it would be 600,000 kg without an increase in commitment or in the number of cattle involved.

We may argue as to the exact value per kilogram to put on this increase; but we must agree that in total the sum will be large. Enough surely to justify a levy of, say ten cents on each cattle beast slaughtered. This would yield about $150,000 per annum - enough to make Beefplan and Beef Cattle Improvement independent of grants from the Meat Producers' Board or government.

The views expressed in this paper are those of the author. They do not necessarily reflect those of the Ministry of Agriculture and Fisheries or of any of its officers.
INTRODUCTION

In the previous paper in this session on 'Carcass Production for the Consumer', Mr D'arcy Walker has described beef recording in New Zealand and the potential role of the national recording service, Beefplan, in helping farmers to make genetic progress for economically important characters within their herds. The purpose of this paper is firstly to describe the development of sire reference progeny test schemes in New Zealand which will enable beef farmers to compare bulls between herds and hopefully also identify herds of superior genetic merit. Secondly the role of exotic breeds of cattle in New Zealand will be reviewed in light of the extensive research studies which have been undertaken both in New Zealand and overseas to evaluate their role in genetic improvement for beef production.

SIRE REFERENCE SCHEMES

A sire reference scheme involves the use, facilitated by artificial breeding (AB), of one or more common 'reference' sires in different recorded (Beefplan) herds. The major aims are:

* To estimate genetic differences among AB sires used,
differences among home sires qualifying in the scheme, and between AB and home sires

* To provide, through progeny testing, further demonstration of the effectiveness of on-farm selection of 'home-bred' bulls on their own weight-for-age records in Beefplan herds

* To estimate the size of genetic differences among participating herds

At present four beef sire reference schemes are operating in New Zealand. A pilot scheme with Angus cattle was initiated at Ruakura in 1977 (Morris and Baker, 1978). The Charolais and Simmental breed societies initiated their own schemes in 1978 with some technical assistance from Ruakura. Progeny testing of Hereford bulls purchased from stud herds as weaners was initiated in 1972 by the New Zealand Dairy Board (NZDB). Beginning in 1978 the NZDB has purchased 18-month Hereford bulls from stud herds and is progeny testing them in dairy herds as previously. But through the use of common reference sires they are linking their programme with the large scale progeny testing of Hereford bulls (mostly unregistered bulls) carried out by Genepool in the South Island.

In these sire reference schemes bulls are being compared initially for progeny weaning and/or later weights (yearling or 20-month weights). Consideration is however being given to including comparative information on the important aspects of calving ease (calf birth weights may be important here), daughter fertility and maternal ability, and perhaps carcass attributes such as the yield of lean meat.

Bulls can be validly compared with others through performance test for weaning or yearling weights only when they are run in the same herd in the same year. Genetic progress can definitely be made by selecting among animals managed similarly in the same herd (Carter, 1971). Comparisons from herd to herd are misleading due to such factors as different stocking rate, pasture production, or management practice.

Central performance tests have been used in New Zealand and overseas to compare bulls from different herds in a single location. But the recent results of the progeny test work being carried out by the NZDB with Hereford bulls revealed that central performance testing
of the bulls brought together after weaning does not provide a good guide to the growth potential they pass on to their progeny (Wickham, 1977). It was largely to meet this deficiency of central performance testing that sire reference progeny test schemes were initiated in New Zealand.

How a Sire Reference Scheme Works

Full details of sire reference schemes were given by Morris and Baker (1978) and just the more important points are given here.

The aim is to use a small number of bulls extensively through AB each year in a large number of herds which are performance recording. It is not necessary to have a large herd to participate. Comparisons are still on a within-herd basis, but differences among the AB sires can be combined over herds for more accurate assessment. In addition to weight measurements, all sires in the scheme may have progeny inspected for structural soundness, such as feet, legs and jaws; and all AB bulls can be compared for calving ease of mates. In each participating herd at least two AB bulls should be used so that comparisons among AB sires can be made.

Not all cows in any participating herd need be involved in the scheme. 'Special' matings would be ignored, but all cows offered for the scheme must be mated in representative groups. It is not possible to compare bulls by progeny test if one bull is mated to the 'best' cows - measured perhaps according to weaning weight of calves from these cows - and another to the poorest. The use of properly randomised mating ensures that each bull is given an equal chance of proving himself. It is recommended that at least 15-20 cows be joined with each AB or home sire participating in the scheme. Thus a farmer with a minimum of 30-40 cows, and using two reference sires, could participate in the scheme.

It is important to avoid preferential treating of any individual cow or group of cows, and of any individual calf or group of calves. The simplest way to avoid such potential biases is to run all stock together, except as required at mating. Male and female calves can be separated at weaning but preferably not before then. Re-randomisation of both dry and nursing cows to bulls from one year to the next is important too. If the mating allocation is by age groups it
is however feasible to run cow age groups separately because all sires are to be represented by progeny from all age groups of cows.

Adjustment factors will be used for calf sex, age of dam, date of birth and calf and, where necessary, the mob in which calves were run. Because adjustment factors for date of birth of calf are unreliable for very late-born calves the progeny testing of 'clean-up' bulls should not be part of a sire reference scheme. Adequate methods of identifying the progeny of clean-up bulls must be arranged. Weaning data from all other calves born during the main calving can be analysed as long as no selective culling has been done. For males this means that all must be left entire or all castrated, but not some of each. For yearling and 20-month weights, data from both sexes will be analysed where available, as long as bias due to differential culling has been avoided. Selection on weaning weight could be checked, for example by comparing the weaning weights of those retained with the weaning weights of those culled.

One of the critical initial aspects is finding acceptable bulls with high breeding value to act as reference sires, before there has been time for progeny test information to be collected in the scheme to identify such bulls. For the Angus scheme this gap has been partially filled by analysing research and some industry progeny test data where common reference sires have linked different locations and different years (Morris, and Baker, 1978; Baker 1978a). The Angus sire ranking lists which have been produced from this exercise should also be useful for any beef farmers prepared to use some AB and wishing to utilise some of these top proven bulls. The best Angus sire identified to date is expected to leave progeny about seventeen kilograms heavier at the yearling stage than the average of the progeny from all the 216 Angus sires ranked to date. Many of the top ranked Angus bulls for both weaning and yearling weight are not stud bulls but most of these unregistered bulls had above average performance rankings prior to being progeny tested.

The Potential Benefits from a Sire Reference Scheme

To illustrate how a sire reference scheme might work the results of progeny testing 18 Angus bulls at Waikite between 1974 and 1976 are presented. Ten of these bulls were bred and performance tested at
Waikite and were the 'home sires'. The other eight industry bulls included four stud Angus bulls purchased by the Lands and Survey Department at an average price of $5375. One of these bulls, was used in each of these three years and thus acted as the 'reference sire' to link progeny tests.

The performance of the progeny of homebred bulls and industry bulls is compared in Table 1. Consistent with the earlier progeny test results at Waikite it is found that on average the homebred bulls produced heavier steer and heifer calves as yearlings (advantage of 3.5 kg) and heavier carcass weights of steers (advantage of 2.4 kg) than progeny of the industry bulls.

**TABLE 1. RESULTS FROM THREE YEARS PROGENY TESTING AT WAIKITE NORTH**

<table>
<thead>
<tr>
<th>Source Of Bulls</th>
<th>Av No of Bulls</th>
<th>Av No of Calves</th>
<th>Av BW</th>
<th>Av WW</th>
<th>Av YW</th>
<th>Av CW</th>
<th>% Prime</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Homebred</td>
<td>10</td>
<td>26</td>
<td>28.0</td>
<td>160.4</td>
<td>235.7</td>
<td>12</td>
<td>203.1</td>
</tr>
<tr>
<td>B. Industry</td>
<td>8</td>
<td>21</td>
<td>28.5</td>
<td>161.6</td>
<td>232.2</td>
<td>10</td>
<td>200.7</td>
</tr>
<tr>
<td>Difference (A-B)</td>
<td>-0.5</td>
<td>-1.2</td>
<td>3.5</td>
<td></td>
<td></td>
<td></td>
<td>2.4</td>
</tr>
</tbody>
</table>

* BW = birthweight  
* WW = weaning weight  
* YW = yearling weight  
* CW = carcass weight

A criticism of an earlier report (Baker, 1976) was that the industry bulls purchased by the Lands and Survey Department at relatively low prices, may have been a below average sample of those available. This is certainly not the case in the recent progeny tests. In Table 2 the actual progeny test results for some of the superior sires are shown. In the top six bulls ranked on their progeny's carcass weight there were three homebred bulls and three industry
TABLE 2. PROGENY TEST RESULTS FOR SOME SPECIFIC BULLS AT WAIKITE *

<table>
<thead>
<tr>
<th>Bull Name **</th>
<th>Av No Calves</th>
<th>Av No BW</th>
<th>Av No WW</th>
<th>Av No YW</th>
<th>Av No Steers</th>
<th>CW</th>
<th>Rank (CW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WN587/71</td>
<td>33</td>
<td>0.3</td>
<td>4.7</td>
<td>5.1</td>
<td>22</td>
<td>8.6</td>
<td>1</td>
</tr>
<tr>
<td>778 of Kaharau</td>
<td>13</td>
<td>0.7</td>
<td>2.7</td>
<td>0.9</td>
<td>9</td>
<td>3.2</td>
<td>2</td>
</tr>
<tr>
<td>WN367/73</td>
<td>20</td>
<td>-1.1</td>
<td>-0.6</td>
<td>0.1</td>
<td>7</td>
<td>2.8</td>
<td>3</td>
</tr>
<tr>
<td>WN293/72</td>
<td>28</td>
<td>0.5</td>
<td>1.3</td>
<td>10.2</td>
<td>9</td>
<td>2.3</td>
<td>4</td>
</tr>
<tr>
<td>727 of Kaharau</td>
<td>10</td>
<td>0.3</td>
<td>1.6</td>
<td>-2.4</td>
<td>4</td>
<td>2.0</td>
<td>5</td>
</tr>
<tr>
<td>Bland of Turihaua</td>
<td>18</td>
<td>1.6</td>
<td>5.2</td>
<td>3.9</td>
<td>9</td>
<td>1.8</td>
<td>6</td>
</tr>
</tbody>
</table>

* Progeny test results shown as a deviation from the mean of all progeny for ease of interpretation.
** WN = Waikite North, i.e. a homebred bull

bulls. In general bulls leaving progeny with heavy carcass weights also left progeny with above average weaning and yearling weights. This association of high yearling weights with above average carcass weights is important since it is a difficult and costly procedure to record carcass weights of sire progeny groups. For stud breeders of course this is not possible at all since they are producing bulls for sale. But research evidence does show that identifying bulls with top weaning or yearling weight rankings will mean they will leave progeny with superior carcass weights.

The analysis presented here and Angus sire ranking lists prepared to date (Baker, 1978a) have identified sires that are expected to leave progeny with at least five to ten kilograms heavier carcass weights than those from average sires. Clearly there must be many other genetically superior bulls in registered and commercial herds and sire reference schemes are designed to help find them.
Genetic Merit of Different Herds

One of the interesting features of a sire reference scheme is the ability to compare genetic levels of sires from different breeding herds. This is done quite simply by averaging the progeny performance of all bulls from a particular herd of origin and multiplying this value by two - since the progeny express only half the bull's breeding value.

Reliable inference about herd average genetic levels clearly requires testing an adequate (at least ten bulls, say) and representative sample of sires. This requirement has been met to date only in the case of research herds. Some preliminary investigations of this question were presented by Baker (1978b) and the results are presented in Table 3. These results are extracted from an Angus sire summary which included in addition to bulls from the three main sources, five British-bred sires and 122 New Zealand industry-bred sires from about 60 different Angus studs.

<table>
<thead>
<tr>
<th>Herd</th>
<th>No. Bulls</th>
<th>Weaning Weight</th>
<th>Yearling Weight</th>
<th>Calves Weaned*</th>
<th>Weaning Weight</th>
<th>Yearling Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waikeria</td>
<td>31</td>
<td>180</td>
<td>240</td>
<td>85-90%</td>
<td>3.2</td>
<td>6.4</td>
</tr>
<tr>
<td>Waikite</td>
<td>41</td>
<td>145</td>
<td>200</td>
<td>78-82%</td>
<td>0.7</td>
<td>2.8</td>
</tr>
<tr>
<td>Waihora</td>
<td>34</td>
<td>175</td>
<td>255</td>
<td>85-90%</td>
<td>0.1</td>
<td>1.8</td>
</tr>
<tr>
<td>Industry sires</td>
<td>122</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-1.0</td>
<td>-2.8</td>
</tr>
</tbody>
</table>

* Calves weaned/cow mated from cows 3-years-old and older. In all three of these herds cows calved first as 2-year-olds.
Table 3 illustrates that herds like the Waikeria (Justice Department) research herd, which has been under closed-herd selection for yearling weight for some 15 years, does have a genetic level for weaning weight and yearling weight well above that of industry sires progeny tested to date. We also see that high genetic levels for a herd such as the Waikite research herd may not necessarily be reflected in high *absolute* performance in the herd. Unfortunately show-ring judging of bulls still places major emphasis on absolute size and performance which are very largely determined by feeding and management levels.

*Other Aspects*

It is important to mention aspects of beef performance other than growth and calving ease which significantly affect profitability—such as female fertility, milk production and carcass attributes. Fertility and weaning ability are put together in Beefplan into a single value called the 'lifetime productivity index' (LPI). As is presently done at the Lands and Survey Department's (Rotorua) group breeding scheme, young stock of either sex can then be selected on a combination of dam's LPI and the calf's own adjusted yearling weight ratio.

It should be noted that with *natural mating*, progeny testing has little economic benefit in improving growth rate, more effective genetic gains being achieved through performance selection within herds. On the other hand progeny testing is a highly important final link in the selection chain for choosing AB sires for extensive use in the industry or in bull-breeding herds. Wide use of AB coupled with performance recording in commercial herds is in the long term likely to provide the most accurate and economic method of progeny test selection, as is well illustrated by the dairy industry. Given the present very low usage of AB in beef herds, associated both with the difficulty of detecting oestrus in large beef herds and with cost, sire reference schemes offer a reasonable compromise between natural mating and AB.

**EXOTIC BREEDS FOR BEEF HERDS**

At this Conference nine years ago, Dr Carter discussed the potential for increased farm efficiency from exotic breeds of sheep and cattle.
It is timely now to review the likely contribution of 'new' cattle breeds in the light of subsequent experimental comparisons with local beef and dairy breeds.

A Ruakura project described as 'Beef production from the dairy herd', has compared nine sire breeds (Friesian, Hereford, Angus, Simmental, Limousin, South Devon, Blond d'Aquitaine, Red Devon and Charolais) when mated to Friesian-type cows in local dairy farmers' herds (Everitt, Jury, Dalton and Ward, 1978). In addition to the Friesian, used in each of the four years, two other sire breeds were included each year. Assessment of resulting steer beef production from the dairy herd is now completed. Information on the crossbred heifers as beef breeding cows (two and three year old calvings only) is not yet available.

Initial objectives of the Ruakura Beef Breed Evaluation trial (designated BBE), currently proceeding at three research locations, were to assess and compare the performance of four local (Angus, Hereford, Friesian, Jersey) and seven exotic (South Devon, Charolais, Limousin, Blond d'Aquitaine, Simmental, Maine Anjou, Chianina) breeds of cattle in crosses with Angus and Hereford cows. Assessment is based on both meat production of the steers and breeding performance of the female progeny. Preliminary reports of this study have been given by Carter, Muller and Baker (1975), Baker and Carter (1976) and Carter (1977).

The main discussion here will update results from the BBE project. These will be considered in relation to findings from Dr Everitt's study and from a large-scale breed evaluation programme being undertaken by the United States Meat Animal Research Centre (Clay Centre) in Nebraska.

**Design of the BBE Trial**

Semen from the same bulls was used at each of three different locations (Phase I). The three herds represent a wide range of environments and, hence, of animal performance. Tokanui (Waikato-500 Angus cows) has the most favourable conditions; Goudies (near Rotorua - 850 Angus and 500 Hereford cows) the hardest, with Templeton (300 Angus cows) being intermediate. From 1971-77, 191
different sires, including at least 12 of each breed were used by AB to generate test progeny.

Steers have been slaughtered at about 20 months of age except that half from Goudies were carried through to 31 months. Mating, calving and weaning performance of all females (Phase II) is being followed for at least four seasons. All yearling heifers have been bred to Angus or Southorn bulls, while subsequent matings have included Blond d' Aquitaine, Limousin, Simmental, Maine Anjou and Charolais breeds as terminal sires.

Calving Performance (Angus and Hereford base cows)

Information (Phase I) on difficult births - observed or presumed from signs of difficult parturition - and calf survival is summarised in Table 4. Results relate to Angus or Hereford cows three years and older.

Relative to the Angus, Hereford and Jersey sires all the exotic crosses were more prone to difficult births. Calving difficulties were more frequent for Hereford than for Angus cows, especially when mated to Charolais and Maine Anjou sires. Friesian sires caused considerable dystocia with Hereford, but not with Angus dams.

Results for calf losses, here including total deaths at birth (excluding abortions) and up to weaning, showed a similar pattern to calving difficulty except for the high survival rate among Friesian-Hereford crosses. In general however the exotic sire breeds differed less from the local breeds for calf losses than for difficult births.

Two important factors influencing calving performance are gestation length (duration of pregnancy) and birth weight. Sire breed means for these two traits are included in Table 4. Calves sired by all the exotic breeds were carried longer than those sired by the local breeds, the Chianina and Blond d' Aquitaine being the extreme breeds at about ten days longer than the Angus or Friesian cross. Likewise, birth weights were heavier for all the exotic crosses than those from local breeds, although the Friesian and Limousin crosses were similar. The heaviest calves were sired by the Chianina, Maine Anjou and Charolais breeds while the lightest were Jersey crosses.
<table>
<thead>
<tr>
<th>Sire Breed</th>
<th>Difficult calvings (%)</th>
<th>Losses to weaning (%)</th>
<th>Gestation length (Days)</th>
<th>Birth wt (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Angus Dam</td>
<td>Hereford Dam</td>
<td>Angus Dam</td>
<td>Hereford Dam</td>
</tr>
<tr>
<td>Angus</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Hereford</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Friesian</td>
<td>4</td>
<td>14</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Jersey</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>South Devon</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Charolais</td>
<td>15</td>
<td>24</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>Limousin</td>
<td>5</td>
<td>11</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>Blond d'Aquitaine</td>
<td>8</td>
<td>17</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Simmental</td>
<td>8</td>
<td>16</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>Maine Anjou</td>
<td>13</td>
<td>24</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Chianina</td>
<td>11</td>
<td>10</td>
<td>8</td>
<td>7</td>
</tr>
</tbody>
</table>

* Results for 5,000 calves (excluding abortions) born 1972-77.
### TABLE 5. GROWTH PERFORMANCE AND CARCASS WEIGHT RANKINGS

<table>
<thead>
<tr>
<th>Sire Breed</th>
<th>6m wt</th>
<th>13m wt</th>
<th>19m wt</th>
<th>Carcass wt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angus</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Hereford</td>
<td>105</td>
<td>106</td>
<td>106</td>
<td>110</td>
</tr>
<tr>
<td>Friesian</td>
<td>111</td>
<td>113</td>
<td>113</td>
<td>117</td>
</tr>
<tr>
<td>Jersey</td>
<td>98</td>
<td>100</td>
<td>101</td>
<td>101</td>
</tr>
<tr>
<td>South Devon</td>
<td>110</td>
<td>111</td>
<td>112</td>
<td>118</td>
</tr>
<tr>
<td>Charolais</td>
<td>114</td>
<td>113</td>
<td>114</td>
<td>121</td>
</tr>
<tr>
<td>Limousin</td>
<td>108</td>
<td>107</td>
<td>107</td>
<td>114</td>
</tr>
<tr>
<td>Blond d'Aquitaine</td>
<td>113</td>
<td>111</td>
<td>112</td>
<td>121</td>
</tr>
<tr>
<td>Simmental</td>
<td>113</td>
<td>114</td>
<td>115</td>
<td>119</td>
</tr>
<tr>
<td>Maine Anjou</td>
<td>114</td>
<td>115</td>
<td>115</td>
<td>122</td>
</tr>
<tr>
<td>Chianina</td>
<td>112</td>
<td>110</td>
<td>110</td>
<td>119</td>
</tr>
</tbody>
</table>

No. animals 4637 4563 4078 1858  
No. sires 201 201 187 164

**Growth and Carass Performance**

Growth performance is presented here in terms of liveweights at ages of about six months, 13 months (prior to mating of heifers) and 19 months (before slaughter of steers and including mated heifers). Results are summarised in Table 5 in terms of breed rankings relative to the purebred Angus calves. Six and 13 month weights are based on five calf drops (1972-77), and 19 month weights four calf drops (1972-76). Progeny of all the exotic breeds grew faster to weaning and subsequently than the Angus and Hereford cross calves. The fastest growing breeds were Simmental, Maine Anjou, and Charolais followed very closely by the Friesian. Jersey cross calves had similar growth rates to purebred Angus calves.
Also shown in Table 5 are steer carcass weight rankings for four calf drops (1973-76). Breed rankings are similar to those for growth to 19 months except that high killing our percentages for Blond d'Aquitaine and Limousin calves improved their carcass weight rankings. In general all the exotic crosses were leaner and had a smaller proportion grading prime than the Angus and Hereford crosses. The Jersey, and to a lesser extent the Friesian carcasses were also downgraded primarily because of lack of conformation or acceptable finish.

Environmental Influences on Calving, Growth and Carcass Performance

Environment, breed of dam and slaughter age have important effects on performance and particularly on post-weaning growth (Table 6). At Goudies, Angus dams have a better calving performance than Hereford. In general, however, breed rankings are consistent over the different locations and slaughter ages.

Reproductive and Maternal Performance of Crossbred Females

Information on reproductive and maternal performance of the females born 1973-76 and calving 1975-78 is summarized in Table 7. This relates to 1943 heifers, 4801 matings and 3366 calvings, after excluding purebred Herefords (present only at Goudies) and Chianina crosses (first calves born 1975). Cows have been culled only if non-pregnant in two years. These provisional results, of which 41% pertain to yearling matings, are as yet inadequate to properly assess lifetime breeding performance.

The late sexual maturity (age of puberty) of the Limousin, Blond d'Aquitaine and Charolais, and the precocity of the Jersey and Friesian crosses relative to the Angus-Hereford cross are sharply reflected in pregnancy rates to mating as yearlings, with less marked breed differences at later matings.

Maine Anjou, Simmental, Charolais and Hereford-Angus cross females are the most prone to difficult calvings with the Jersey cross being clearly superior in this respect. Difficult births and calf losses at two year old calvings were on average two to three times those for three year old and older calvings (Table 9) and particularly accentuated in straightbred Angus and Hereford cows
TABLE 6. ENVIRONMENTAL INFLUENCES ON CALVING, GROWTH AND CARCASS PERFORMANCE

<table>
<thead>
<tr>
<th>Location</th>
<th>Dam Breed</th>
<th>Difficult Calvings %</th>
<th>Calf Losses %</th>
<th>Birth wt kg</th>
<th>Gestation Length Days</th>
<th>6m wt kg</th>
<th>19m wt kg</th>
<th>Slaughter Age m</th>
<th>Carcass wt kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Templeton</td>
<td>Angus</td>
<td>4</td>
<td>6</td>
<td>32</td>
<td>283</td>
<td>173</td>
<td>370</td>
<td>20</td>
<td>215</td>
</tr>
<tr>
<td>Tokanui</td>
<td>Angus</td>
<td>8</td>
<td>7</td>
<td>33</td>
<td>283</td>
<td>182</td>
<td>410</td>
<td>20</td>
<td>250</td>
</tr>
<tr>
<td>Goudies</td>
<td>Angus</td>
<td>7</td>
<td>7</td>
<td>31</td>
<td>283</td>
<td>176</td>
<td>370</td>
<td>(20*)</td>
<td>(200)</td>
</tr>
<tr>
<td></td>
<td>Hereford</td>
<td>11</td>
<td>9</td>
<td>33</td>
<td>286</td>
<td>170</td>
<td>372</td>
<td>(31*)</td>
<td>270</td>
</tr>
</tbody>
</table>

* Results from Angus and Hereford dams combined at each slaughter age
<table>
<thead>
<tr>
<th>Breed*</th>
<th>Puberty Days</th>
<th>In Calf 1 yr</th>
<th>In Calf 2+ yr</th>
<th>Difficult Births (3yr+)</th>
<th>Calf Losses (3yr+)</th>
<th>Wng % Ranking (3yr+)</th>
<th>Wng wt Ranking (3yr+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angus</td>
<td>413</td>
<td>70</td>
<td>74</td>
<td>7</td>
<td>7</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Hereford/Angus</td>
<td>392</td>
<td>84</td>
<td>79</td>
<td>9</td>
<td>9</td>
<td>103</td>
<td>103</td>
</tr>
<tr>
<td>Friesian</td>
<td>353</td>
<td>91</td>
<td>79</td>
<td>8</td>
<td>6</td>
<td>112</td>
<td>114</td>
</tr>
<tr>
<td>Jersey</td>
<td>340</td>
<td>89</td>
<td>76</td>
<td>2</td>
<td>5</td>
<td>107</td>
<td>108</td>
</tr>
<tr>
<td>South Devon</td>
<td>402</td>
<td>77</td>
<td>70</td>
<td>5</td>
<td>3</td>
<td>103</td>
<td>113</td>
</tr>
<tr>
<td>Charolais</td>
<td>430</td>
<td>71</td>
<td>70</td>
<td>10</td>
<td>9</td>
<td>98</td>
<td>109</td>
</tr>
<tr>
<td>Limousin</td>
<td>436</td>
<td>61</td>
<td>68</td>
<td>5</td>
<td>6</td>
<td>98</td>
<td>101</td>
</tr>
<tr>
<td>Blond d'Aquitaine</td>
<td>443</td>
<td>68</td>
<td>70</td>
<td>7</td>
<td>7</td>
<td>94</td>
<td>105</td>
</tr>
<tr>
<td>Simmental</td>
<td>414</td>
<td>73</td>
<td>69</td>
<td>10</td>
<td>10</td>
<td>91</td>
<td>112</td>
</tr>
<tr>
<td>Maine Anjou</td>
<td>404</td>
<td>77</td>
<td>76</td>
<td>14</td>
<td>7</td>
<td>104</td>
<td>108</td>
</tr>
</tbody>
</table>

* Angus are straightbred, all remainder are crosses with Angus and Hereford cows
and Charolais, Simmental and Hereford-Angus crosses. In general high levels of calving difficulty were associated with high calf losses with the exception of the Maine Anjou crosses.

Weaning weights, influenced by both milk production and growth potential, are highest for the Friesian, South Devon and Simmental crosses. Only the Limousin crosses produced lower weaning weights than the Hereford-Angus cross calves.

In assessing the merits of different breeds and crosses a measure of overall cow performance such as weight of calf weaned per cow mated (productivity) can be calculated. Productivity, obtained from the product of weaning percentage and calf weaning weight is appropriate for comparisons where all animals consumed the same amount of feed, or if ample feed were available for all stock. Productivity rankings can change with both calving age (two year vs three year and older cows) and experimental location (Goudies vs Tokanui) as is illustrated in Table 8. Differences among breeds and crosses are accentuated in early calvings (two year old) and in harsher environments (Goudies). Breed rankings are broadly similar for both early and late calvings. The Friesian, Jersey and South Devon crosses have the highest productivity with substantial advantages over the straight Angus (due in part to hybrid vigour) and over the French beef breed (Charolais, Blond d'Aquitaine, Limousin) crosses. There are some changes in rankings of breeds when the most favourable (Tokanui) and the harshest (Goudies) experimental locations are compared. Environmental differences clearly have greater affect on reproduction (Table 9) than on individual growth and carcass traits (Table 6).

From Table 8 it can be seen that the Friesian and Jersey crosses are in the top bracket for productivity at both locations. But the clear superiority of the Hereford-Angus crosses over the straight Angus at Goudies is not evident at Tokanui strongly suggesting that hybrid vigour is less marked in a favourable environment. In general all exotic cross heifers performed satisfactorily at Tokanui with the Simmental and Limousin crosses in particular performing relatively much better than they did at Goudies.

In comparing the relative productive efficiency or profitability of different breeds or crosses, allowance should be made for the higher
TABLE 8. PRODUCTIVITY RANKING OF CROSSBRED FEMALES BY CALVING AGE AND LOCATION

<table>
<thead>
<tr>
<th>Breed*</th>
<th>2yr</th>
<th>3yr+</th>
<th>Goudies</th>
<th>Tokanui</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angus</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Hereford/Angus</td>
<td>135</td>
<td>109</td>
<td>133</td>
<td>100</td>
</tr>
<tr>
<td>Friesian</td>
<td>179</td>
<td>128</td>
<td>166</td>
<td>131</td>
</tr>
<tr>
<td>Jersey</td>
<td>160</td>
<td>116</td>
<td>145</td>
<td>118</td>
</tr>
<tr>
<td>South Devon</td>
<td>143</td>
<td>116</td>
<td>129</td>
<td>111</td>
</tr>
<tr>
<td>Charolais</td>
<td>111</td>
<td>107</td>
<td>112</td>
<td>99</td>
</tr>
<tr>
<td>Limousin</td>
<td>96</td>
<td>99</td>
<td>94</td>
<td>102</td>
</tr>
<tr>
<td>Blond d’Aquitaine</td>
<td>110</td>
<td>99</td>
<td>102</td>
<td>102</td>
</tr>
<tr>
<td>Simmental</td>
<td>129</td>
<td>102</td>
<td>108</td>
<td>123</td>
</tr>
<tr>
<td>Maine Anjou</td>
<td>129</td>
<td>112</td>
<td>124</td>
<td>110</td>
</tr>
</tbody>
</table>

* Angus are straightbreds, all remainder and crosses with Angus and Hereford cows.
TABLE 9. COMPARISON OF OVERALL FEMALE PERFORMANCE AT THREE LOCATIONS

<table>
<thead>
<tr>
<th>Location</th>
<th>Puberty Days</th>
<th>In Calf 1-yr %</th>
<th>In Calf 2-yr+ %</th>
<th>Difficult births 2-yr %</th>
<th>Difficult births 3-yr+ %</th>
<th>Calf Losses 2-yr %</th>
<th>Calf Losses 3-yr+ %</th>
<th>Wng %</th>
<th>Wng wt kg</th>
<th>Productivity Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Templeton</td>
<td>381</td>
<td>87</td>
<td>80</td>
<td>14</td>
<td>4</td>
<td>14</td>
<td>5</td>
<td>73</td>
<td>171</td>
<td>102</td>
</tr>
<tr>
<td>Tokanui</td>
<td>371</td>
<td>86</td>
<td>86</td>
<td>25</td>
<td>7</td>
<td>13</td>
<td>6</td>
<td>75</td>
<td>162</td>
<td>100</td>
</tr>
<tr>
<td>Goudies</td>
<td>415</td>
<td>69</td>
<td>67</td>
<td>16</td>
<td>9</td>
<td>16</td>
<td>8</td>
<td>57</td>
<td>156</td>
<td>73</td>
</tr>
</tbody>
</table>
feed maintenance costs of larger animals. This applies particularly in the suckler beef enterprise, where feed supply is an important constraint and where a high proportion (about 75%) of the total feed consumed by a grazing cow and her calf up to weaning is needed simply for cow maintenance.

Since maintenance costs are known to be related to animal liveweight, a rough but useful measure of efficiency is productivity per 100 kg of cow liveweight. If we accept the 19 month weight rankings (Table 5) as indicative of corresponding cow liveweight rankings, similar at all locations, we find that the Jersey now equals the Friesian cross in efficiency. The only other breeds to match or surpass the straight Angus and Hereford-Angus cows are the South Devon, Maine Anjou and Simmental.

**DISCUSSION AND CONCLUSIONS**

Two main points have emerged from Phase I of the BBE programme.

* The exotic breeds, especially the Charolais and Maine Anjou, cause more calving difficulties and higher calf losses to weaning than the local breeds. This is due largely to heavier birth weights. The position is aggravated in matings to younger cows and, particularly, to yearling heifers.

* Progeny of the large European breeds grow faster to weaning and, subsequently, yield heavier and leaner carcasses than the Angus and Hereford, but with a smaller proportion grading prime or chiller when slaughtered at about 20 months. KIling-out percentages are highest for the Limousin and Blond d'Aquitaine, lowest for the dairy crosses.

Carcass weight productivity rankings (weight of carcass produced per 100 cows calving) can be calculated as a guide to the potential of these breeds as terminal sires in our grassland farming conditions. From Angus dams all crosses, except the Jersey, produce more carcass weight than the Hereford-Angus cross or straight Angus. Blond d'Aquitaine and Maine Anjou sires produce the greatest output of lean meat per cow mated. Despite the claim often made that these large exotic breeds lead to too high calving difficulty and calf losses to be viable breeds in New Zealand these drawbacks can be
more than offset by superior growth potential and high carcass weights. The calving problems can be appreciably reduced by using the large exotic sires only over mature cows, by judicious pre-calving cow management and by choice of progeny tested sires shown to have low incidence of dystocia. It is therefore encouraging to see the Charolais and Simmental Breed Societies becoming involved in sire reference progeny test schemes.

Results from Phase I of the BBE programme are in broad agreement with the Ruakura dairy beef trials and the Clay Centre programme. Calving difficulties and calf losses are accentuated in matings to Friesian cows, especially for the Charolais, Blond d'Aquitaine, Simmental and South Devon breeds (Everitt, Jury, Dalton and Ward, 1978); with the exception of the higher relative ranking of the Limousin and lower ranking of the Blond d'Aquitaine carcass weight rankings are also similar (Everitt, Jury, Dalton and Langridge, 1979). The highest carcass weight productivity from Friesian cows comes from using Limousin or South Devon sires. All the sire breeds used in the BBE programme except Friesian and Blond d'Aquitaine are included in the Clay Centre programme where to date calving difficulties, calf losses and carcass weight rankings have been reported from both Angus and Hereford cows combined (Gregory, Koch and Cundiff, 1978). When carcass weights are adjusted to a standard age (465 days) the highest carcass productivity comes from Maine Anjou and Chianina crosses.

Although the results for reproductive and maternal performance of crossbred females in the BBE programme are still preliminary, use of exotic crosses as dams under a yearling mating regime can be recommended only when conditions are favourable. In all environments greatest calf productivity will be achieved by Friesian and Jersey crosses. The Hereford-Angus cross female is substantially superior in calf production to the straight Angus or Hereford, especially at young ages and under hard conditions. Under favourable conditions the Simmental, South Devon and Maine Anjou crosses perform at calf productivity levels well above the Hereford-Angus and approaching the Jersey-cross performance.

The crossbred females at Clay Centre perform at levels somewhat above the best BBE environment (Tokanui). Calf productivity rankings are highest for the Maine Anjou, Chianina and Simmental
crosses followed by the South Devon and Jersey crosses (Gregory, Koch and Cundiff, 1978). The lower performances of the Jersey crosses in the Clay Centre trials relative to the BBE programme was due largely to a decline in reproductive performance at older ages (five, six and seven year old calvings).

REFERENCES


SUPPORT FOR NEW ZEALAND AGRICULTURE

This session was introduced by Mr J.G. Pryde with a prepared paper. Four commentators followed with informal comments and this was followed by general discussion.

Edited versions of the commentators' remarks and the general discussion are included here.

Commentators were:

Mr C.W. Maughan,
Massey University

Professor B.J. Ross,
Lincoln College

Dr R.W.M. Johnson,
Ministry of Agriculture & Fisheries

Mr G.E. Rennie,
Federated Farmers
The term 'subsidy' is almost invariably used when government expenditure on agriculture is discussed. But there are masses of subsidies in the non-agricultural world; yet the term 'subsidy' is rarely used.

When government finance provides the total cost of an agricultural project we may say it is completely financed by government subsidies. But government also provides the salaries and allowances of a Member of Parliament; yet we don't say that M.P.'s are totally 'subsidised' by taxpayers. Their pension scheme gets a substantial subsidy yet there is never a debate about the wisdom of subsidising M.P.'s pensions.

Import controls confer on many of our industries the right to fix their own prices. In so doing they are also deciding on the level of subsidies they receive. Unlike subsidies for the agricultural sector these are not the subject of an annual Parliamentary debate. The system of protection gives them a virtual right to decide on their own prices. Unlike tariff protection in which government (or the people) receive the revenue derived from the system of protection, under import controls the industry itself pockets the monopoly profits. And so long as competing imports are kept out, consumers remain unaware of the extent of these gains that the protected industries derive.
We are conscious of subsidies to agriculture because they are mentioned each year in the Budget and are debated in the Annual Estimates of Expenditure. Also, in recent years they have expanded significantly. In the 1960s they hardly existed and they were then opposed by most farmers and their leaders. Today they are demanded by the majority of farm leaders who believe they are necessary for their industry's survival in an economy which operates under a relatively free wage bargaining system, a virtually fixed exchange rate and uncontrolled interest rates, plus, of course, import controls and restrictive practices of many kinds.

Let me give you a quick historical run-down of government expenditure on agriculture, by referring to the annual budgets over the last 18 years.

1960 Reference to production trends, markets and export prices.

1961 Introduction of initial depreciation allowances for farm workers and other employer-built homes. Reductions in estate and gift duties.

1962 A reduction in land tax and some further deductible allowances for capital development; more adjustments to estate duties.

1963 Liberalisation of development expenditures and encouragement to fertiliser and lime application by means of tax allowances. Finance for farm development. A new investment allowance and an expansion of special depreciation allowance.

1964 Further taxation concessions to encourage farm investment. Adjustment of estate duties.

1965 Introduction of the farm income equalisation scheme. A subsidy on fertiliser transport replaces the tax concession. Further liberalisation of farm development expenditure deductions.
1966 Introduction of nil standard value livestock taxation system.
Continuation of fertiliser transport subsidy.
Emphasis on farm development finance from the State Advances Corporation (S.A.C.).

1967 Borrowing from abroad to support downturn in wool prices and payouts from floor price scheme.

1968 Approval for dairy industry development bonds.

1969 Increased S.A.C. finance to encourage development of larger and more economic units.
Increased depreciation allowances for farm buildings.
Subsidy on pesticides (50% of ex-factory price).
Flat rate subsidy on fertiliser transport.
Introduction of dairy industry diversion incentive scheme.

1970 Price subsidy on fertiliser.
Emphasis on enlargement of farms into more economic units.
Sales tax taken off farm motor cycles; exempting all farm land from land tax.

1971 Introduction of farm mortgage guarantee scheme.
Increased price subsidy on fertiliser and increased transport subsidy on lime. Price subsidies on stock drenches.
Increased assistance to Wool Board in payments to International Wool Secretariat (I.W.S.), and to meat industry for hygiene. Government finance for brucellosis eradication.

1972 Sheep Retention Scheme, supplementary finance, financial support for lamb prices (these three measures in 1971-72 period). New lending limits on S.A.C. loans.
1973
Reductions in fertiliser price and transport subsidies. Cessation of subsidies on weedicides, pesticides, stock drenches and the aerial application of fertiliser and lime.

1974
Adverse Event Bonds; Extension of drought relief; lucerne establishment grant; new lending limits for Rural Bank.

1975
Suspension of meat inspection fees, stabilisation of fertiliser prices. Government offer of $50m grant to establish stabilisation schemes for wool, beef and lamb farmers. Financial assistance to agricultural servicing industries. Increased loan limits for Rural Bank.

1976
Introduction of Livestock Incentive Scheme. Reduction of fertiliser price subsidy and changes in fertiliser transport subsidy, 40% special investment allowance for new farming plant and machinery. Reintroduction of lucerne establishment grants for certain areas. Special settlement loan scheme for young farmers with potential. Payment of 3 percent on Farm Income Equalisation Deposit. Pesticide assistance for Pipfruit growers.

1977
Amendments to livestock incentive scheme. Stamp duty, exemption for those purchasing their first farm; increased finance for water and soil projects and noxious weed control. Increased Rural Bank interest rates and some concessional rates for settlement. Extension of nil value tax scheme to deer farming. Extension of Rural Bank lending for rural housing.

1978
Livestock grants; establishment and underwriting of supplementary minimum price scheme for sheep, beef and dairy farmers. Increased price and transport subsidies on lime and fertiliser. Government assumes responsibility for all inspection fees. Land development
encouragement loans. Increased irrigation subsidies. Increased Rural Bank loans for small holdings and agricultural plant and machinery. Additional money for Marginal Lands Board. Establishment of Horticultural marketing unit within Export-Import Corporation. Encouragement to artificial breeding in dairy industry to improve milk output.

It will be evident from the brief summary of the main measures introduced since 1960 that there have been important changes. Firstly, the assistance was almost entirely in the area of taxation allowances, apart from government expenditure on research, extension and so on, which dates from early times in the development of New Zealand. Then came the transport subsidies on the major input fertiliser and later the price subsidies on this and other inputs such as pesticides. In 1971 there was the sheep retention scheme - a direct capital grant to supplement incomes and encourage investment. This was repeated seven years later in the 1978 budget. The 1959 measure which offered dairy farmers a subsidy to divert some of their livestock solely into the beef industry was also a milestone in government intervention in agriculture.

Climatic disaster relief has expanded in certain years, while perhaps the most recent form of assistance is the encouragement given to more labour on to farms. There have also been government measures aimed at improving the quality and availability of services in rural areas.

To assist towards the stabilisation of incomes, the farm income equalisation scheme was largely a self-help measure but it was not until 1976 - 11 years later - that a 'carrot' in the form of an interest payment on these deposits was given. The stabilisation theme reappeared in the mid 1970's with government offering to underwrite schemes that imposed ceilings as well as offered high 'floors' to pay-out prices. Other trends have been the development of the livestock incentive scheme involving planned development programmes with financial assistance being conditional on the achievement of agreed targets. The Rural Bank has played an increasing role in the financing of farming and the industries servicing it.
On two occasions, in 1971 and 1978, government used the major measure of a cash distribution to farmers in respect firstly of sheep and in 1978, of the three main types of livestock. Responsibility for inspection fees fluctuated but now rests entirely with government.

Reserve Bank concessional credit to finance export stocks of some farm produce was extended to other products and in respect of price stabilisation schemes. The taxation concessions originating in the 1960's have been largely continued and these would amount to a substantial sum of tax foregone by government especially in years of improved farm incomes.

How successful have the various measures been? If the measuring rod is increased farm output, the answer must be that they have not been very successful. On the other hand, it could be argued that without the measures farm production would have fallen away drastically.

But we must concern ourselves with the future. Of the policy options available, which ones will achieve the generally-agreed aim of agricultural policy - increased output for sale in the markets of the world? I should like you all to ponder over this question which I shall first direct a members of the panel.

Import controls have become a permanent characteristic of our economy. Recent research suggests that their presence is the reason for New Zealand's dismal economic performance. But in the light of political realities it appears as if they will be with us for a long time yet. Thus the industries concerned can assume that subsidies for them will continue. But can agriculture make the same assumption? I do not think so. They have always been regarded as stop-gap measures that would be reduced or removed when farm incomes recovered.

It could be said that government expenditure has distorted resource allocation and caused farmers to waste resources. For instance, the allegation has been made that fertiliser price subsidies have persuaded farmers to apply increased fertiliser, not primarily to increase output but rather as a means of reducing their taxation
liabilities. It has also been said that linking subsidies to particular inputs is most unfair to those farmers who should be assisted in other activities such as fencing and drainage if they are to expand output. Other criticism is that undue emphasis has been placed on livestock numbers rather than performance and that if we want to realise the potential of our farms we must, in policy decisions, concentrate on performance as well as livestock numbers.

If today we were meeting at a time when government was changing its method of protecting industry from import controls to tariffs I suggest that the farming industry would be saying they could no longer justify many of the subsidies they now receive. But, unfortunately this stage in New Zealand's economic development has not yet arrived. Thus, it does not surprise me when I hear farming leaders demanding continued assistance for their industry.

If government policy is to be 'carrots only' then we must ask 'Which carrots?' and 'How many carrots?' will be needed to achieve government's declared aim.
To understand the present incentives and subsidies to farming, it is necessary to see them in their historical perspective and in very broad terms - not just in farming terms.

I know farmers get the money. I know it matters to farmers whether they have, for instance, a gorse eradication subsidy as opposed to a special depreciation allowance on machinery. But the incentives and subsidies are not, from the point of view of government, devised solely with farmers in mind.

Why is it then, that government involves itself in agriculture? the simple answer is that agriculture in New Zealand, as in all countries, is a fragmented industry. It is therefore difficult for the individual within the industry to undertake complex research projects or organise the provision of adequate investment funds without government assistance. Government is also the owner of all land, in the absolute sense, and in this capacity becomes involved in land development. It also generally has the responsibility of providing an economic infrastructure - such as roads and electricity.

But in New Zealand the government is even more involved - through all the various subsidies, incentives, stabilisation schemes and so on.
The reason for this is that New Zealand needs imports. Not exports. We need imports so that all the people who live in New Zealand can have a decent standard of living. Without imports there would be no oil, few jobs and a much lower standard of living.

So, if we need imports, obviously we need exports - unless someone is prepared to give us the imports or lend us the overseas exchange. And that, of course, brings us to agriculture which has the comparative advantage of low cost grassland production and has had, until now, the tied United Kingdom market.

We have tried at various times to diversify into other products and I do not want to be rude about our efforts in this direction, but it is hard to see what comparative advantage we have in producing many products compared with manufacturers in say Japan and Taiwan or Korea. Anyone can, after all, buy the technology and marketing skills to do the same thing. Moreover many manufactured products have just as many access problems as do farm products.

I am not, however, saying that we should not be exporting everything we can lay our hands on; rather, that we should concentrate on those products in which we have a particular advantage, such as grass and sunshine, and the necessary skills to exploit that advantage. Even when one analyses manufactured exports, one finds that many of the 'other manufactures' are closely linked to the agricultural industries - dairy milking machinery, chemicals derived from agricultural products and so on.

I am therefore personally convinced that the agricultural industries - and I hope you note that I am using the words 'agricultural industries' as opposed to the word 'farming' - are very important for everybody. So the government is bound to get involved in agriculture, whether farmers like it or not.

Now we can ask the question; 'if agriculture has got such a comparative advantage, why should it need subsidies and incentives?' There are two basic reasons for this, and they are both interrelated. Firstly farming, despite its comparative advantage has not been profitable enough for the individual farmer for the last few years. And secondly, government has been increasingly conscious of this
lack of profitability and has transferred money across to farming because of the country's needs for exports.

I think this is better explained if we liken the process to a contract. The contract runs quite simply - if farmers and everybody else produce output for export, then within reason they can get what they want. Now I emphasise 'within reason' because it is very easy to see something as reasonable from one viewpoint, which other people see as totally unreasonable. Take current land values for instance. It is very difficult to persuade anybody who is say, a trade unionist with a small section of land, that somebody else who has a piece of land worth a quarter of a million dollars, really needs a transfer of income. So one has to think what those words 'within reason' mean.

I would suggest that what has happened over the last ten years is that the 'contract' was originally unspoken. The idea was accepted that if farmers produced output they would get what they reasonably wanted - land, income or a way of life. Since then, for various reasons, the 'contract' has had to become more formal and obvious - and it is in these terms that we must view the present incentives and subsidies.

The 'unspoken' services such as research and advisory services have been there for a very long time. They were then supplemented in the early 1960's by the taxation incentives. I think by the time we got through to the input subsidies past 1967 we really were moving towards subsidies, and there is a big difference between those two words. So we were then into the period of direct subsidies. Output however still did not increase apart from a short period in the early 1970's. Government therefore, became disenchanted with input subsidies and moved towards a more explicit contractual relationship. These we could roughly call output subsidies - things like the livestock incentive scheme. In affect the L.I.S. say "If you put 'X' number of sheep on a farm then you get a specific amount of cash". Then I believe the next major step was the supplementary minimum price scheme, where the contract is becoming very, very explicit. Someone is saying "We will pay you a salary so long as you keep on farming and hopefully increasing output".
All of this has affected farmers and their perceptions of farmers' independence. Many of them do not like what has happened and resent it.

How then has it happened, that this contract has become so formal and obvious? I think it is basically because that original unspoken contract has been broken. Farm production did not increase and farmers were not getting what they reasonably wanted. Consequently no-one else could get what they wanted. I think the fault lies with both sides in that contract - with society and with the agricultural sector.

With society, I would say the major problem is that although there may be a contract with the agricultural sector to produce for export, there is no comparable contract with the rest of the productive mechanism. This brings us back to the question of import control and lack of competition. Farmers have to take the world market prices for their produce; others in the productive chain are not restricted in that way and it is from these people that farmers must buy their inputs. This has caused that wide divergence of opinion between agriculture and the community. There is no point in farmers increasing their output if, on the one hand, inflation is chasing them - and catching them up; and on the other hand if everybody else in the rest of the economy can apply for a wage increase and get it each year.

So, that is one of the places in which the contract has gone astray. Accordingly, I am very much against all these controls, particularly import controls.

I also said that the 'unspoken' contract has been broken on the agricultural side. Output for export has not increased despite the fact that the knowledge to increase output has been available and despite the fact that there has been a willingness on government's part to transfer money to farming, in the form of incentives, in order to redress the imbalance between the export and domestic sectors.

While it is easy to point the finger at someone else, it is also true that the agricultural sector could probably have done more but didn't want to, because it felt it was operating in an unfair situation. In other words, I think that agriculture began to make unreasonable demands - or demands that appeared unreasonable to
other people. For instance, farmers have had increasing wealth and yet demanded increasing incomes without realising how difficult it was for a non-farmer to sympathise with their position. A lot of this to me is simply just very poor public relations - or whatever you care to call it. The way in which the agricultural sector presents itself to the rest of the country is often quite appalling. I am talking about agriculture in the general sense - including farmers, freezing workers, waterside workers and everybody else involved in agriculture and its servicing industries. The public quite often says, when incentives and subsidies are under discussion and public debate, "What are farmers moaning about now - what is going on - they've got plenty of money in the land haven't they, what more do they want?" The public forgets that this has been caused by the rest of the country breaking the contract by, for example, not taking part in our export drives.

I believe therefore that we have to look at incentives in the broad sense as an attempt - made by all sorts of people within government, the farming sector and others who have been consulted to solve this problem of a broken contract. Unfortunately, in my opinion, those who devised the incentives did not consult individual farmers, they consulted farmers as organisations, and therefore the incentives have not been as useful as they could have been.

My next comment is that I see no way in which the situation will voluntarily get better. I know beef prices are good at present, they will probably stay up but unfortunately I believe we will have an inflation figure of about 15 percent this year, so the amount of money left over for reinvestment in farming will probably be not much more than the previous year. Moreover these price movements are cyclical and will almost certainly decline again in the future.

I just do not see it getting much better, so where does one go from here? It seems to me farmers can go one of two ways. Firstly, farmers can press everybody else to take part in that social contract to export; that is to accept taking their incomes from overseas - and this is essentially what a foreign exchange policy is. Or, secondly, farmers could say, "Well, if everybody else is going to live in a tidy little closed market, I will do the same". This of course will mean increasing the supplementary minimums for ever and ever.
I believe that this second alternative will increase the distortions which already exist in the productive mechanism within the agricultural sector. Take for example the Land Development Encouragement Loans. The major effect of these will probably be that land which is capable of being developed under these loans will now increase in value very quickly.

These are the sorts of distortions which can occur, as they can with supplementary minimum prices. Why, for instance, do you put that price on that product as opposed to anything else? In the end you must know what the market is prepared to pay for that product before you can assign a value to it. I do not believe it can be done through a multiplicity of incentives.

I think incentives and subsidies 'hold the line' but I am sure that in the end they get into such a tangle that we should instead be aiming towards broader policies such as reliance on movements in the exchange rate. I believe we must also get rid of controls which distort market signals - in particular import licensing. In short, I do not believe the present situation can be rectified until all sectors of the economy are operating on more or less the same basis - that is, taking their returns in competition with producers in other countries.
SUPPORT FOR NEW ZEALAND AGRICULTURE - COMMENTS

B.J. Ross

Professor of Agricultural Economics
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SETTING THE ECONOMIC ENVIRONMENT

Let me return to the issue of comparative advantage raised earlier. This lets me return to fundamentals and ask where are we really trying to go; are we trying to apply principles at all, and if so what are they? I think we should be; but first we need some decisions as to where the economy is headed. I am not talking about a plan that defines precisely what we should do here and there; I am talking about setting an economic environment within which various sectors of the economy can make their own directional plans. Even doing nothing to change anything is a decision based on some sort of criteria, and in a sense constitutes a plan. If we want to free up our economy, we are going to have to restructure it and we are going to have to cope with our balance of payments problems. It seems to me that we have to make many more fundamental changes than are going to be made this year. We need subsidies at present because of the combination of free wage bargaining, fixed exchange rates, high interest rates and the absence of competition. These are the very things we need to change, but before doing so we need to define our direction, because our ultimate objective may well affect the type of changes we make.

Just look at the absence of competition for example. The Agricultural Economics Research Unit has prepared some figures on relative cost increases in two major processing industries, and related them to the rate of inflation. In the wool scouring industry we have plenty
of competition; the overseas buyers can have their wool scoured here or in other countries. Thus there is competition both within the industry internally, and between the New Zealand industry and overseas scourers. Taking the consumer price index we see that consumer prices went from 100 in 1971 to 241 this year - an increase of two and a half times. The wool scouring charge on the other hand rose by less than twice, and I would be surprised if competition had nothing to do with that!

On the other hand, and from the same base, killing charges in the North Island went up to 457 for lambs and to 493 for ewes (nearly five times), and South Island charges went up to 393 (four times). Beef charges rose to 365 over the same period in the North Island. The meat processing industry is one in which there is virtually no competition. You either have your stock killed or you do not, but there is very little opportunity to ship them abroad to have them killed somewhere else. And within the industry itself we have a Meat Industry Licencing Authority designed to reduce competition, apparently because some people might go out and spend their own capital building freezing works that we apparently do not need. One of the arguments used is that if they build too many processing works they would not get the throughput required for efficient operation and therefore they would have to raise charges. It does not seem to be stopping the increases in charges at present; maybe a little extra freedom would help! Competition is what we need. This lack of competition is not restricted to the meat processing industry, or just to the industries farmers deal with directly. It is a phenomenon occurring throughout our economy.

IMPORT CONTROLS

The January O.E.C.D. report has been criticised throughout the country by many who have said that because the report advocated the removal of import controls, acceptance of the reports recommendations would mean destroying many jobs within New Zealand. The Prime Minister was quoted as saying that he would not be a party to removing import controls and seeing the destruction of industries built up by the hard work of New Zealanders. Nobody is advocating destruction of jobs in that way. Those who have read the report would know that it says that import controls should be removed and replaced by tariffs which would give the same level of protection as industries now have as a
result of import controls. If they are given the same level of protection, where are the jobs lost? What we have gained, however, is a ceiling on the extent which industries can raise their prices.

With present import controls New Zealand manufacturers can simply raise their prices without having to consider overseas competition. With a tariff system, manufacturers could charge a price equal to the overseas price plus the tariff. If, after a period of internal inflation, their price exceeds that import price plus tariff, they will start to experience overseas competition.

One reason why the government has been very reluctant to use exchange rate changes to deal with our problem is the often experienced spiral following devaluation when higher import prices are passed on to consumers. The O.E.C.D. exercise was designed to set an environment in which prices could not rise by more than the amount of devaluation. The point was made in the report that New Zealand, at the moment, gets less from devaluation than any other western country. This is because we have set ourselves up as a very inflationary country through the lack of competition we have imposed upon ourselves.

Some New Zealanders also confuse changing our protective structures, with reducing them - the O.E.D.C. report said that reducing the level of protection is a different exercise which should be looked at some other time. I would like to start now. It is also said that New Zealand should not reduce the level of protection because our products are being excluded from other markets, and that therefore we should exclude their products from ours. I have heard of cutting off one's nose to spite one's face, but that suggestion is an extreme example!

It may be that somebody working in an agricultural industry has a gross output of say $40,000. Because of agricultural protectionism it is merely selling for $25,000 - not a particularly pleasant situation. But, if we divert that person from agricultural production or from export production in general, to producing for the local market, because protection makes this apparently profitable, it may be that he produces something that we could import for $15,000. Because we diverted him into producing something where, say, on the grounds of labour costs, we do not have a comparative advantage compared with Taiwan or Korea, he only produces something worth $15,000 on the world market. Of course it is unfortunate that we are not getting
the $40,000 we feel the worker's output is worth, but there is no reason why we should reduce the value of his contribution even further by our own protection.

The protection given to agricultural producers in other countries is irrelevant in discussing the protection we should be giving our manufacturing here.

These to me are principles which should be discussed, promulgated and thought about. They are, however, principles which are not being tackled in any way.

WHERE TO NOW?

Where do you go from here? Some say subsidies, and I guess given everything we have got, it is subsidies. So what subsidies? Again we come back to principles. I still have a hope that at some stage we are going to free up this economy a bit. If that is so, then we should be structuring the agricultural industry in such a way that it is moving towards the form we would need under a freer economy. I see two possibilities here. The exchange rate should be different, so maybe we should be talking about assistance to agriculture through higher minimum prices more appropriate to the different exchange rate, and lower import subsidies in general. Same cost to the taxpayer perhaps, but a different way of giving the assistance. We would have a lower exchange rate if we had a freer economy.

Secondly, we should look at the form of subsidies we give, and work towards the sort of input structure agriculture would have in a free market economy. The way in which you mix inputs as a farmer - the way in which you mix expenditure on fertiliser, pesticides, machinery, labour and so on, is to some extent determined by the relative price of these commodities. To some extent you can substitute one type of expenditure for another. So we should be thinking about the items of expenditure which would be cheaper under a freer market situation. We should perhaps subsidise those to encourage their use now, so that we get closer to the input structure farmers would be using in a freer economy. Conversely, we should be discouraging subsidies on items which farmers would consume less heavily in a freer economy.
Consider the fertiliser subsidy; it is always talked about as being directly related to production, but in fact there are no taxes on fertiliser, there are no massive import duties, and we are therefore getting fertiliser at its free market rate. Our exchange rate is too high, so fertiliser is being subsidised, in a sense, by the import cost of the rock phosphate. This import cost is less in New Zealand dollars than it would be if we had our equilibrium exchange rate. So, even without a fertiliser subsidy, fertiliser is cheaper to the farmer than it would be in a free market situation. Yet that is the one item we choose to put our biggest subsidies on. To me this does not make sense; because if we had a freer market situation and reduced subsidies (and we devalued at the same time) the change in fertiliser usage would be phenomenal. It would cause dislocations which we could be avoiding if we were structuring the farming industry itself - and its servicing industries - for the sort of industry we want to have in five or ten years time.

One affect of protection for manufacturing is that there is a much increased demand for labour. So labour is in fact more expensive now than would be the case in a freer situation. Certainly in Australia it was the argument used in the first instance for protecting industry - to shift income towards the wage earner. If we were ultimately not only going to change the form of our protection, but also reduce the amount of it (remember these are two separate exercises), then perhaps farm labour would be a little cheaper relative to other things. So maybe farm labour, given our unemployment situation, is one thing we should be subsidising now. Does that make sense? To me it does. I would like to make a plea for returning to principles, thinking through where we are going, and what it is we are really trying to achieve when we discuss forms of assistance to farming.
First let me explain some of the workings of that group of people classed as 'those faceless bureaucrats', as far as support policies are concerned. Our job is not to make decisions. It is to collect facts and opinions, write them down on paper, sort them out, and send them to the policy makers where they are debated and decisions are made. Civil servants plan the economy and lay it down on paper; but they do not make the decisions on the final policy. Once the political decision is made, the package is tidied up and it becomes the policy for the ensuing year.

What factors then do we take into account in deciding these matters? We take a very pragmatic view. We try to get down to the grass roots of politics and suggest schemes which we think will work. So our test is not really "Is it good for the country?", but "Will it work?" The test really is administrative convenience, because it is no good having schemes if they do not achieve the effect they are designed to have. That does not alter the fact that sometimes plans are rather heavily altered and do not end up as intended.

Now let me consider incentives and subsidies. The first point to remember is that every one of these has been asked for by somebody. It may well be that a minority group got something done but the fact remains that all incentives were requested by someone.
In the Ministry of Agriculture and Fisheries it goes without saying that the concern of the farmer comes first. The best possible view of agriculture is put forward on behalf of farmers to counteract others who are demanding use of the resources of the country.

We do have a fundamental conflict, in that assistance measures cannot be granted for every purpose when resources are limited. What we should be thinking about is not the individual parts of the total assistance package, but what they add up to as a whole. It is the principle we should be debating - do we really want all this package of Mr Pryde's, or is there some other economic system we would prefer to operate by? We must open a public debate on the kind of economic system desired and what kind of country we want this to be. This involves the active participation not only of the farming groups, but also the community as a whole. This discussion is a start, but it does not relate to the urban sector where we must try to convince people that they must accept fewer subsidies on municipal buses, a smaller family benefit, fewer tarmac roads and hospitals, if agriculture is to benefit by more direct assistance of the kind discussed by Mr Pryde.
The economic position of the agricultural sector is influenced by policies involving the overall economy. Consequently, while policies specifically directed towards farming have an immediate impact on the industry, the wider economic environment is probably even more critical in determining the financial state of the industry.

Many of the recent economic policies directed at agriculture have been designed to offset the diminishing residual return to farmers from the sale of farm produce on the overseas markets. This income squeeze has been caused largely by substantial increases in on and off farm costs within New Zealand over recent years.

Increases in foreign exchange earnings from agriculture have shown substantial increases over recent years and still represent 76% of the country's total overseas earnings. At the same time, farmers' net returns have been relatively static and have fallen in real terms.

From the effort in the 1960's to increase production, farmers ended up in a worse position. As the last link in the chain, the farmer is forced to accept all increased costs arising from higher wages and input prices. For example, over the past season the killing and processing charges for a lamb have increased by 38%.
As shown by the latest O.E.C.D. figures, New Zealand has a high rate of inflation, particularly compared to our main trading partners, and also a low growth rate.

Efficient though it is, New Zealand farming cannot continue to survive as a viable industry under these conditions. The virtually static production levels over the past ten years can be directly attributed to the lower than desirable reinvestment in the industry. At a time when increased foreign exchange earnings are vitally necessary, and when the other export sectors are not faring well, it is extremely serious that the industry with the greatest export growth potential is showing little expansion.

Currently, considerable debate is centred on the most effective policies which should be adopted to stimulate the export economy. The two alternative directions most commonly considered have become labelled the "more interventionist" and the "more market orientated" approaches.

Federated Farmers traditionally has favoured a policy of minimum government intervention in the economy, preferring a relatively free interplay of market forces to allocate our scarce national resources to best advantage. Recently, the Federation re-affirmed this policy as the most effective means of returning the country to a sustainable increase in its standard of living.

I believe that the country must reverse the trend towards increasing government intervention, which generally has been designed to protect more and more sectors of the economy from effective competition.

The effects of the economic policies over recent times have created serious distortions in the allocation of the country's scarce national resources. As more and more sectors have become protected by cost-plus operations, the major export industry has been starved of resources. Government has attempted to redress the balance somewhat by channelling funds back to farming through subsidies and incentives. In this regard, it must be acknowledged that the 1978 budget contained a number of new policies which, initially at least, boosted farmer returns and confidence. While it is acknowledged that these measures have assisted the industry to remain viable, the
current level of assistance does not offset the direct higher costs loaded onto the industry by the cost-plus operations of other sectors.

The recently published Agricultural Review Committee report expressed a clear preference for market forces to provide the agriculture sector with more of its necessary resources as opposed to a continuation of past ad hoc government support policies. Otherwise subsidies must continue and increase.

I believe that the only long term effective way to achieve the necessary levels of investment in agriculture is to channel more resources into the industry by progressively dismantling the protectionist arrangements which load increasingly high costs on the industry.

While I support the user pay principle, moves in this direction deal essentially with the affects of the cost-plus system and do not necessarily tackle its causes. For example, government spending as a percentage of gross domestic product (G.D.P.) still remains excessively high at approximately 42%, as does the recent substantial increase in the total money supply. These two factors alone provide a significant boost to the inflationary pressures in the economy.

The recent report by the Planning Council - Economic Strategy for 1979 - clearly and succinctly outlined the measures required to generate real growth in the economy.

The Federation has strongly urged the government to adopt a package of measures along these lines as a stated objective to be achieved over a well defined period - say five years. Obviously such a move towards a freer, more competitive economic environment will require a number of relatively painful re-adjustments. However, if progressively and carefully implemented over a reasonable span of years, and as an integrated package, the disruptive effects on such things as employment, should not be unduly serious, and in the long run should return the economy to a sustainable growth path.

The most important immediate decision is for the government to publicly commit itself to such a policy.
Obviously, until the successful implementation of such policies reflect themselves in a more adequate income for the export sectors direct from the market place, agriculture will continue to need substantial assistance from the Consolidated Fund.
SUPPORT FOR NEW ZEALAND AGRICULTURE - GENERAL DISCUSSION

*Should we devalue, and if so, by how much?

C.W. Maughan

I would like to see a devaluation of about 20% now and I would like to see the exchange rate float after that. I say that in full recognition of the effects of this on prices. I would not like to see more than a 20% devaluation at one time. (In a later comment Mr Maughan made it quite clear that along with devaluation of this form would need to go a removal of subsidies and supplementary minimums - Ed.)

R.W.M. Johnson

There is the usual suggestion in this question that it would be good to devalue the New Zealand dollar a little and so raise the level of receipts all farmers would receive. At the moment as far as farmers are concerned, and as far as growth in the economy is concerned, we do not need any devaluation at all. In my view the farm economy of New Zealand is roughly in balance with the present profitability level and I would not like to see any more money flowing into the economy at present. Through the 1974-76 period we could have done with 15-20% or more, but at the moment we happen to be out of that terrible 1974 trough in the beef cycle, and from the farm point of view I think we are not badly off. I do not think that a massive devaluation would do much good.

B.J. Ross

Consider the effect of devaluation on the economy as a whole and the fact that we have 50,000 people unemployed. These people are unemployed...
because we cannot afford to buy the imports that are required in the work places. Because of this inability, the government has had to squeeze the economy sufficiently to put them out of work. Now we need to generate more exports somewhere or other; not just in farming, but anywhere in the economy in order to buy enough imports as inputs into the factories to put those people back to work. To that extent the farming industry may be all right at the moment, but the economy as a whole is not. Devaluation would be one way of encouraging the production of more exports.

*Can the $400m or so, presently spent on subsidies and incentives, be exchanged for an alteration in the rate of exchange of the New Zealand dollar?

R.W.M. Johnson

In some senses you can have it one way or the other. You can have $400m as a series of payments on different inputs such as the livestock incentive payments or the present amounts going into supplementary prices. But if those were withdrawn there would need to be some compensation at the product end and that would involve the rate of exchange.

In forming the policy for agriculture there may be little chance of getting the exchange rate adjusted, but opportunities may exist somewhere else. It is easier to change the fertiliser subsidy than it is to change such things as exchange rates. These two things have different political perspectives; some things are relatively easy to change, some things are very difficult.

*Comment please on our overseas debt and our devaluation against West Germany.

S.J. Ross

We have been borrowing from high currency countries and we have devalued heavily against them; this makes our borrowing much more expensive than it appears. For example, it was announced that we have taken out a five percent loan from West Germany; the fact that the German mark goes up relative to the New Zealand dollar makes the loan much more expensive than it might seem. This is not always made clear to us publicly when we take the loan out. There would be
no problem if we sold a lot of our products to those countries. But if we borrow more from strong currency countries than the proportion of our trade is with those countries, then those strong currency debts are an additional burden. In addition, it is the very countries with balance of payments surpluses whose currencies rise, and they are also the countries who have money to lend. We would be doing something else by devaluing, (assuming the country can hold internal costs at least for a period after devaluation). One of the things devaluation is designed to do is change the distribution of the total receipts New Zealand gets for lamb for example. Devaluation changes the distribution of those receipts between freezing worker and farmer. If we devalued by 20%, and the New Zealand dollar receipts available for distribution within New Zealand rose by 20%, but we paid the same killing charges as before, the farmers' receipts would rise not by 20%, but say 30%, and there would be a change in the distribution of the reward within New Zealand.

Let me comment now on the effect of devaluation. It has been suggested that the effect of a devaluation is very short lived. Do not forget that the whole of our export boom in manufactured products dates from the highly successful devaluation of 1967 which was forced on us - we did not choose to devalue then. It was forced on us because there was a devaluation of sterling, but it came at a time when we had calmed the economy down. We had had subsidies removed in February 1967 and we had had tax increases in May 1967. This calming down of the economy, squeezing out excess demand, and then coupled with a devaluation, produced a situation in which our manufactured exports were growing at about 12-15% per month in 1968. This was largely because we had made it profitable to export; farmers benefited as well.

*Many of our more successful trading partners have removed the responsibility of supporting the exchange rate, and the exchange rate adjustments, by floating the rate. I cannot see why this would not work in this country?*

C.W. Maughan

One of the difficulties of discussing the use of an exchange rate policy is that the policy has unfortunate implications. The major
implication is that money is going from one sector of the community to another and the sector from which it goes does not like it - it is as simple as that. If, however, one says that this is a valid reason for not using an exchange rate policy, one has to justify alternative methods of transferring money, such as subsidies and incentives.

Subsidies and incentives have considerable disadvantages. For instance, consider how many decisions have to be made before they are devised. Firstly, government has to decide between private and government expenditure; then between capital expenditure and current expenditure, and ongoing expenditure versus new expenditure. These broad totals then have to be broken down by vote such as education and agriculture, and then by items within the vote such as salaries and grants. Somewhere way down that list comes an item 'agricultural subsidies' and within this item are the different types of subsidy. Now how many decisions are there before you get to that point? And each one has the possibility of being wrong.

This is the real problem in using subsidies instead of an exchange rate. If you shy away from the obvious (the exchange rate) and move towards a 'tricky' way (subsidies) of transferring income, then you are likely to create a lot of 'tricky' problems along the way. On the other hand, since the effects of using an exchange rate policy are immediately obvious to people, particularly the groups that are hurt, it is hard to get public acceptance for such broad solutions. We must therefore educate people to realise that the present mess we are in is partly a result of trying to avoid using an exchange rate policy - floating or otherwise. These comments have not directly answered your question, but I see the two as related. Ideally of course a floating exchange rate is better than massive infrequent movements in the rate.

*Why do we not look at a basic change in taxation systems.*
*What about a factor tax?*

J.G. Pryde

One of the reasons we did not talk about the productivity system was that it implies 'sticks' as well as 'carrots' and we know the government's attitude to this. In any profession you should not
have to apply the 'stick' and I do not believe you should have to
dangle a 'carrot'. Farming is a way of making money; it is a way
of producing income for the country as well as for the farmer and if
we get a sound economic base for farmers to work on we will need
neither 'sticks' nor 'carrots'. I do not support subsidies; I
believe we should have as few as possible. I think we are an
efficient industry and we object to being subsidised - it makes us
look inefficient. We can compete on an open market, but we are not
able to compete with import levies and entry restrictions.

I suggest that some of these subsidies could be alleviated by the
government taking over the advalcrem levies. But we should be
wary of production related 'carrots' and 'sticks'.

"Could our industry have a 'tax holiday' for the next three
years and trade it off by taking no subsidies or incentives
over the same time?"

G. Rennie

That suggestion would only be helping the larger farmer. I believe
in the idea that the farm is a family farm. There were some very
nice 200 acre farms up my road which a few years ago were making a
good profit and doing very well. But now, if anybody likes to
take those farms over they will find them no longer profitable. I
do not believe that this is the way farming in New Zealand should
go. I believe that it is the family farm, and by that I mean the
small family farm, that is going to give us the production we need
and that family farm must be protected.

"Remission of tax would therefore be an unfair imposition on
the farming sector."

G. Rennie

Yes, I believe in an economic situation where we can make farming a
profitable business. The 'carrots' we talk about are sunk into the
agricultural sector not for the agricultural farmer; they are there
because it is a very easy method for the government to inject money
into the economy. Most of the carrots that go in, immediately go
out; $100m went in from the budget and $90m went out the next week.
The government gave $1.7m to settle the processing industry problems; but the government did not pay it, it went on to killing charges this year and farmers paid it.

*What alternatives should now be considered besides freeing up the economy?*

B.J. Ross

One alternative is to subsidise heavily and I guess that is the way we are going. But I would like to see some principles applied as to how we do it - principles that will allow us to free up the economy later. The Prime Minister is talking about carrots and he made a statement a fortnight ago covering production. If we produce for export we will get incentives, if we produce for the domestic market we will be taxed. The recent 'mini budget' was in line with that. The taxing of domestic production means internal prices rise. The subsidies for export (incentives of various forms that manufacturers and farmers get) mean that exporting is more attractive. It is an alternative way of doing exactly the same thing as devaluation. Internal prices rise because the taxes put on production for the internal market are the same thing as devaluation. The interesting thing to me is that this exercise is as inflationary as devaluation and the reason why we are shying away from devaluation is the inflation it might cause! Devaluation does have certain advantages, but trying to do the same thing by subsidy means that we do not catch everything. There may be some new activity someone wants to engage in which has not been thought of yet, and has not been included in the range of incentive schemes. In other words, there may be potential earning activities which will slip through the net and not get caught if we try to operate by subsidies and taxes. Devaluation would catch things automatically.

Similarly we have our welfare system, and we pay, through National Superannuation, a lot of money. We find lots of older people taking holidays in Queensland for the winter to avoid the winter here - it is relatively cheap to do so because we have only a 10% travel tax. People complain about the travel tax and yet travel is one of the overseas commodities which is most lightly taxed. So by maintaining the exchange rate the way we do, we encourage people to spend foreign exchange at a time when we say we are short of it.
I have half answered the question. I have said that the alternative to freeing the economy is to subsidise more, and my impression is that this is the way we are heading. We are heading towards more subsidies, and that means more controls and supervision to ensure that the money and subsidy are spent properly. It means more taxes because somehow or other the money has to be raised to pay the subsidies.

To me, those are the alternatives - the two stark alternatives; one is devaluation, the other is more subsidies and more taxes and a great deal more government involvement in the community.
New Zealand farmers should be grateful to the rose growers of this country for their keen interest in plant breeders rights. These rights enable New Zealand to obtain the best rose cultivars in the world and have encouraged an expansion in rose breeding in New Zealand. When our cultivars are sold overseas they will earn a useful income.

The rose growers had a strong lobbyist at parliament in the Rt. Hon. Sir Keith Holyoake, and there was strong support for the introduction of plant breeders rights because Mr Sam McCready - a rose breeder of international fame - wanted to bring his rose breeding enterprise to New Zealand, but would only come if New Zealand had laws for Plant Variety Rights (PVR).

The first serious proposal to introduce plant breeders rights was put forward to the Ministry of Agriculture and Fisheries about 1965, and discussions were held by various plant breeding groups in New Zealand. As Director of the largest group of plant breeders in New Zealand I arranged for full discussions at Lincoln. The decision from our meeting was that establishment of rights could be a very costly exercise and involve an unnecessary expansion in government activity without adequate return to the New Zealand farmer or industry. We realised however that there was a need to keep this closely under review because New Zealand was in danger of losing access to new cultivars developed overseas and could lose out on overseas markets for New Zealand-bred cultivars. We agreed the question should be
reviewed after five years.

The rose growers' lobby came to the fore again about 1971 and the Ministry of Agriculture and Fisheries was instructed to draft legislation for PVR with the initial object of protecting horticultural plants developed in New Zealand.

Crop Research Division decided to review the situation again and agreed that introduction of PVR was now appropriate for New Zealand in agricultural and horticultural crops. Secondly, it was decided that PVR would give greater access for our plant breeders to new improvements being made overseas, and finally that it would give our primary industry access to new cultivars developed overseas and provide overseas markets for our cultivars.

Crop Research invited Mr F.R. Horne to New Zealand to discuss PVR systems, the development of a suitable scheme, and means of implementation in New Zealand. We held meetings with seed merchants and farmers and gained acceptance of the proposal to apply rights to crop cultivars in New Zealand provided we developed a scheme suited to our needs, and with a minimum of plot testing and regulation by government.

Mr R.F. Fryer (CRD) travelled overseas in 1973, and undertook an extensive review of PVR schemes in Europe and United States of America to find the most suitable for New Zealand's needs. Mr Fryer was impressed with the minimal cost of the United States computer-based system and recommended that we adopt it as far as possible, provided that we were still able to have adequate access to European developments. He also recommended the adoption of plant descriptive forms which would fit both the European and United States systems.

Crop Research staff worked very closely with the Ministry of Agriculture and Fisheries to ensure that the legislation passed in 1973 was suitable for all agricultural and horticultural crops. We are satisfied that we have a very valuable system which has already attracted quite a large overseas investment into plant breeding in this country.
INTERNATIONAL PLANT BREEDING

Crop Research Division, D.S.I.R., now has nine international plant breeding agreements in operation with Canada, England, Wales, Scotland, Denmark, France, and Switzerland, and several more under negotiation. In addition we have two co-operative plant breeding agreements with industry in New Zealand in which we have agreed to assign rights in any developments to the co-operating partners. In the New Zealand commercial sector there has been a similar expansion in international plant breeding agreements between New Zealand and American, English, and European plant breeding organisations.

New Zealand has stolen a march on Australia and Canada with PVR and has already benefitted with better access to a wide range of new cultivars.

ADVANTAGES OF PVR

* More investment in plant breeding. At present industry is expanding investment faster than the State is reducing it.

* Better cultivars of crops will become available to farming and horticulture, both from New Zealand and overseas, with improved yield and quality.

* Opportunities for marketing New Zealand cultivars overseas. There is an immediate market in Australia, United States, Canada, England, Europe and North Africa for wheat, oats, barley, potato and pea cultivars. In future we will also be able to market small fruit (strawberry, raspberry) cultivars.

* Royalties provide money to reward the investment in plant breeding. They also give a return for advertising, accelerated multiplication and faster development of new, improved cultivars.

In the case of government-bred cultivars the royalties provide a financial return to the government, and a very effective measure of the success of the plant breeding programme.
WHAT IS THE COST OF PVR TO THE FARMER AND SOCIETY

The farmer pays more for seed that he buys, but only if the cultivars have rights awarded and if the agent demands a royalty.

The amount of royalty is limited however. For cereals it averages less than $1.50 per hectare (60c/ac). Royalties are not payable on any seed that the farmer saves for his own use, he only has to pay a royalty on the first lot of seed that he purchases. Royalties are not payable on the crop that is sold to industry, but only on seed that is sold for sowing. Whether a farmer wants to sell seed for sowing to another farmer or to a merchant, he must have the crop certified, and he must pay royalties on all the seed sold.

Farmers however are protected from excessively high prices. Plant breeders are required to make sufficient seed available to meet demand at a reasonable price. Breeders are not permitted to create a monopoly or a shortage in order to obtain high prices. Provision is made in the Plant Variety Rights Act to allow an appeal against the breeder if farmers believe they are not being treated fairly.

WHY SHOULD ROYALTIES BE CHARGED ON GOVERNMENT-BRED CULTIVARS

* I believe that government breeding stations are very competent and effective, but are in serious danger of being run down because government is reducing its expenditure.

If royalties are paid on government-bred cultivars then the government will receive a very substantial payment into its funds and this will make it much easier to ensure continued government investment in successful plant breeding.

* Another reason is that government-bred cultivars should be marketed on the same basis as commercial cultivars and receive a similar degree of promotion. They should not have an unfair price advantage over their competitors which could occur if they were marketed without any royalty.

WHAT TYPE OF MARKETING ARRANGEMENT IS BEING MADE FOR D.S.I.R. CULTIVARS

Breeding of crop cultivars is much more advanced and far more
competitive than for herbage and pasture plants in New Zealand so a marketing agreement is being developed firstly for these. The D.S.I.R. has been having intensive discussions on this topic for over a year and has recently finalised its marketing agreement. The main general principles that have been adopted by D.S.I.R. are as follows:

* The cultivars should be marketed as far as possible through existing industry facilities.
* The cultivars should be promoted by the designated agent but only to the level necessary to capture an appropriate share of the market. The level of promotion should be set after consultation with the growers.
* The royalties should be set at the standard New Zealand rate and the nett royalty be payable into the consolidated fund.
* The effectiveness of the agents should be monitored by D.S.I.R. committees representing government departments, farmers and growers, and the seed industry.

THE IMPORTANCE OF PLANT VARIETY RIGHTS FOR THE NEW ZEALAND EXPORT SEED TRADE

* I believe that New Zealand has a very high degree of competence in its government and private plant breeders. It has excellent advantages in climate and for alternate season co-operative plant breeding programmes that should enable us to breed new cultivars which should be very successful in Europe and North America.
* I believe that New Zealand will see a continuing expansion in commercial plant breeding and that this will lead to a major expansion in our export seed trade as well as bringing in royalties from cultivars marketed overseas.

The next ten years will be a very exciting and challenging period for the New Zealand seed industry and will present many opportunities for co-operation between farmers, the commercial seed trade, and the government. New Zealand should meet this challenge confidently and firmly.
I am very pleased to give my views on the function and involvement of the commercial breeder and seed company, as this applies to plant variety legislation. It is particularly appropriate that we should address our remarks to you the consumer, as our continuing viability is dependant on your support.

Plant variety legislation was introduced to New Zealand in 1973, and, without question, this was the most progressive step taken affecting our seed industry since the introduction of a seed certification scheme some 50 years ago. I feel I should elaborate on this. An increase in the country's agricultural output can only be achieved by enhancing the production of basic materials. For example, the keeping of livestock can only be intensified if more productive pastures and feedstuff supplements can be produced. Thus any development leading to higher genetic yield potential, greater disease resistance, or plants to thrive in particular climate or soil conditions will benefit the entire agricultural sector. Modern scientific plant breeding has given dramatic improvements in many crops over the last 20 years, and there is unlimited scope for further development. A continuous policy of using and developing improved varieties is neccessary to accelerate the expansion of the country's agricultural economy.

We must face the reality that plant breeding is extremely costly and it takes a minimum of 10 years, normally 15 years, to produce a new
cereal variety. A cereal seed can be multiplied between 16 and 20 times in each generation, using normal farming and seed handling methods. Therefore, in the absence of any legislation to the contrary, the multiplication and subsequent sales of a new variety would be outside the control of the breeder who has spent so much time and money on its original development. Inventors in other fields, such as engineering, are protected by patent law throughout the world for the very purpose of encouraging people with new ideas to produce something novel, recover their outlay and ultimately make some profit. The plant breeder is even more vulnerable to exploitation since the material is immediately available for reproduction. Therefore the plant breeder can only exist where protection is made available to him. We must however, get this form of protection into perspective, because the plant variety legislation serves only as a register of distinct varieties. It does not have any influence on commercial application or success. The commercial success or demise of any particular variety will be determined by you, the farmer. It is pertinent to mention that where no form of plant protection is available (Canada and Australia are two examples) agricultural progress is being restricted.

The wider implications of the legislation include not only the incentive for our Company to become seriously involved in plant breeding, but it also provides adequate machinery to encourage prominent overseas breeders to have their material introduced to the New Zealand market. The resources behind this overseas material can be very considerable, and well beyond the capabilities of any organisation, government or private in New Zealand. There exists an international union for the protection of new varieties of plants known as U.P.O.V., and Belgium, Denmark, France, Germany, Italy, Netherlands, South Africa, Sweden, Switzerland and the United Kingdom are all members of this union. The United States and New Zealand expect to join this year. Uniform rules are developed and, where possible, reciprocal arrangements are made. The membership of this union will provide some appreciation of the international coverage of plant variety legislation, and the opportunity which it presents for New Zealand.

We believe in a free flow of seed with as little interference as possible by administrative provisions. However, for the reasons
already outlined, legislation in the field of protection of new plant varieties is helpful and progressive.

So far I have discussed the need for legislation and I am sure you will be wondering what effect this development will have on the purchase price of your seed. There will be a royalty imposed, and the level of royalty varies from one species to another. As an example, let's look at a spring barley variety 'Hassan' which our Company introduced three years ago.

The royalty level on this cultivar was $15.00 per tonne and, calculated at a sowing rate of 140 kg ha this equals $2.38/ha. Based on extensive M.A.F. trials over a period of three years, 'Hassan' produced a grain yield nine percent above the standard variety 'Zephyr'. Calculated at $85.00 per tonne and four tonnes per hectare, this increased yield available from 'Hassan' is valued at $30.00/ha. The net benefit to the grower is therefore $27.62/ha. This is only one example, and there are others which could be cited as more, or less favourable. There are other very important factors such as grain quality, disease and insect resistance, plant stature, market preference and others which are not necessarily reflected in yield.

It is important to remember varieties protected by plant selectors rights have no special access to any commercial market. Their success or otherwise will be determined by the results achieved in your fields.

There are two other important aspects to consider. Firstly the breeders' or agents' responsibility in the handling of a protected variety. It is clearly stated in our act that restrictive practice with regard to distribution of the variety is prohibited; therefore there is no likelihood of any party cornering a market.

Secondly, because there will always be a head licensee or principal agent who will have the responsibility for ensuring the material is adequately marketed, extension services offered to the farmer will receive close attention. Continual reference is made to the gap between agricultural science and the farmer, and we believe closer attention to marketing grain and seed varieties can contribute
substantially to bridging this gap. Effective marketing of a cultivar goes beyond extolling the virtues of a variety, and should logically extend into cultural practices and management.

Our Company maintains substantial research facilities initially developed to undertake evaluation programmes screening overseas varieties for our New Zealand market, new crop programmes and multiplication projects in co-operation with overseas principals. However, by design, we are moving quickly into plant breeding programmes as we believe the future of our seed industry is dependant on developing new and improved varieties.

We consider our business is food production, and there are four necessary ingredients in food production - seed, sunlight, plant nutrients and water. Seed offers the greatest opportunity for improvement, which can affect the efficient utilization of the other three. In other words, we can, and have, developed varieties that help us to get more output from a given amount of sunlight, nutrients and water.
PLANT BREEDERS' RIGHTS - FEDERATED FARMERS' VIEW

The seeds industry was set up under the Seeds Act in 1923, and the growth in certified seeds has developed over the years from one that has been basically able to produce high quality seeds for our own pastures to one that is increasingly competing on worldwide markets. The growth of this industry can be seen when we note that between 1972 and 1977 the total production returns of crops and seed rose from $87 million to $145 million. This is in keeping with other agricultural production but has the added advantage of giving diversification to our national products.

New Zealand enjoys certain advantages for the arable industry in the export field.

* New Zealand's averages are high by world standards.
* Our growing areas are close to our ports - again by world standards.
* We have shown the ability to produce high quality certified seed.
* We have plenty of suitable land capable of more intensive use.
* Sales of seed and grain can be made on the futures market if desirable and contracts let before the growing season to cover sales.
The political difficulties attendant with the developing and maintaining of market access do not apply to the same extent with small seeds as with most of our major primary products.

Coarse grains comprise the largest single commodity moving in international trade.

Our total production by world standards will always be infinitesimal in relation to world trade so we have a unique opportunity to diversify into important and intensive seeds crops like vegetables and other horticultural crops.

Other advantages include

The successful integration of arable farming with livestock, where specialisation in certified seeds under intensive conditions can be fitted in with high stock numbers per arable grass hectare.

Many of our maximum farming areas suffer from the ravages of grass grub and porina attacks on pastures; diversification of these areas to arable crops minimises the overall financial loss.

Plant breeders' rights can be described as the right of plant breeders to have patent rights to control and receive royalties for the cultivars they have produced. Each cultivar in order to be given such rights, must prove superiority in yield, disease resistance, an ability to respond to moisture levels or fertiliser, or finally be identifiable by colour, palatability or growth pattern.

We must accept the concept of royalties being included in the price of seed because in today's cost structure, we can accept nothing less than the cultivar likely to give the maximum yield per hectare. Large financial rewards will ensure maximum production, through competition, between Crop Research Division, D.S.I.R., and private plant breeders. At the same time, we must not put breeders and agents in a position where they completely control all certified multiplication of their registered cultivars. It would be unacceptable to allow them to dictate the price, irrespective of the going market value or to control completely the area sown. Neither would we want them to be able to select growers for reasons other than their ability to produce a quality product, and the farmer must have
the opportunity to negotiate costs where such things as grain drying and dressing are involved.

Our policy must be to accept royalties on the seed we use, but the breeder or his agent must not, because they control the seed, be in a position to make an unreasonable profit on the resultant crop.

In ten years, when most existing cultivars are replaced, merchants could have total control of our seed industry if we do not build up safeguards so that Crop Research Division cultivars receive an equal chance on the market.

The executive of the Agricultural Section of Federated Farmers have over the past year made several submissions to D.S.I.R. maintaining that a system be introduced where individual members be appointed as breeders' agents - if they come up to the required standard to act as agents - and thus prevent a monopolistic position by powerful consortiums.

The executive believes that royalties from such activities should be retained by Crop Research Division of D.S.I.R. and used for further research and/or promotion of the industry. Farmers' organisations such as United Wheatgrowers, are levied approximately $70,000 a year and this money is used for wheat breeding research. If royalties were collected on wheat varieties, then the money wheatgrowers have provided by way of levies in the breeding of new varieties, should be recognised. For example, on Kopara, which is over half the present crop, the royalties would be in the vicinity of $60,000 calculated on a royalty fee of $1.50 per hectare. The executive is strongly of the opinion that this money should be used on further research and the promotional activities of Crop Research Division and United Wheatgrowers. It should not be paid into the Consolidated Fund.

The executive was strongly opposed to original proposals put forward by the Plant Breeders' Association that Crop Research Division bred cultivars be taken two-thirds of the way, and then handed over to firms to complete the process. This would enable the private sector to gain all the royalties for work done by Crop Research Division.

Recently, after a number of discussions initiated by D.S.I.R., the executive of the Dominion Agricultural Section, Federated Farmers,
support the following:

1. The Minister of Science and Technology assigns D.S.I.R. plant breeders' rights under certain conditions for periods of five years to the New Zealand Agricultural Merchants Federation or the appropriate horticultural federation.

The Federation agreed on this point.

2. The New Zealand Agricultural Merchants Association, through the New Zealand Plant Breeding and Research Association (or the appropriate horticultural federation) will prepare licensing agreements for all D.S.I.R. crop cultivars.

The Federation agreed to this broad principle as the New Zealand Merchants Federation is the principal organisation and the New Zealand Plant Breeders' organisations are responsible to them. The controlling safeguard is built in there.

3. Conditions for rights as determined by the Minister will be a proportion of the plant variety royalty to be retained by the licensee for development, administration and promotion for each cultivar after consultation with the growers. The remaining proportion of plant variety royalty is the crown royalty and will be paid into the Consolidated Fund.

This point is one of the key conditions in this submission by which expenses for development, administration and promotion can be taken off the royalties by the licensee before handing the nett amount to D.S.I.R. The Federation questioned the wording 'consultation with growers', but agreed that this would again be an adequate safeguard to growers and conceded that the Minister have the ultimate decision after consultation.

4. Rights will be terminated if there is a disagreement between the licensee and the licensor.

The Federation agreed with this point: again a safeguard for the licensor.
5. Monitoring of the Licensee's performance will be carried out through existing government, merchants' and growers' committees.

The Federation strongly believed that the committee, as outlined in the original submission, should be the appropriate authority to monitor the licensee's performance and stressed again that the committee should consist of two representatives from D.S.I.R. and one each from M.A.F., Federated Farmers', growers, New Zealand Merchants' Federation and New Zealand Plant Breeding and Research Association (or appropriate horticultural association). This committee would be responsible for the monitoring and co-ordination of the multiplication, marketing and promotion of the D.S.I.R. crop cultivars.

6. In general, plant breeders' royalties would be set at a standard level for the country where they are marketed.

The Federation agreed with this, and stressed strongly that royalties set must be at a reasonable level and not be an undue cost to the end producers in New Zealand.

Royalties which will be paid into the Consolidated Fund should be used for further research and/or promotion activities within the industry. The Federation reserves the right to make submissions on this matter and quotes other organisations where joint enterprises are now working.

The Wool Research Organisation of New Zealand is one outstanding example where there is a joint approach to research and promotion and we bring to your attention the role that United Wheatgrowers Limited play regarding the $75,000 research levy which they administer each year. This is used for research by the D.S.I.R. on wheat breeding. The Federation believes that any royalties received by D.S.I.R. from wheat cultivars should not be put into the Consolidated Fund, but used for further research and promotional activities.

If this is not the case, and monies must be paid into the Consolidated Fund, the Federation asks that the wheatgrowers' share be returned to the industry through a self-balancing account for
further research and promotional activities within that sector.

In summarising all the discussions over the past year, I firmly believe that, as long as adequate safeguards are built into any proposal by individuals or firms, the scheme is workable as follows:

* Complete reporting to the controlling authority.

* Responsibility at any time to independent auditors (this is actually the case in the Merchants' Federation now).

* Royalties. I stress again that where monies paid in the form of levy for research (royalties derived from the cultivars bred such as Arawa and Rongatea) be used for further research and promotional activities, even if a self-balancing trust fund has to be set up for this purpose. If this does not eventuate, I can see no good reason why farmers, through their wheat growers' organisation, should continue to be levied approximately $70,000 a year when all royalties go into the Consolidated Fund.

* Competition within the trade will provide most safeguards.

* Horticultural groups should be represented on any advisory committee.

* The Agricultural Merchants' Federation should be accountable to the Crop Cultivar Authority.

* Any scheme finally agreed upon must have flexibility and agreements should be reviewed regularly.
The plant varieties rights scheme is administered by the M.A.F., and up until now the plant varieties office has been in Wellington supervised by Mr T.E. Norris, the Registrar of Plant Varieties in a part-time capacity, assisted by a clerk. A technician carries out trial work at Lincoln.

A grant of plant selectors' rights is only made if it can be established that the variety concerned is distinct from other varieties, is uniform and is stable. At present, plant selectors' rights can only be obtained for varieties of seven species, namely roses, barley, fodder-type perennial ryegrass, annual ryegrass, potatoes, peas, lucerne and lotus. To date a total of 23 varieties (17 roses, 6 barleys) have been protected by grants of plant selectors' rights. It has not been possible to cater for additional species with present staffing.

To enable the needed expansion to take place various changes are underway or planned.

* The plant varieties office was in mid May of this year transferred to Lincoln with a full-time Registrar.

* Subject to Cabinet approval it is planned to employ more technicians and erect accommodation for staff involved in plant varieties work.
Other changes planned are:

* Joining U.P.O.V. - the international body on plant variety rights.

* Amending the Plant Varieties Act and Regulations.

* Increasing the plant variety fees - the Government is adopting the 'user pays' principle for plant varieties work.
As the arable crop breeder to the nation, Crop Research Division, (C.R.D.) D.S.I.R., has selected and bred most of the crop cultivars grown commercially to suit the conditions of this country. Our track performance has led us to the position of providing almost all of the commercial wheat cultivars grown in New Zealand, all of the oat and ryecorn cultivars, and a major portion of the barleys (that is taking Zephyr barley into account because C.R.D. is the maintainer of this cultivar).

Following on, we have developed and improved about three-quarters of the garden and process peas, one-third of the field peas and over one-third of the potatoes. In the brassica field crops, such as swedees, turnips, rape and kale, C.R.D. has had a hand in maintaining and usually improving all the commercially grown cultivars. The long established cultivars have been continually re-selected and the more recent cultivars arose from breeding programmes, usually to incorporate disease and pest resistance.

Lastly in this brief summary, and to put things into perspective, most of the lucerne established in New Zealand at present is Wairau which was the result of work by R.A. Calder and J.W. Hadfield at Lincoln, the breeding station then being known as Agronomy Division.

This story of long-term endeavour will never end. Continuing and intensified efforts are being made to provide improved cultivars in
a very wide range of crops. Luckily for the careers of present and future plant breeders perfection will never be reached. Admittedly it is the goal, but fickle nature and new factors appearing to limit crop performance make for programmes longer than the span of generations of troops in the Trojan Wars.

NEW CULTIVARS

On with the new! Below are what might be called short pen portraits of some recent cultivars coming out of the Crop Research Division pipeline.

Rongotea Wheat

Bred by Dr J.M. McEwan, C.R.D., Palmerston North. Yields five to eight percent below Karamu in the North Island, but equals Karamu in yield in Canterbury, either winter or spring sown. Rongotea was intended as a replacement for Karamu, but surprisingly is also yielding 15-18% higher than Kopara in Canterbury and is as good as Kopara in Southland. Rongotea is highly significantly superior to Karamu in MDD baking quality and is at least equal to Kopara. Limited quantities of seed were distributed this season.

Oroua Wheat

Bred by Dr J.M. McEwan, C.R.D., Palmerston North. Yields about 10% lower than Karamu in the North Island. Closely approaches the yield of Karamu when spring sown in Canterbury and Southland. Gives outstanding MDD bake scores being highly significantly superior to Karamu and Kopara. Limited quantities of seed were distributed this season.

Kaniere Barley

Bred by Messrs L.G.L. Copp and G.M. Wright, C.R.D., Lincoln. Consistently in the highest yielding group of barleys in all regions. Strong straw, resistant to neck break, moderately resistant to leaf scald. Low screenings, plump grain making a very good feed barley.
Manapou Barley

Bred by Messrs L.G.L. Copp and G.M. Wright, C.R.D. Lincoln. Yields high in Canterbury - North Otago showing to advantage over other barleys in dry seasons. Not recommended for the Southland region or the North Island except possibly the drier areas of Wairarapa - Hawkes Bay. Moderate resistance to brown rust, early powdery mildew and leaf scald. Resistant to neck break, low screenings, suitable for malting or feed.

Mata Barley


Omihi Oats

Bred by Mr G.M. Wright, C.R.D., Lincoln. Yields 18% above Makuru when autumn sown and 30% above Makuru when spring sown. Much better quality feed grain. Produces a higher chaff yield with a higher and coarser straw content. Rather slow in straw ripening in some seasons. Limited seed distributed 1979.

Ohau Oats

Bred by Mr G.M. Wright, C.R.D., Lincoln. White oat with considerably better milling quality grain than Makuru for Southland. Yields at least the same as Makuru. Main advantage in the south is the very short, strong straw very resistant to lodging and post-ripening straw break. Seed will be available 1980.

Whero Pea

Bred by Messrs M.J. Crampton, R.E. Scott and D.S. Goulden, C.R.D., Lincoln. New maple pea, similar in general appearance to Partridge 73 with substantially higher yields autumn or spring sown. Successful cropper when spring sown, earlier maturity, even and determinate flowering and ripening. Resistant to pea top yellows, pea mosaic viruses and Fusarium wilt of peas. Larger seed size.
**Kuru Pea**

Bred by Messrs M.J. Crampton and R.E. Scott, C.R.D., Lincoln. Processing pea of the Victory Freezer type particularly suitable for South Canterbury, Marlborough and the North Island. Yields better when its resistance to pea mosaic, pea top yellows and *Fusarium* wilt Race 2 are contributing factors.

**Iwa Potato**

Bred by Mr C.M. Driver and Dr A.S. Bedi, C.R.D., Lincoln. Bulks up as rapidly as Ilam Hardy for early digging, yields substantially more at late maincrop digging. Attractive, smooth, white tubers of good cooking quality. Not suitable for crisps or chips. Moderately resistant to commonly occurring races of blight, immune to mild mosaic, field resistant to severe mosaic. Limited seed will be available to seed potato growers in 1980.

**Kiri Swede**

Bred by R.W. Hart, C.R.D., Gore and J. Lammerink, C.R.D., Lincoln. Wider range of clubroot resistance than any other swede in New Zealand and outyields other cultivars where clubroot is a problem. Yields as well as other swedes on disease-free land. Red-purple, semi-tankard shaped bulb palatable to sheep. Not advisable to grow where dry rot is a problem. Seed readily available.

**Rere Lucerne**

Bred by Dr M.W. Dunbier and T.J. Ellis, C.R.D., Lincoln. Resistant to blue-green aphid, pea aphid and moderate resistance to bacterial wilt and spotted-alfalfa aphid (not yet reported to be in New Zealand). Rere has produced as much forage as other top cultivars and grows more in regions with mild winters. Limited seed for forage crop sowing will be available spring 1980.

These are good examples of Crop Research Division's plant breeding successes in recent times. Work is being carried out on a much wider range of crops and plants than those already described.

For the record other crops which are being worked on are: turnips,
rape, kale, dry beans, lentils, oilseed rape and triticale; vegetable crops, such as green beans, tomatoes, onions, pumpkin, sweetcorn, asparagus, cabbage, cauliflower and broccoli; the fruit crops, strawberries, raspberries and apricots; herb crops, parsley, garlic, horseradish, lavender, thyme and sage; and new crops such as solanum, peppermint, blueberries and tree crops for nuts, animal forage or shelter.

A few words now on seed supplies. There have been queries about the distribution and contract control of Rongotea and Oroua wheats and Omihi oats. The reason for the tight contract agreements to the growers is that C.R.D. wish to keep these cultivars eligible for plant selectors rights. This is desirable for adequate development and promotion of the cultivars to establish their true position in farming in New Zealand. Of more importance may be the opportunity to obtain rights for the wheats overseas where they show encouraging prospects especially in Mediterranean countries.

The hold-up in New Zealand has been the lack of progress by M.A.F. in scheduling wheat, oats and swedes under the Plant Varieties Regulations. Crop Research Division made the first request to M.A.F. in August 1976 to have these crops scheduled for rights, knowing that cultivars were likely to prove worthy of release. Since then repeated attempts have been made to extend the workings of the Plant Varieties Act to cover these important crops; so far without success. The private plant breeders and other organisations have also pressed for action over this period.

Crop Research Division has therefore had to control the wheat and oat cultivars so that they were not traded in New Zealand, which would have precluded their chances of ever being granted rights. Now an Amendment to the Plant Varieties Act is likely to be passed allowing for one year’s trading before an application for rights is accepted. C.R.D. are banking on this by deciding to release the wheat and oats for the 1979/80 season.

Limited quantities of seed were offered to all members of the Agricultural Merchants Federation and with greater demand pro rata allocations were made according to all applications received. The Agricultural Merchants Federation/C.R.D. Committee made the allocations in a fair and proper manner, under a contract system
through each merchant then to grower to keep control of a trading situation for this vital year.

Let me draw your attention to C.R.D. publications - publications that contain most of the information listed above. Crop Research Division publishes and distributes Cereal News and Field Crop News to anyone asking to be on the mailing list. We also have descriptions and performances of lucernes and barleys published and available through the M.A.F. Aglink series. It is hoped that this series will be extended to cover other crops for the benefit of the grower and his crop production.
DIRECT DRILLING

M.L. Smetham
Senior Lecturer
Department of Plant Science
Lincoln College

Direct drilling is the technique of introducing crop or pasture seed into previously uncultivated ground - either uncultivated within the previous two or so months, or completely undisturbed. It has been called many names e.g. sod seeding, direct seeding, zero tillage, no till cropping, overdrilling, underdrilling, zero cultivation, chemical ploughing, undersowing and oversowing. However direct drilling is an accurate descriptive name and is therefore preferable. The last two names in the list mean something different in New Zealand and should not be used to describe the technique under discussion: "undersowing" being where pasture seeds are drilled into worked ground at the same time as a crop of cereal or roots, while "oversowing" means either broadcasting, or spreading seed from the air.

The technique of introducing seed into unworked ground really started in New Zealand in the early 1950's with the experiments of Blackmore (1952) and others. The results of early trials (Cross and Glenday 1956) quickly highlighted two points. One was the need to minimise competition from existing vegetation. The other was that the type of drill coulter used had a great bearing on the success of the operation. The most successful coulters were those which cleared a narrow track through the vegetation and deposited the seed in a groove in the soil. Results from broadcasting were poor and so were those using a single disc coulter. Small seeds tended to be sown too deep for good emergence and in addition the cut closed after drilling and allowed resident vegetation to form a closed canopy over any emerging seedlings.
In the same decade Leonard (1956) investigating the control of nassella tussock, obtained spectacular control of this weed and the adjacent plant cover with certain chemicals, but in addition managed to re-establish pasture by broadcasting seeds onto the chemically killed turf. Chemicals appeared therefore to provide a new means of controlling competition from existing vegetation. Both Leonard and Blackmore (1957) of the Department of Agriculture quickly foresaw the potential of the situation and from then on research proceeded space, investigating both broadcasting and drilling pasture seeds, as well as crops, into chemically killed turf.

PROBLEMS ASSOCIATED WITH CHEMICALS

Several chemicals were available, but the best of these at the time was dalapon used at 5.5 kg ha ai, sometimes together with 0.55 kg ai of amitrol (Blackmore 1957). Dalapon controlled fibrous-rooted grasses and also weakly stoloniferous and rhizomatous species like browntop, but failed to kill strongly rhizomatous plants like couch, Californian thistle, and yarrow. Amitrol assisted dalapon absorption and controlled flatweeds.

A problem with these chemicals was that pasture and other seeds could be adversely affected if sown within 10 to 20 days of spraying, especially if there was much bare ground present (Thompson 1960). Beggs (1975) recommends an even longer period of five weeks between spraying and sowing, and a longer period still over the winter; when with the cooler temperatures dalapon needs longer to take effect. In the intervening period between spraying and crop establishment, flatweeds particularly thistles, and also annual grasses (hairgrass - Vulpia spp. and Poa annua etc.) sometimes re-established from seed to compete with the sown seedlings. Rhizomatous weeds and grasses could also recover to compete. In addition the spray was only really effective when used on new, actively growing regrowth following hard clean-up grazing particularly where browntop was the main resident grass (Ayson 1968).

In spite of these drawbacks vegetation kill was however in practice generally good with dalapon-amitrol, and using these, improved species
have been successfully established on a farm scale by oversowing from the air (Beggs 1975). An important part of this technique involved sowing the seed at a time of year (July - August) when seedlings would establish with no moisture stress. On the other hand, overdrilling following spraying often gave variable results because sowing took place in November or March at a time when moisture stress was inevitable. Other factors which helped cause variable results were the competition caused by re-establishing weeds mentioned above, and problems with machinery, which will be discussed later.

In the early 1960's the chemical paraquat became available (Leonard 1973). This material had the big advantage that it was rapidly inactivated on contact with soil, and therefore the seed could be drilled immediately after spraying. However unlike dalapon, which is both leaf and root absorbed, paraquat is only taken up through green actively growing leaf. Best results with paraquat are obtained by very close cleanup grazing to encourage active regrowth which should be sprayed on a warm overcast day. Although dalapon has some effect on stoloniferous and rhizomatous species including paspalum, paraquat has none since it is not translocated. Nevertheless paraquat has, ever since its discover, been widely used for chemical turf-killing prior to overdrilling, in research by ICI and the Ministry of Agriculture and Fisheries and others.

Paraquat will remove some flatweeds, but other plants, including white clover are not killed. Dicamba or diquat has therefore to be used with paraquat if white clover or flatweeds are present. Some plants still remain a problem even with paraquat plus dicamba or diquat mixtures. These are sorrel, Californian thistle, couch and docks.

The apparently ideal chemical, glyphosate, became available in New Zealand in the mid 1970's (Matthews 1977). Absorbed through the foliage; readily and quickly translocated into the root system; and inactivated on soil contact, glyphosate will kill a wide range of herbaceous plants including the strongly rhizomatous grasses like couch, and weeds like yarrow, (Scherp 1975) although not white clover (F. Allan pers. comm.). Recent experiments (Atkinson 1976) indicate that glyphosate is at least as effective as dalapon and paraquat when used just prior to direct drilling.
PROBLEMS WITH MACHINERY

Early trials showed that drills with conventional hoe coulters had difficulty penetrating unworked ground. Entry was helped by sharpening and narrowing the point of the coulter (Blackmore 1952), adding weight to the drill, and helped still more by adding a plain disc coulter ahead of the seeding coulter. However high wear rate, high loading for penetration, high drawbar pull and easy blockage by trash were unfavourable features (Koronka 1973). In addition sowing depth was uneven since coulters had not sufficient vertical movement to cope with uneven ground, and there was no positive depth control (Cross 1957). Australian spring-tine cultivator-seeders worked satisfactorily in dry stony ground but could not penetrate thick turf, or if they did, tended to rip large pieces of turf loose making an extremely rough surface. The rotaseeder; virtually a rotary cultivator with seed box, was moderately successful but had a high power requirement and was slow. Single disc coulters penetrated if sufficient weight was applied, but few plants established since the slot closed soon after drilling. Coulters which gave the best emergence results were those which neatly removed a strip of vegetation and laid the seed on a substantial groove (Cross 1957). These included disc coulters with a skim-coulter attachment and the Australian "Grasslands" sod-seeder with a narrow, hollow, tine-like coulter which squeezed a track in the turf. Germinating seedlings were to some extent sheltered from drying winds as the groove remained moist for longer than the untouched ground surface. After considerable research, ICI Great Britain produced the "triple-disc" coulter consisting of a vertical, opening disc in front, followed by two inclined discs side by side between which the seed dropped into a groove squeezed in the soil. Penetration was good, tractive effort and weight loading were all lower than required for a tine-type coulter; wear rates were acceptable and the coulter coped with trash satisfactorily (Koronka 1973). By 1973 several manufacturers were making machines with these coulters, and they were sufficiently robust and heavy to overdrill satisfactorily (Figures 1 and 2).

Although the triple disc drill has largely solved the mechanical problems, even now plant establishment is not always good, especially where drying conditions are experienced after drilling (Hay et al. 1978). This is thought to be due to root growth being restricted,
firstly by consolidation of the base of the groove by the discs, and secondly by the smearing and drying of the sides of the groove itself (Baker 1970). The latter is a problem common to most coulters. Both conditions are apparently overcome by the Baker coulter (Baker 1977b). This consists of an opening disc in front, fitted with depth-regulating flanges, running in front of a hollow tine-coulter, the base of which has small wings on either side which have a subsoiling action. Final establishment figures for lucerne, kale and cereals, have been considerably better than for triple-disc or hoe coulters, but wear is rapid, and the units are prone to blockage by trash.

ADVANTAGES AND DISADVANTAGES OF DIRECT DRILLING

It is clear that direct-drilling gives better establishment of oversown species than broadcasting, (Blackmore 1952) particularly under adverse conditions (Janson and White 1971). However comparisons of direct-drilling with conventional methods of cultivation for establishment, (e.g. Matthews 1972), indicate that while direct-drilling has many advantages, it does have some disadvantages.

A major biological advantage seems to be in the higher levels of organic matter preserved in direct-drilled soils, and this in turn means better soil structure. Better structure confers increased water holding capacity, better nutrient reserves, less erosion loss and lower power requirement for drilling or working. Conventional cultivation accelerates organic matter oxidation and thereby decreases the proportion of stable structural units. In addition damage is caused to structure by repeated passes with tractors and implements, particularly discs. The preservation of good structure associated with direct-drilling is an important consideration in areas where the potential for soil erosion by wind is high (Painter 1976).

Conventional cultivation does cause substantial mineralisation of all plant foods especially nitrogen (Matthews 1972). Not only is this slower when direct-drilling, but in addition readily plant-available nitrogen is temporarily removed from the system by micro-organisms dealing with the breakdown of chemically killed plant remains so that when direct drilling, nitrogen fertilizers are needed at sowing (Blackmore 1967, Taylor 1967, Hart and Jacobson 1978). Conversely (Blackmore (1967) showed that a chemically induced fallow removed the need for N at the time of direct-drilling.
Direct drilling uses considerably less energy as fuel per unit area sown, (Hughes & Baker 1977) and consequently machinery costs are reduced as compared to conventional cultivation. However the cost of some of the chemicals used may mean that total cost is much the same. As a result Morris (1969) found costs of direct drilling to be lower, whereas Muscroft Taylor (1971) quotes costs as being similar. It is possible to reduce costs by band-spraying the herbicide infront of each coulter, decreasing chemical usage by two thirds but also decreasing to some extent the yield of the direct-drilled species (Hay et al. 1978).

Time is saved by direct-drilling. Successive crops can be drilled immediately after the harvest of any one, and a valuable advantage is that pastures are available for grazing right up until spraying and drilling, rather than being unproductive for some 2 to 8 weeks during conventional preparation for subsequent crop or pasture.

One of the disadvantages of direct-drilling is that soil insects like grass grub, normally physically decimated by cultivation, are spared this fate, and therefore insecticides need to be applied alongside the seed. Argentine stem weevil and other insects may also survive the herbicide to colonise the new sown species (Carpenter et al. 1978). Unfortunately the use of insecticides with the seed does not reduce damage to the low level experienced with conventional land preparation.

Another major disadvantage is that stubble and grass pasture residues are not buried and can therefore act as a reservoir of infection, particularly with cereal diseases like Take-all and Eyespot.

Certain crops like the beets and potatoes, which need deep cultivation for maximum yield, are lower yielding where direct-drilled (Kuipers and Boone 1977).

Unlike conventional methods of seedbed preparation, direct-drilling does not allow a period of fallow for weed control or moisture accumulation. Whilst most weeds which formerly required a fallow are now controlled by glyphosate, there is no compensation for the latter function, apart from irrigation.
ENSURING SUCCESS

To be successful the technique must ensure minimum competition between resident vegetation and the seedlings establishing, for the three factors that plants must have to grow successfully, namely water, light and nutrients. Resident vegetation left alive will inevitably mean strong competition for all these, especially nutrients (King, 1971). Larger plants are in a stronger position to compete than are smaller plants or seedlings, hence the importance of getting as complete a vegetation kill as possible. Grasses such as browntop, compete successfully for nutrients at the expense of other grasses and legumes (Jackman & Mowat 1957). Establishing brassicas seem to be especially sensitive to competition (Taylor 1967, Muscroft-Taylor 1971) while even wheat is susceptible and responds to complete removal of competition by increased yield (Taylor 1967, Blackmore 1967). Except when resowing bare patches caused by insect damage or winter pugging, the use of a herbicide is essential, and makes all the difference between success and failure, (Leonard and Hart 1977, Table 1). Recently the advantage

<table>
<thead>
<tr>
<th>PARAQUAT + DICAMBA</th>
<th>SUPPRESSION</th>
<th>GREEN TURNIP YIELD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = nil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 = complete</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRASS</td>
<td>CLOVER</td>
<td></td>
</tr>
<tr>
<td>1.37</td>
<td>0.87</td>
<td>3.0</td>
</tr>
<tr>
<td>SPLIT APPLICATION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.1</td>
<td>7.4</td>
<td>53.3</td>
</tr>
</tbody>
</table>

(Leonard and Hart 1977)

of getting complete control by using split applications of paraquat has been demonstrated by Leonard & Hart (1977) for brassicas. Yield was increased 20% by splitting the usual rate of paraquat into two doses 2 weeks apart (Table 2).

Direct-drilled crops almost always suffer from a greater N deficiency as compared to those grown conventionally, so that responses to added
nitrogen are obtained (Table 2, Vartha 1973, Table 3, Blackmore 1967). This is because applied fertilizer removes competition by providing a readily available source of N.

TABLE 2

<table>
<thead>
<tr>
<th></th>
<th>DIRECT DRILLED TAMA RYEGRASS YIELD kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO SPRAY</td>
<td>- N</td>
</tr>
<tr>
<td></td>
<td>+ N</td>
</tr>
<tr>
<td>SPRAY</td>
<td>- N</td>
</tr>
<tr>
<td></td>
<td>+ N</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2240</td>
</tr>
<tr>
<td></td>
<td>4020</td>
</tr>
<tr>
<td></td>
<td>3800</td>
</tr>
<tr>
<td></td>
<td>6100</td>
</tr>
</tbody>
</table>

(Vartha 1973)

TABLE 3

<table>
<thead>
<tr>
<th></th>
<th>SPRING WHEAT YIELD kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONVENTIONAL CULTIVATION</td>
<td>4645</td>
</tr>
<tr>
<td>SPRAY AND DIRECT DRILL</td>
<td>5047</td>
</tr>
<tr>
<td>SPRAY AND DIRECT DRILL AND 50 UNITS N</td>
<td>5468</td>
</tr>
<tr>
<td>CHEMICAL FALLOW; SPRAY AND DIRECT DRILL</td>
<td>5575</td>
</tr>
</tbody>
</table>

(Blackmore 1967)

However crops direct-drilled after vigorous pasture show only small responses to N (Blackmore 1967). Many authors (e.g. Taylor 1969) stress the need to pick high fertility areas to ensure success. High levels of nitrogen in the soil are essential for sustained growth and high yields of brassica crops, cereals, and grasses, but legumes can be successfully overdrilled into soils with low levels of available N so long as any other nutrient deficiencies such as P are corrected.

It is important to direct drill only when soil moisture conditions allow some crumbling of the surface (Moore 1979) and to avoid drilling
when the soil is sticky, since this accentuates the problems associated with smearing of the groove. However a good soil moisture level during the early stages of crop or pasture growth is most important. Moisture stress can be avoided initially by removing or killing all resident vegetation close to the drill row, and by choosing a time of year for drilling when rainfall is adequate and climatic conditions are cool and humid. Irrigation however enables direct-drilling to proceed successfully during the drier periods of the year. For instance without irrigation the direct-drilling of turnips in January on the shallow soils of the Canterbury Plains is never likely to succeed, however in the same area, rape sown in September is likely to be a success since there is better moisture in the establishment period. Likewise the direct-drilling of Tama ryegrass into lucerne in February-March in Canterbury is only consistently successful at increasing feed supply if irrigation is used during establishment (Vartha and Frazer 1978). One of the advantages of conventional cultivation is that it conserves moisture in the worked ground. This does not occur with direct-drilling, so that in the absence of irrigation the timing of sowing needs to be fitted to periods of assured moisture supply. Drying of the surface of the groove left after drilling can be avoided by using a bar-harrow behind the drill. Baker (1973) has demonstrated the substantial advantages from harrowing when dry weather follows direct-drilling, particularly for cereals and maize (Table 4).

| (Baker 1977b) |

<table>
<thead>
<tr>
<th>Plants/m² at 10 days</th>
<th>DIRECT - DRILLED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NOT HARROWED</td>
</tr>
<tr>
<td>MAIZE</td>
<td>0.3</td>
</tr>
<tr>
<td>LUCERNE</td>
<td>87</td>
</tr>
<tr>
<td>BARLEY</td>
<td>22</td>
</tr>
</tbody>
</table>

TABLE 4
Direct-drilling undoubtedly has advantages for the cropping farmer, for the sheep and cattle man growing winter feed, and for pasture renovation, but the technique has a further application with great potential for expansion. This is for introducing superior herbage cultivars into old, but otherwise healthy pastures. For instance Nui may be direct-drilled into old pasture based on Ruanui; or winter-active cultivars such as Tama, or Matua prairie grass drilled into ordinary pastures on a regular and continuing basis.

Indications from research are that yields of direct-drilled brassicas (Muscroft-Taylor 1971, Hart & Jacobson, 1978) and cereals (Blackmore 1967 and Taylor 1967, 1968) may be just lower, equal to; or higher yielding than those from conventionally grown crops. Studies in Holland (Kuipers & Boone 1977) show that root crops are lower yielding while wheat is higher yielding. There is surprisingly little data on the establishment and yield of pasture species but what figures there are indicate that sometimes there is success (Hay et al. 1978, Vartha 1973) while at other times there is not (Vartha 1977). One of the problems in assessing the present status of direct drilling is that while successes are often documented, failures are not.

The area of direct drilled brassicas in New Zealand had, by 1973, risen to 2000 ha according to Leonard (1973) with the majority of crops being grown in areas with reasonable summer rainfall or with irrigation. Nevertheless other crops e.g. wheat (Taylor 1967) have been grown successfully in summer dry areas. A recent estimate (R.W. Moore pers. comm.) puts the total area of direct drilling, both crops and pasture, at about 5000 ha - still less than 1% of the total New Zealand area cultivated for cash and fodder crops and new grass annually (Harris 1978).

A major limitation in the past, especially in cropping areas, has been the inability to control certain weeds. This limitation is now removed with the advent of the latest chemicals. Direct drilling has undeniable biological, financial, and energy-saving advantages and in spite of the need for a high level of managerial skill in its application the time would seem ripe for very much wider adoption of this technique.
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CONSERVATION TILLAGE

INTRODUCTION

The term conservation tillage refers to the sowing of seed into an uncultivated seedbed, usually with a modified seeding drill, often with the aid of herbicides to eliminate existing vegetation competition during plant establishment.

Advantages of Conservation Tillage

Lower energy and cost inputs
Reduction in labour required
Maintenance or improvement in soil structure and drainage
Increase in the soils surface fertility
Increase in earthworm populations
Erosion protection (wind and water)
Reduction in soil damage caused during cultivation
Conservation of moisture
Control of perennial weeds
Reduced ridging on border-diked land
Greater farmer flexibility
Longer utilisation of pasture or crop
Drilling can be conducted at optimum time
Often reduced post-planting herbicide treatment
Easier movement of machinery on paddocks
Less winter 'pugging' by animals
Limitations

Drilling equipment
Greater insect problems
Higher nitrogen requirements
Changing of common practice and farmer attitudes
Proof of reliable yields

Data compiled by the United Kingdom National Institute for Research in Agricultural Engineering shows some of the following savings in energy inputs, labour and costs.

<table>
<thead>
<tr>
<th></th>
<th>Plough</th>
<th>Shallow Plough</th>
<th>Rota-Digger</th>
<th>No-till</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Input (MJ/HA)</td>
<td>314 = 100%</td>
<td>57%</td>
<td>72%</td>
<td>9%</td>
</tr>
<tr>
<td>Labour (man hrs/ha)</td>
<td>3.39 = 100%</td>
<td>47%</td>
<td>54%</td>
<td>15%</td>
</tr>
<tr>
<td>Cultivation cost (£/ha)</td>
<td>14.63 = 100%</td>
<td>55%</td>
<td>61%</td>
<td>50%</td>
</tr>
<tr>
<td>Average capability (ha)</td>
<td>141 = 1 x</td>
<td>2 x</td>
<td>2 x</td>
<td>5 x</td>
</tr>
</tbody>
</table>

Conservation tillage has been practised by many farmers mainly in southern New Zealand for the establishment of brassicas and pasture with often limited success. However, during 1977 and 1978 no-tillage has proven more reliable with improved vegetation control, insect control, drilling equipment and fertiliser recommendations.

Much information is available overseas and this is where many New Zealand farmers have been gaining insight into the concept. During 1978 220,000 hectares was no-till planted in the United Kingdom and 2.9 million hectares in the United States of America. In New Zealand during 1978 it is estimated 10,000 hectares was no-till planted and of that area approximately 50% (from survey) was with the assistance of herbicides.

Areas Where No-Tillage can be Adopted

Conversion of native pasture into improved pasture
Rejuvenate existing pasture. For example, from weed drought or insect damage.
Introduce improved cultivars into low producing cultivars
Establish pasture following cropping
Establish lucerne and other legumes
Plant winter and spring cereals
Establish fodder crops such as brassicas, maize or greenfeed cereals

FACTORS TO CONSIDER

There are many advantages in crop rotations although reliable yields, improvement in soil structure and cost reductions will not always be obvious at the beginning. In pasture establishment and especially pasture renovation, costs can be reduced considerably while gaining all the conservation tillage advantages except improvement in soil structure. Pasture establishment in previously uncultivated soils by the no-tillage method will often result in uneven paddocks which may not be acceptable to all farmers.

With the recent development of glyphosate which is foliar active with no soil activity, most problem weeds can be adequately controlled or eliminated so the no-tillage concept can now be adopted in a wider range of weed situations.

When applying glyphosate it is important to identify the weed species present and determine what rate will be the most cost efficient to obtain the desired level of control. Weeds present will range from annuals to deep rooted hard-to-kill perennials like couch *Agropyron repens*, browntop *Agrostis tenuis* and docks *Rumex spp.*, which require higher application rates. We are confident that the problem perennial weeds which have previously been a problem in no-tillage can now be effectively controlled using glyphosate.

In pasture establishment where problem perennial weeds are not present low rates of one to three litres per hectare of glyphosate will be satisfactory as annual and perennial weeds like barley grass *Hordeum spp.* and ryegrass *Lolium spp.* can be controlled, while white clover *Trifolium repens*, is affected but not controlled. This can be an advantage as lower white clover sowing rates to finally achieve ground cover of 20-30% of the established sward are possible. When establishing spring cereals, brassicas or legumes
dicamba 1-1.5 litres per hectare should be used to control the white clover which will compete with the introduced plants for soil nutrients, light and moisture. A period of two to three weeks between dicamba application and drilling must occur before establishing legumes as dicamba soil residues can be phytotoxic to germinating seedlings. Cereals and brassicas are tolerant to these rates of dicamba so can be drilled at application or soon after.

We are studying the effects of conservation tillage on weed populations post emergent to the first crop and subsequent weed populations in cropping rotations. In southern New Zealand post emergent herbicides have not been necessary for brassica establishment, saving $40-$55 per hectare. In cereals and legumes, perennial weeds have been reduced by the use of glyphosate and provided there is limited soil disturbance at drilling, annual weeds have been reduced especially in the second and subsequent years. We are also looking at the reduction of *Rumex* sp. in white clover seed crops in a cereal-cereal-white clover rotation. If conservation tillage can reduce weed populations and therefore herbicide treatments in a cropping system the initial cost of glyphosate can be off-set against the subsequent savings in that rotation. Without the need for post-emergent herbicides later in the rotation total herbicide costs may not increase substantially. This of course could reduce the cost of production in many crops.

**HERBICIDE APPLICATION**

When applying glyphosate for no-tillage the vegetation to be controlled should be 5-10cm in height and actively growing for best results. Couch should be treated when 10-20cm in height and at the three to four leaf stage of growth. Often farmers graze the vegetation and let it grow for 7-10 days before application. Drilling can take place one day following application but where there are perennial weeds with underground stems or rhizomes, then drilling should be delayed three days to allow herbicide translocation. Only accurate spray equipment with a marker system should be used and water rates of approximately 200 litres per hectare should be applied. The treated plants should be rain free for six hours following application.
DRILLING EQUIPMENT

Seeding equipment is the biggest limitation to successful conservation tillage at present as no single drill available is ideal in all soil types, moisture conditions and use situations. Coulter penetration, depth control, creation of a seedbed in the bottom of the coulter opening and seed coverage are essential. The triple disc drill is the most commonly used, but seedling establishment has been improved by fitting wavy edge discs which allows greater soil disturbance and creates more loose soil to be replaced in the coulter groove, especially when covering devices are used. Disc coulters should not be used in wet soils as smearing of the coulter opening occurs and the groove opens on drying. The conventional drill with hoe coulters has been used successfully for pasture renovation but when fitted with grassland coulters which are narrow hoe coulters, plant establishment has been improved. The hoe coulter must have an adequate covering device to allow seed coverage for good establishment. The single dished disc drill has been successful in good soil conditions for sowing of small seeds.

In cereals a drill capable of penetrating cereal stubble is required and no drill available is very successful. Mulching, shredding or burning of stubble can overcome this problem. The triple disc drill fitted with a wavy edge disc coulter is the most satisfactory as the flat disc tends to revolve slower than the drills ground speed causing build-up of stubble in front of the coulters. These disc coulters also tend to force stubble down the coulter opening when conditions are damp or the discs are worn, causing reduced seed germination. A drill fitted with a scalloped disc and with a chisel coulter for seeding would appear to have the most potential. (P.D. Aitchison pers. comm.)

SOME RECOMMENDATIONS WHEN DRILLING

* Soil should not be wet or sticky but dry enough to be pliable; that is, it should be capable of being crumbled with the fingers.

* Drilling speed should be six to seven kilometres per hour and certainly no faster than 10 kilometres per hour, as seed will be broadcast and not deposited.
Average sowing depth is often too deep, especially when drilling in spring and sowing close to the surface with some coulters has been more satisfactory than sowing too deep with others, provided the seed is covered.

Covering devices are advisable where loose soil occurs near the coulter opening.

CONCLUSION

There is limited data available from New Zealand experiments on agronomy aspects and long term benefits of conservation tillage. Further research work is required to determine;

- Changes in soil structure and drainage
- Root development
- Changes in management practices
- Possibilities of greenfeed catch crops in cropping rotations
- Fertiliser requirements, especially nitrogen in cereals
- Worm populations
- Crop residues and fungous diseases
- Insect problems
- Drilling equipment
- Introduction of new cultivars into pasture
- Moisture conservation and effects on production
- Short and long term production changes

At present there are many long term experiments being established and monitored for cropping and pasture establishment in differing localities, soil types and rainfall areas where we plan to look at many of these aspects.

If farmers see advantages in conservation tillage and are considering no-tillage, they should accumulate as much information available from publications, other farmers, government departments and industry where there is experience with the concept. It would be wise to try small areas initially, in each crop, to gain experience with no-tillage especially in cropping rotations. As conservation tillage is a new approach to plant establishment, immediate benefits will certainly not be obvious to all farmers.
MY EXPERIENCE WITH CONSERVATION TILLAGE

With the increased reliability of conservation tillage, cultivation is no longer necessary. In fact I believe it to be destructive.

WHAT ARE THE REASONS FOR CULTIVATION

* To destroy existing vegetation - possibly a valid point.
  * To aerate the soil and in the process kill all the worms which can aerate the soil, far more efficiently than the plough.
  * To enhance mineralisation - but in fact cultivation reduces soil micro-organisms.
  * For weed control - when in fact all we do is increase weed populations.
  * To mix the soil - and yet earthworms are continually mixing soil.
  * To make a seed bed and in the process ruin the soil structure and with it the natural seed bed.
  * For moisture conservation but in fact destroy its water holding capacity.
  * Leave it open to erosion from both wind and water.

I think the real reason for cultivation is the fact that farmers have always done it and find it hard to accept that it is no longer...
necessary! I believe the only valid reason for cultivation is to destroy the existing vegetation. Today this can be done by chemical means.

WHAT DO WE NEED FOR SUCCESSFUL CONSERVATION TILLAGE

* A good soil structure.
* A herbicide capable of killing the existing vegetation.
* A drill capable of successfully depositing seed in the ground.
* Adequate covering harrows.

Where all these conditions are met yields have been as good as, and often better than, the yields obtained under conventional tillage.

GOOD SOIL STRUCTURE

Drilling into soil with a poor soil structure will result in a depressed yield. However, do not despair as continued direct drilling will improve soil structure. Well structured soil will come up like worked ground with two passes of the drill.

Do not use the back paddock that has never been any good for cropping because conservation tillage will not work there either. It is best to start with a paddock with a high white clover content.

KILLING EXISTING VEGETATION

With the advent of glyphosate, a broad spectrum herbicide with no residual problems, existing vegetation can be controlled with reliability. Herbicides must be applied accurately and it is therefore necessary to have reliable equipment in the form of contractor's gear or one's own spray unit.

With time and continued direct drilling there is a reduction in weeds, both perennial and annual, and herbicide usage can therefore be reduced. Where there is minimal grass and no perennial grasses or broadleaf weeds, paraquat is a satisfactory herbicide.

It may be possible to get to the stage of no chemical every second or third year, or use only a post emergent herbicide. Some of my wheat.
crops last season did not require herbicides.

ADEQUATE DRILLING EQUIPMENT

I am using a conventional drill which has been modified for direct drilling. The rocker shaft has been strengthened and heavier coulter springs fitted. In conditions where no stubble is present modified over-drilling hoe coulter points are used. These points are lasting for 100 hectares (250 acres). Where stubble is present conventional disc coulters are used. Although not as satisfactory as the hoe coulters for making a seed-bed, they do work in stubble where the hoe coulter will not.

These systems work well on my soil type which is a Mairaki silt loam, has a high clay content, and is on a clay subsoil. Unlike the triple disc drill both systems create some soil disturbance where the seed is placed. Disc coulters tend to leave the ground rougher and I prefer to use the hoe coulters.

My practice is to drill paddocks two ways to create a good seed bed and allow seed coverage, but when a good soil structure has developed only one way drilling is necessary.

COVERING EQUIPMENT

It is most important that the seed is well covered and to achieve this I have built several configurations of railway irons and posts. However, I am sure that there are many other systems, including chain harrows, that would work equally well. Two sets can be put in tandem in difficult situations.

My experience in conservation tillage began four years ago when I started with twenty acres of linseed which was disastrous. Last year I successfully established wheat, barley, linseed and grass on 270 hectares (650 acres) under a conservation tillage system. I now believe the system to be more reliable than cultivation.
BENEFITS OF CONSERVATION TILLAGE

To the Soil

* Improvement in soil structure and increase in organic matter.
* Better moisture conservation.
* Less erosion from wind and water.
* Increase in earthworms.
* Faster breakdown of stubble and trash.
* Reduction in weed populations and therefore less need for post emergence spraying.

To the Farmer

* Reduction in labour 75-80%.
* Reduction in fuel 75-80%.
* Reduction in capital invested in machinery.
* Reduction in chemical usage with time.
* Sowing dates less affected by weather.
* Greater flexibility.
* Longer utilisation of land.

MY SYSTEM OF CONSERVATION TILLAGE

Initially I try to establish a good white clover base from which to start.

Paddocks are allowed to come away and produce sufficient growth to spray with glyphosate. They are then left from three to seven days depending on the weather, and the weed species that have been sprayed.

Stock are then used to bare paddocks off before drilling. After drilling, crops are treated in the same way as a conventionally sown crop and are subject to all the problems of weather associated with conventional paddocks.
COSTS OF CONSERVATION TILLAGE

Initial costs vary depending on existing vegetation and I have tried to produce some average costs from my experience using glyphosate.

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
<th>Per/ac</th>
<th>Per ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>Out of white clover containing couch</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Glyphosate 3 lt/ha (2.1 pts/ac) applied</td>
<td>$30.00</td>
<td>$74.10</td>
</tr>
<tr>
<td></td>
<td>Drill 2 ways</td>
<td>8.80</td>
<td>21.74</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>38.80</td>
<td>95.84</td>
</tr>
<tr>
<td>Year 2</td>
<td>Same glyphosate rates and costs</td>
<td>38.80</td>
<td>95.84</td>
</tr>
<tr>
<td>Year 3</td>
<td>No glyphosate</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Drill 2 ways</td>
<td>8.80</td>
<td>21.74</td>
</tr>
<tr>
<td>Year 4</td>
<td>Glyphosate 2 lt/ha (1.4 pts/ac)</td>
<td>21.00</td>
<td>51.87</td>
</tr>
<tr>
<td></td>
<td>Drill 1 way</td>
<td>5.40</td>
<td>13.34</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>26.40</td>
<td>65.21</td>
</tr>
<tr>
<td></td>
<td>Average costs over 4 years (glyphosate &amp; drilling)</td>
<td>$28.20</td>
<td>$69.65</td>
</tr>
</tbody>
</table>

Succeeding years should see these costs reduce

By using 1 litre per hectare (0.7 pts/ac) of glyphosate every year or 2 litres per hectare (1.4 pts/ac) every second year or double drilling with no herbicide every second year would give an average cost of between $42 and $44.50 per hectare ($17 and $18 per acre) for spraying and drilling.

You will see that it is not until year three that big savings become apparent. My cultivation costs using a 120 H.P. tractor were high under the conventional systems as I consider the tractor cost $35.00 per hour to run.

My system of cultivation was to plough and roll in one operation, followed by a rotary harrow, and then drill with a smaller tractor in a separate operation.
Total Cost

<table>
<thead>
<tr>
<th></th>
<th>Per Hour Cost</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acres</td>
<td>Hectares</td>
</tr>
<tr>
<td>Plough and roll</td>
<td>3</td>
<td>1.2</td>
</tr>
<tr>
<td>Rotary Harrow 2X</td>
<td>3</td>
<td>1.2</td>
</tr>
<tr>
<td>Drill (small tractor)</td>
<td>4</td>
<td>1.6</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$39.00</td>
<td>$96.33</td>
</tr>
</tbody>
</table>

DISADVANTAGES OF CONSERVATION TILLAGE

The main disadvantage is that all costs become direct costs and have to be met at the time of crop establishment. Although the greater initial outlay will be offset with the reduction in cultivation costs in the longer term, it can play havoc with cash flow in the short term.

I strongly suggest that anybody moving into a conservation tillage system in a big way, should budget forward very carefully and ensure that adequate finance is available to continue the programme right through.

Conservation tillage must be a long term project to succeed in cropping.

Finally I would like to emphasise the requirements for successful conservation tillage.

- Good soil structure.
- Killing of existing vegetation.
- Drilling equipment capable of putting seed efficiently and effectively into the ground.
- Adequate covering device.
- And finally, the will to want the system to succeed.
Pasture is by far the major feed used by the dairy herds of New Zealand; therefore its efficient utilisation is essential for the overall efficiency of the dairy farm. Efficient utilisation of pasture is achieved if a large amount of milk is produced per tonne of pasture dry matter grown. However this description really incorporates two aspects of efficiency which are individually so important that each must be described separately.

Firstly the efficiency with which pasture eaten by the stock is converted into milk which can be expressed as

\[
\frac{\text{kg milkfat produced}}{\text{tonne of pasture dry matter eaten}}
\]

and will be referred to as efficiency of feed conversion.

Secondly the efficiency with which the pasture grown is actually eaten by the stock which can be expressed as

\[
\frac{\text{kg pasture eaten}}{\text{kg pasture grown}}
\]

and a high value means that most of the grass which is grown is also eaten. This will be referred to as efficiency of pasture removal.

A third aspect of efficiency should be added to these two, namely that the grazing management used on the farm must result in a large amount of high quality pasture dry matter being produced per hectare annually.
Only if all three of these factors are efficient will a high value be achieved for production of milkfat per hectare. However a high value for milk fat produced per hectare does not necessarily mean that a farm is efficient in all three aspects - efficiency in one respect may hide low efficiency in another respect. For example, an irrigated farm produced twice as much pasture as an unirrigated farm, but only one and a half times as much fat per hectare; in this case the irrigated farm must be utilising its pasture less efficiently despite its higher production of fat per hectare.

The present discussion will concentrate on the first two aspects of efficiency described above.

EFFICIENCY OF FEED CONVERSION

Efficiency With Which Cows Convert Pasture Eaten Into Milk

The energy utilised from the diet meets their requirements for:

* Maintenance (and pregnancy)
* Gain in body weight and in body condition
* Milk production

If the amount of feed utilised for milk production is high relative to that utilised for maintenance and gain in body weight then efficiency of feed conversion will be high. If on the other hand, maintenance is high (as for a very heavy cow) or the rate of gain in body weight is high, then efficiency of feed conversion may be lower.

These points are illustrated by calculating values for kg milk fat (MF) produced per tonne of pasture dry matter eaten (Table 1), which are in general agreement with values derived from actual experimental measurements by Hutton (1963), but expressed in a slightly different way.

The data in Table 1 show that for a cow of a particular liveweight (LW) efficiency of feed utilisation is likely to increase as milk production increases; the data also shows that if two cows produce the same yield, the lighter cow will be the more efficient.
TABLE 1. CALCULATED VALUES FOR YIELDS OF MILKFAT ACHIEVED PER TONNE OF PASTURE DRY MATTER EATEN (KG MILK FAT/TONNE DM EATEN) BY COWS WHICH DIFFERED IN YIELD OR BODY WEIGHT

<table>
<thead>
<tr>
<th>Milk Fat Yield (kg-cow annually)</th>
<th>Liveweight of cows (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>300</td>
</tr>
<tr>
<td>120</td>
<td>37</td>
</tr>
<tr>
<td>160</td>
<td>45</td>
</tr>
<tr>
<td>200</td>
<td>50</td>
</tr>
</tbody>
</table>

Level of Feeding and Efficiency of Feed Conversion

For a herd of cows on a farm, probably the most important factor which can influence their milk yield and thus their efficiency, and which is also usually under the farmer's control, is the level of feeding offered to the herd.

What level of feeding is most appropriate for greatest efficiency of feed conversion by the cow? The only real data that is available on this topic in New Zealand is that of Hutton (1963) which showed that, for cows in the second half of lactation, restriction of feed intake by ten percent did not cause a decrease in milk yield and therefore was associated with an increase in efficiency when compared with cows fed to appetite. Presumably the restricted cows gained less body weight than those fed to appetite during the second half of lactation, a difference which may have either influenced the cows' requirements for feed during their dry period of the yield achieved by the cows during the following lactation, or perhaps both.

However the data in Table 2, from a Canadian study on cows of high or low genetic merit fed to appetite, demonstrate that although the good cows ate more feed that the poor cows, they produced much more milk so that they were more efficient converters of feed into milk than the poor cows. If the good cows had been fed less than their appetites, would their efficiency have been improved, as was
the case in Hutton's cows? (see below). The answer is not known, but I believe that such a restriction of food intake to the good cows would have led to a decrease in their efficiency, because of a decrease in their milk yield. Information on this topic is urgently needed for cows in New Zealand, fed on pasture; work currently beginning at Massey and at Ruakura should provide some answers.

TABLE 2. RESULTS FROM A CANADIAN EXPERIMENT WITH GENETICALLY HIGH AND GENETICALLY LOW PRODUCING COWS; FED TO APPETITE

<table>
<thead>
<tr>
<th></th>
<th>High Producers</th>
<th>Low Producers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield of milk fat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(kg/cow annually)</td>
<td>200</td>
<td>105</td>
</tr>
<tr>
<td>Feed eaten (kg DM/cow</td>
<td>4,680</td>
<td>3,800</td>
</tr>
<tr>
<td>annually)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>kg milk fat produced per</td>
<td>43</td>
<td>27</td>
</tr>
<tr>
<td>tonne DM eaten</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changes in body weight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(kg/cow)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) in early lactation</td>
<td>- 54</td>
<td>- 26</td>
</tr>
<tr>
<td>(b) over full lactation</td>
<td>+ 91</td>
<td>+ 169</td>
</tr>
</tbody>
</table>

(MacLeod, G.K., Burnside, E.B., Batra, T.R. and Grieve, D.G. 1974. (University of Guelph, Canada.)
Fig. 1 The effect of an increased level of feeding on poor and good cows

Poor Cow: Weak "drive" to produce milk

Good Cow: Strong "drive" to produce milk

Fig. 2 Changes in milk yield and body condition score for cows which calved in Autumn or Spring (Massey No. 1 Dairy Farm)

Time and stage of lactation
The difference between cows with strong or weak *drives* for milk production is illustrated diagrammatically in Figure 1; those with strong *drives* respond to an increase in food intake by a large increase in milk yield, whereas those with weak *drives* respond by no increase in milk yield but a large increase in body weight. Obviously a restriction in food intake by the cows with weak *drives* would have increased the efficiency with which they converted feed into milk. These differences in *drive* between cows may be at least partly of genetic origin; a healthy cow of high genetic merit, or high breeding index, can be expected to have a strong *drive* to produce milk. The *drive* will vary at different stages of lactation (Figure 2) but will always be relatively strong for high genetic merit cows.

In this context some data from No 1 dairy farm, Massey University is of interest (Figure 2); cows fed very well in *early* lactation (the spring calvers) produced a high yield of milk, and kept body condition score relatively constant, whereas cows fed very well in *later* lactation (autumn calvers) showed only a small increase in milk yield, to a moderate level, but a very big increase in body condition score. The cows in early lactation have a strong *drive* to convert feed into milk, whereas this *drive* is weaker for thin cows in later lactation. It can be expected that cows with strong *drives* to produce milk will be efficient converters of feed into milk, whereas cows with weak *drives* to produce milk will be inefficient converters of feed into milk but efficient converters of feed into meat - an attribute which is not an advantage to dairy cows in the short term.

The conclusion that I draw is that good cows should be fed well so that they are able to produce to their potential and thus most efficiently. Farmers have little information about their own cows in this respect, but observations of milk yields and body condition can probably provide the farmer with valuable insight; the cow which never seems to gain body condition at any stage of lactation no matter how well she is fed almost certainly has a strong *drive* whereas the cow which gains body condition when fed well even in early lactation has a weak *drive*. It seems likely that the average *drive* of most cows, for most herds in New Zealand will be strong as a result of the many years of genetic selection for high milk yield within the New Zealand dairy industry. Therefore most cows should be
fed well, particularly in early lactation, in order to achieve greatest efficiency of feed conversion.

Achieving High Levels of Feeding by Grazing Cows

Cows offered large areas and quantities of pasture each day, will achieve high levels of intake; however under these conditions the cows are actually offered two to three times as much pasture each day as they can eat so that a lot of pasture is left ungrazed on the paddock after the cows have been moved on. These points are illustrated clearly by the data presented in Figures 3 and 4; the Ruakura data showed that cows which were offered more pasture per day in either early, mid or late lactation showed increased milk yields presumably because their intakes also increased. However the Massey data showed that cows, either dry or lactating, which were offered and ate a lot of pasture also left large amounts of pasture ungrazed. The close relation seen in Figure 4 suggests that the level of feeding for cows can be assessed with reasonable accuracy by inspection of the paddocks immediately after grazing.

It can be concluded therefore, that in order to achieve the high levels of feeding that are necessary for high production and hence high feed conversion efficiency it is necessary to graze lactating cows relatively laxly, particularly in early lactation.

THE EFFICIENCY OF PASTURE REMOVAL

The Effects of Lax Grazing on Pasture

Relatively low stocking rates, and continuous lax grazing resulted in increases in the proportion of dead material present in pasture (Table 3) and in decreases in the digestibility of the pasture (Table 4). These effects occurred because pasture which is not grazed when relatively young will die, or at certain times of the year will become stemmy with seed heads; such dead and stemmy pasture is less digestible than young green leafy pasture.

A decrease in the digestibility of pasture can be expected to have two effects
Fig. 3  The effects of increasing the amount of pasture offered to cows on milk yield at 3 different stages of lactation (Bryant, 1977)

![Graph showing the effects of pasture intake on milk yield.](image)

Table 1: Digestibility of grasses subjected to different stocking rates: Measured in spring and autumn. (Taylor 1975)

Fig. 4  The relation between pasture intake and residual yield of pasture after grazing. (Holmes C.W., Glassey C., & Davey A.W.F., Massey Univ.)

![Graph showing the relation between pasture intake and residual yield.](image)
### TABLE 3. YIELD OF DEAD PASTURE DURING SUMMER, IN PASTURES SUBJECTED TO DIFFERENT GRAZING MANAGEMENT (CAMPBELL, 1964)

<table>
<thead>
<tr>
<th>Grazing Management and Stock Rate</th>
<th>Rotational</th>
<th></th>
<th>Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock Rate</td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Dead material (kg DM/ha)</td>
<td>380</td>
<td>1000</td>
<td>1200</td>
</tr>
</tbody>
</table>

### TABLE 4. DIGESTIBILITY OF PASTURES SUBJECTED TO DIFFERENT STOCKING RATES; MEASURED IN LATE SUMMER AND AUTUMN. (TAYLOR 1975)

<table>
<thead>
<tr>
<th>Stocking Rate</th>
<th>High</th>
<th>Moderate</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digestibility of pasture DM (%)</td>
<td>64</td>
<td>61</td>
<td>56</td>
</tr>
</tbody>
</table>
* less pasture will be eaten
* of the pasture that is eaten a lower percentage will be useful to the animal for productive purposes

Taken in combination, these effects mean that a decrease in pasture digestibility will have severe effects on productivity of cows; cows may well produce very poorly when grazing on what appears to be very generous quantities of pasture which is of low digestibility, a situation which is relatively common on farms with low stocking rates, in late spring or summer.

Another factor to be considered is that each blade of grass does not survive indefinitely; if left ungrazed it will die and eventually rot away which of course amounts to an inefficiency because potential feed has been lost. The rate at which this loss of pasture by rotting can occur has been measured to be 33 kgDM/ha daily in a laxly grazed rye grass pasture and 2 kgDM/ha daily in a hard grazed pasture (Korte and Sheath 1978). A loss of 30 kgDM/ha daily amounts to almost one tonne DM/ha over a month, a considerable amount of potential feed which has almost literally gone up in smoke.

The growth and botanical composition of a pasture can almost certainly be influenced by whether it is grazed laxly or hard; however the relevance to the dairy farm of much of the published data on this subject is difficult to assess because the experimental pastures were usually grazed by sheep or cut mechanically.

The Effects of Lax Grazing on the "Efficiency of Pasture Removal"

How can pasture and stock be managed so that most of the grass which grows is eaten? The most straightforward answer is to ensure that the amount of feed required by the stock is always at least equal to or greater than the amount of feed available to them. In the long term this can be achieved by using a high annual stock rate (measured as cows/ha for the full year) and in the shorter term it can be achieved by restricting the amount of pasture made available to the stock each day, or using a high daily stocking intensity (measured as cows/ha per 24 hr). These methods will ensure that the cows' appetites are never fully satisfied with the result that they are keen, undiscriminating grazers which eat everything that moves! The consequence will be that efficiency of removal of pasture is
high; however at the same time the cows will be on relatively restricted levels of feeding so that their efficiency of feed conversion might be expected to be reduced to a lower level than they could have achieved if fed on a higher level of feed (see section 1).

"Annual efficiency of pasture removal", or (pasture eaten per year) \%/ (pasture grown per year) \%

was measured by Campbell (1966) to be about 95 to 98\% for two stocking rates and two grazing managements; however these values are probably too high because the amounts of pasture grown would have been underestimated due to the relatively large amounts of pasture which grew but were not measured because they had disappeared by rotting. It is more likely that true values for efficiency of removal would be about 60 to 90\% with higher values being achieved with higher stocking rates; however these true values would be extremely difficult to measure with existing methods.

At any one individual grazing of a particular paddock some pasture is left behind ungrazed; dry cows on a restricted level of feeding may eat 90\% of the pasture which they were offered, whereas for lactating cows on a high level of feeding the corresponding value may be as low as 30\%. However at least some of the ungrazed pasture will contribute to the next grazing of the paddock although some of it will have been lost by decay and rotting. The values of 30\% and 90\% for individual grazings should not be confused with the values discussed in the previous paragraph for "annual efficiency of pasture removal".

Note: It is sometimes said that lactating cows should not be expected to eat more than about 50\% of the pasture offered to them on any one day; otherwise their level of feeding and milk production will decrease. If the pasture offered to the cows had a total yield of 3000 kg pasture DM matter/hectare before grazing, 50\% removal would leave behind 1500 kg DM/ha; if however the pasture offered had a total yield of 1500 kg DM/ha before grazing, 50\% removal would leave behind only 750 kg DM/ha. It seems very unlikely that the two situations would have achieved the same level of pasture intake and milk production although both resulted in the removal of 50\% of pasture offered. Such values for percentage removal should be treated with caution and interpreted sensibly.
It can be concluded that if cows are grazed so as to eat as much pasture as they can over a long period, the quality of pasture and efficiency of pasture removal are both likely to be affected adversely.

The discussion in the preceding sections indicate that in practice it will be difficult to feed grazing cows very well, so that they achieve maximum feed conversion efficiency, and at the same time ensure that the cows eat most of the grass which is grown. This statement is supported by the results of experiments carried out on research farmlets in New Zealand which were reviewed recently by Karlovsky and others (1978; see Table 5). These results show that increases in stocking rate (cows/ha) have invariably been associated with increases in production of milk fat per hectare despite decreases in production of milk per cow.

The relatively low values for milk fat production per cow in these experiments (86 to 163 kg; average 126 kg per lactation) suggest that at these high stocking rates the cows were relatively underfed and therefore the increases in stocking rate would have caused still further decreases in the levels of feeding and thus in the efficiency of feed conversion by the cows. Nevertheless production of milk fat per hectare increased with increases in stocking rate; it must be presumed, therefore, that these increases in stocking rate caused increases in the efficiency of pasture removal which were large enough to offset the associated decreases in efficiency of feed conversion by the cows, so that the overall conversion of pasture grown into milk fat was increased at the higher stocking rates.

### TABLE 5. EFFECTS OF INCREASES IN STOCKING RATE ON PRODUCTION PER COW AND PER HECTARE, MEASURE ON RESEARCH FARMLETS (AVERAGE VALUES FROM KARLOVSKY AND OTHERS, 1978)

<table>
<thead>
<tr>
<th></th>
<th>Change in production of milk fat for an increase in stocking rate of 1 cow/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk fat per hectare</td>
<td>+ 65</td>
</tr>
<tr>
<td>Milk fat per cow</td>
<td>- 19</td>
</tr>
</tbody>
</table>
Theoretical calculations suggest that production per hectare could be increased by a further twenty percent if both efficiency of feed conversion and efficiency of pasture removal were maximised simultaneously; this would amount to an increase of 80kg fat per hectare for a farm which was already producing 400kg fat/hectare. Under these conditions high levels of production would be achieved both per cow and per hectare. An example is provided by No 3 Dairy Farm, Massey University where these goals were achieved consistently in the 1960's with values of 620kg fat/hectare and 190kg/cow at 3.3 cows/hectare being recorded in 1966-67 (McQueen, 1970) (it should be noted that No 3 carried no yearlings or replacements in these trials).

The secret to further increases in per hectare production on many farms lies in the farmer's ability to manage stock and pasture so as to achieve simultaneously

* Maximum growth of good quality pasture
* Maximum feed conversion efficiency by the cows
* Maximum efficiency of pasture removal

I can give no definite rules, although the principles discussed above are very relevant to the problem.

However a few suggestions can be made

* The condition of pastures in spring can be influenced by winter management; if possible pastures should be grazed frequently enough during winter to keep them green and leafy down to ground level. Such pastures will be grazed much more cleanly by well fed lactating cows in spring, thus achieving efficient feed conversion and efficient pasture removal.

* If pastures are grazed laxly in early lactation, in order to give the cows high levels of feeding, the taller ungrazed pasture should be removed soon after grazing either mechanically or by other classes of stock which have lower feed requirements and can therefore graze harder. If the mechanically removed toppings can be made into silage, this avoids wastage of the pasture and achieves efficient
removal of pasture.

* It is important that we should keep our minds open to possible new methods of grazing management. Zero grazing or the mechanical harvesting of all pasture, is one such method, but it will certainly never be economically viable in New Zealand. Perhaps cows could be stimulated to eat large quantities of pasture while at the same time grazing reasonably intensely, or close to the ground, by offering them

* their daily allowance in four breaks instead of two or one
* pasture which is green and leafy down to ground level

I have great confidence that the ingenuity of the New Zealand dairy farmer will be able to achieve improvements in these directions probably by methods that have not been mentioned in the present paper.

CONCLUSION

The basic principles of efficient pasture utilisation can be summarized as

* Good cows must be fed well enough to achieve the high levels of milk production required for efficient feed conversion.

* Grazing management must maximize both the quality and quantity of pasture grown, and ensure that most of the grass which grows is also eaten.

The success of efficient dairy farmers depends on their ability to achieve points one and two simultaneously.
REFERENCES

FEED STRATEGIES FOR DAIRY FARMS UNDER BORDER-DYKED IRRIGATION

P. Wilson
Consulting Officer
New Zealand Dairy Board

Renewed interest is being shown in establishing dairy farms on the lighter soils of the irrigation schemes of North Otago and Canterbury. Dairying is not new to this area - the Winchmore Irrigation Research Station itself milked up to 83 cows from 1950 to 1956 - until they closed the dairy operation. Today there are about 20 herds farming on the so called "light land" with border-dyke irrigation. This number is increasing due to the following advantages.

* Low cost of land. Land costs around $1500 per hectare. This gives a land cost per kilogram of milkfat of around $5.00 compared with $10.00 per kilogram in the North Island and the traditional dairying areas of the South Island. Adding to this the cost of a cow shed, border-dyked development, raceway and water supply brings the 'real' cost of dairy land in Mid-Canterbury area up to about $2,500 per hectare or about $7.50 per kilogram of milkfat.

* Annual pasture production is about the same as the North Island dairying areas - but due to irrigation, production is much more reliable.

* The light land soil in the area is free draining, so there is less of a pugging problem. This makes far better pasture utilisation, especially in the winter and early spring.
* The development cost of the dairy farm is a tax deductible expense which will increase the capital value of the property.

PASTURE PRODUCTION

Before discussing the feed strategy for a dairy farm under border-dyke irrigation, we must have a knowledge of the amount of grass that can be grown, and the rate of such growth. (See figure 1.)

The average grass growth each year is

- Non-irrigated pasture: 6,940 kg DM/ha + 48%
- Irrigated pasture: 11,990 kg DM/ha + 12%

To see how this grass growth matches cow requirements, a graph of the feed demand of 2.5 ewes per hectare is superimposed on the irrigated pasture production graph. (See figure 2.)

Figure 2 assumes a start of calving on the first of September and drying off in mid May. It is interesting to note how close the cow demand fits the feed supply. A slight deficit through the winter or early spring can be bridged with hay or silage made when supply exceeds demand through October, November, and December. The effect of calving earlier or later, or drying off earlier or later can easily be seen by sliding the cow demand line to the left or right.

FEED STRATEGY

The same basic principles apply wherever cows are milked - and this area is no different to any other. To achieve maximum economic production per hectare, five basic points must all be followed.

* Good rearing of young stock
* Calve cows in good order
* Feed cows well after calving
* Recognise surplus growth - and harvest such growth
* Have a flexible drying off date
Figure 1  Pasture Production — Rate of Growth
Source — Winchmore Irrigation Research Station

Figure 2  Feed Supply and Cow Demand at 2.5 Cows/ha.
Grass management to maximise production should always be aimed at keeping grass in a growing state. This means not letting grass get rank in the late spring or summer, and efficient winter management aimed at maximising regrowth. Efficient winter management involves limiting stock to one block of grass for 24 hours, and then shifting them on. This is commonly called "block grazing".

Unfortunately I cannot give any recipe as to calving date, when to dry off, what length of winter rotation is optimum, how much hay is needed and so on. Every farm situation is different. It is over to each farmer and his advisor to make these decisions based on that farm's situation. Some factors to consider in winter management are

* The amount of feed to offer dry cows depends on their condition. But remember that it takes twice as much feed per day to put on one kilogram liveweight per day as it takes to maintain a cow.

* The speed of rotation, and the amount of supplement (hay or silage) to feed depends on:
  Growth - if growth is good, you can afford to rotate faster.
  Management - Good management (block grazing) should reduce hay demand and maximise grass growth.
  Stocking rate
  Fertiliser and nitrogen use - the higher the fertility, the more grass grown and the consequent reduction in hay requirements.
  Pasture species
  Drying off date - early drying off means less hay is required and the herd can be rotated more quickly.
  Calving date - later calving means that less supplementary feed is required and the herd can be rotated quicker as a build up of grass is not required for calving.

In general, you can rotate the herd quicker if growth is good and feed supply is plentyful.
The main criteria for good winter management is that grass should be kept in a growing state.

Production levels of 0.9 kilograms of butterfat per cow per day should be aimed at. If this is not achieved you will probably find that it was because of a shortage of spring feed. Factors that will influence spring cow production are:

* Drying off date
* Winter management
* Fertiliser policy
* Calving date
* Stocking rate

Finally, a word on nitrogen usage. Nitrogen is a means of boosting grass growth three - six weeks after application and can therefore be looked on as a cheap insurance policy. Its application will help ensure a high level of spring pasture production.
It is quite apparent that technically the border-dyked irrigated light lands of Canterbury and North Otago are ideally suited for seasonal supply dairy production. The climate, soil types and irrigation result in:

* A guaranteed feed supply.
* More efficient pasture utilisation.
* Allow an all grass wintering system with no pasture pugging problems.
* Lower fertiliser requirements.
* Fewer stock health problems such as facial eczema.
* A minimum seasonal fluctuation in production.
* Better utilisation of supplements.

These main points reinforce the suitability of this area for seasonal supply dairy production and in the not too distant future may confirm that this area is better suited to dairying than some of the present conventional dairying districts.

I have been asked to examine some of the economic aspects of dairying on this irrigated light land, and have decided to confine this to two cash budget case studies; one on a well developed dairy unit and one on an equivalent sheep and wool production unit.

In addition to this I will then examine the costs of converting the
sheep unit to a dairy one and the resultant return on the capital outlayed. Farmers considering this area should not overlook the possibility of combining to buy a sheep farm and then splitting it into two or three dairy units.

The case studies are set out in the following tables and figures quoted apply to the 1979/80 financial year.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Definition of Dairy Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 2</td>
<td>Dairy Livestock Reconciliation</td>
</tr>
<tr>
<td>Table 3</td>
<td>Dairy Production Revenue Details</td>
</tr>
<tr>
<td>Table 4</td>
<td>Dairy Farm Cash Budget Summary and Economic Analysis</td>
</tr>
<tr>
<td>Table 5</td>
<td>Definition of Sheep Unit</td>
</tr>
<tr>
<td>Table 6</td>
<td>Sheep Livestock Reconciliation</td>
</tr>
<tr>
<td>Table 7</td>
<td>Sheep Unit - Revenue Details</td>
</tr>
<tr>
<td>Table 8</td>
<td>Sheep Farm Cash Budget Summary and Economic Analysis</td>
</tr>
<tr>
<td>Table 9</td>
<td>Sheep Unit to Dairy Unit Costs of Conversion and Return to this Capital Expenditure</td>
</tr>
<tr>
<td>TABLE 1. DAIRY FARM DEFINITION</td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td></td>
</tr>
<tr>
<td>Well developed - good management</td>
<td></td>
</tr>
<tr>
<td>150 hectares</td>
<td></td>
</tr>
<tr>
<td>120-130 ha border-dyked, automatic irrigation</td>
<td></td>
</tr>
<tr>
<td>28 cow turnstile rotary dairy</td>
<td></td>
</tr>
<tr>
<td>Farm fully subdivided with internal raceways</td>
<td></td>
</tr>
<tr>
<td>3 total labour units</td>
<td></td>
</tr>
</tbody>
</table>

Livestock carried

<table>
<thead>
<tr>
<th>Stock units</th>
<th>Livestock carried</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>360 cows (@ 7 s.u.)</td>
</tr>
<tr>
<td></td>
<td>70 yearling heifers (@ 4 s.u.)</td>
</tr>
<tr>
<td></td>
<td>4 bulls (@ 5 s.u.)</td>
</tr>
</tbody>
</table>

Total Stock units

<table>
<thead>
<tr>
<th>Stock units</th>
<th>Livestock</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2,820</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stock units</th>
<th>Stock units per hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18.8 s.u.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stock units</th>
<th>Stock units equivalent/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.68</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stock units</th>
<th>Stock units equivalent/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.09</td>
</tr>
</tbody>
</table>

Total Capital Value

<table>
<thead>
<tr>
<th>Stock units</th>
<th>Capital Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land &amp; Improvements</td>
<td>150 ha @ $2,200/ha ($900/acre)</td>
</tr>
<tr>
<td>Livestock</td>
<td></td>
</tr>
<tr>
<td>360 cows @ $300</td>
<td></td>
</tr>
<tr>
<td>70 1 yr heifers @ $150</td>
<td></td>
</tr>
<tr>
<td>5 bulls @ $400</td>
<td></td>
</tr>
<tr>
<td>Plant (excluding milking plant)</td>
<td>30,000</td>
</tr>
</tbody>
</table>

Total Capital Value $480,500
TABLE 2. SEASONAL SUPPLY DAIRY - CASH BUDGET

LIVESTOCK RECONCILIATION

<table>
<thead>
<tr>
<th></th>
<th>On Hand 1/7/--</th>
<th></th>
<th>On hand 30/6/--</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cows</td>
<td>360</td>
<td></td>
<td>Cows</td>
<td>360</td>
</tr>
<tr>
<td>Yearling Heifers</td>
<td>70</td>
<td></td>
<td>Yearling Heifers</td>
<td>70</td>
</tr>
<tr>
<td>Bulls</td>
<td>4</td>
<td></td>
<td>Bulls</td>
<td>4</td>
</tr>
<tr>
<td>Bull calf</td>
<td>1</td>
<td></td>
<td>Bull calf</td>
<td>1</td>
</tr>
<tr>
<td>Natural Increases</td>
<td></td>
<td></td>
<td>Sales</td>
<td></td>
</tr>
<tr>
<td>Calves (95%)</td>
<td>342</td>
<td></td>
<td>Cull cows</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bobby calves</td>
<td>265</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Heifers</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bulls</td>
<td>1</td>
</tr>
<tr>
<td>Purchases</td>
<td></td>
<td></td>
<td>Deaths</td>
<td></td>
</tr>
<tr>
<td>Nil</td>
<td></td>
<td></td>
<td>Cows (4%)</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Calves (2%)</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Heifers (2%)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>777</td>
<td></td>
<td></td>
<td>777</td>
</tr>
</tbody>
</table>

The above assumes a status quo or stable situation with no change in livestock numbers or levels of production throughout the period.
### TABLE 3. REVENUE DETAILS

Butterfat Production (replacement calves reared on whole milk).

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Price</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>350 cows @ 140 kg/cow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>49,000 kgs B/fat @ $1.80/kg</td>
<td></td>
<td></td>
<td>$88,200</td>
</tr>
</tbody>
</table>

Livestock Sales

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Price</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cull cows</td>
<td>46</td>
<td>$200</td>
<td>9,200</td>
</tr>
<tr>
<td>Cull Heifers</td>
<td>8</td>
<td>$180</td>
<td>1,440</td>
</tr>
<tr>
<td>Bobby calves</td>
<td>265</td>
<td>$25</td>
<td>6,625</td>
</tr>
<tr>
<td>Bull</td>
<td>1</td>
<td>$400</td>
<td>400</td>
</tr>
</tbody>
</table>

Total Livestock Sales: $17,665
**TABLE 4. DAIRY FARM CASH BUDGET SUMMARY**

<table>
<thead>
<tr>
<th>Expenditure</th>
<th>Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal Health</td>
<td>Butterfat Production</td>
</tr>
<tr>
<td>A.I. Breeding Costs</td>
<td>$88,200</td>
</tr>
<tr>
<td>Herd Testing</td>
<td>Livestock Sales</td>
</tr>
<tr>
<td>Dairy Shed Expenses</td>
<td>$17,665</td>
</tr>
<tr>
<td>Electricity</td>
<td></td>
</tr>
<tr>
<td>Hay (twine &amp; cartage)</td>
<td></td>
</tr>
<tr>
<td>8,000 bales @ 40c</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous contracts</td>
<td></td>
</tr>
<tr>
<td>Fertiliser &amp; lime</td>
<td></td>
</tr>
<tr>
<td>Weed &amp; pest control</td>
<td></td>
</tr>
<tr>
<td>Water charges</td>
<td></td>
</tr>
<tr>
<td>Freight</td>
<td></td>
</tr>
<tr>
<td>Wages (2 labour units)</td>
<td></td>
</tr>
<tr>
<td>Repairs &amp; Maintenance</td>
<td></td>
</tr>
<tr>
<td>Vehicle Running &amp; R &amp; M expenses</td>
<td></td>
</tr>
<tr>
<td>Administration</td>
<td></td>
</tr>
<tr>
<td>Prof. fees</td>
<td></td>
</tr>
<tr>
<td>Telephone &amp; mail</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Standing Charges</td>
<td></td>
</tr>
<tr>
<td>Rates</td>
<td></td>
</tr>
<tr>
<td>Insurance</td>
<td></td>
</tr>
<tr>
<td>Current account interest</td>
<td></td>
</tr>
</tbody>
</table>

| **TOTAL**                   | **$41,300**           |
| Economic Farm Surplus       | **$64,565**           |

(The economic farm surplus has to meet the following charges: debt servicing, owner's reward, taxation, capital and development expenditure and depreciation.)

- Economic Farm Surplus per hectare $430.4
- Economic Farm Surplus per Stock Unit $22.9

\[
\text{Total Farm Expenditure} = \frac{41,300}{105,865} \times 100 = 39\%
\]

\[
\text{Total Farm Capital} = \text{Gross farm Income} = \$480,500
\]

\[
\text{Economic Farm Surplus} = \frac{64,565}{480,500} \times 100 = 13.44\%
\]

This 13.44% represents the return to the owner operator's labour, management, and capital, as no wages for management have been allowed for.
TABLE 5. SHEEP FARM DEFINITION

Equivalent farm to the dairy example used

150 hectares
120-130 ha irrigated
Well developed unit
2 labour units

Livestock carried (Coopworth flock)

<table>
<thead>
<tr>
<th>Livestock</th>
<th>Number</th>
<th>Stock Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ewes</td>
<td>2,300</td>
<td>2,300 @ 1 s.u.</td>
</tr>
<tr>
<td>Ewe hoggets</td>
<td>600</td>
<td>600 @ 0.8 s.u.</td>
</tr>
<tr>
<td>Rams</td>
<td>30</td>
<td>30 @ 0.8 s.u.</td>
</tr>
<tr>
<td>Killers</td>
<td>20</td>
<td>20 @ 0.8 s.u.</td>
</tr>
</tbody>
</table>

Total Stock Units = 2,820
= 18.66 per hectare
= 7.55 s.u./acre

Total Capital Value

Land and Improvements
150 ha @ $1,600/ha (approx. $650/acre) $240,000

Livestock

<table>
<thead>
<tr>
<th>Livestock</th>
<th>Number</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ewes</td>
<td>2,300</td>
<td>@ $20</td>
</tr>
<tr>
<td>Ewe Hoggets</td>
<td>600</td>
<td>@ $25</td>
</tr>
<tr>
<td>Killers</td>
<td>20</td>
<td>@ $15</td>
</tr>
<tr>
<td>Rams</td>
<td>30</td>
<td>@ $30</td>
</tr>
</tbody>
</table>

62,200

Plant

30,000

Total Capital Value $332,200
### TABLE 6. SHEEP UNIT - CASH BUDGET

**LIVESTOCK RECONCILIATION (Coopworth flock)**

<table>
<thead>
<tr>
<th></th>
<th>On Hand 1/7/--</th>
<th>On Hand 30/6/--</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ewes</strong></td>
<td>2,300</td>
<td>2,300</td>
</tr>
<tr>
<td><strong>Ewe hoggets</strong></td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td><strong>Killers</strong></td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td><strong>Rams</strong></td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2,950</td>
<td>2,950</td>
</tr>
</tbody>
</table>

**Natural Increases**

<table>
<thead>
<tr>
<th></th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lambs (110% S to S)</strong></td>
<td>2,530</td>
</tr>
<tr>
<td><strong>Ewes</strong></td>
<td>458</td>
</tr>
<tr>
<td><strong>Lambs</strong></td>
<td>1,910</td>
</tr>
<tr>
<td><strong>Hoggets</strong></td>
<td>38</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2,406</td>
</tr>
</tbody>
</table>

**Purchases**

<table>
<thead>
<tr>
<th></th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rams</strong></td>
<td>8</td>
</tr>
<tr>
<td><strong>Ewes (4%)</strong></td>
<td>92</td>
</tr>
<tr>
<td><strong>Hoggets (2%)</strong></td>
<td>12</td>
</tr>
<tr>
<td><strong>Killers</strong></td>
<td>20</td>
</tr>
<tr>
<td><strong>Rams</strong></td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>132</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>5,488</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>5,488</td>
</tr>
</tbody>
</table>
TABLE 7. REVENUE DETAILS

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Price</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wool</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ewes 4.5 kg, Hoggets 4.0 kg, Ewe lambs 1 kg</td>
<td>13,275 kg</td>
<td>210c/kg net</td>
<td>$27,878</td>
</tr>
<tr>
<td>Livestock Sales</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wether lambs</td>
<td>1265</td>
<td>$13</td>
<td>16,445</td>
</tr>
<tr>
<td>Ewe lambs</td>
<td>645</td>
<td>$16</td>
<td>10,320</td>
</tr>
<tr>
<td>Old ewes</td>
<td>458</td>
<td>$10</td>
<td>4,580</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$31,345</td>
</tr>
</tbody>
</table>
### TABLE 8. SHEEP FARM CASH BUDGET SUMMARY

<table>
<thead>
<tr>
<th>Expenditure</th>
<th>Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal health</td>
<td>Wool</td>
</tr>
<tr>
<td>Stock purchases - 8 rams</td>
<td>Sheep sales</td>
</tr>
<tr>
<td>Shearing expenses</td>
<td></td>
</tr>
<tr>
<td>Electricity (farm)</td>
<td></td>
</tr>
<tr>
<td>Hay - 3,000 bales @ 40c</td>
<td></td>
</tr>
<tr>
<td>Freight</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous contracts</td>
<td></td>
</tr>
<tr>
<td>Fertiliser &amp; lime</td>
<td></td>
</tr>
<tr>
<td>Weed &amp; pest control</td>
<td></td>
</tr>
<tr>
<td>Water charges</td>
<td></td>
</tr>
<tr>
<td>Wages - 1 labour unit</td>
<td></td>
</tr>
<tr>
<td>Repairs &amp; Maintenance</td>
<td></td>
</tr>
<tr>
<td>Vehicle running &amp; R &amp; M</td>
<td></td>
</tr>
<tr>
<td>Administration</td>
<td></td>
</tr>
<tr>
<td>Rates</td>
<td></td>
</tr>
<tr>
<td>Insurance</td>
<td></td>
</tr>
<tr>
<td>Current account interest</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$27,500</strong></td>
</tr>
</tbody>
</table>

**Economic Farm Surplus**

Note, this has to meet the following charges: debt servicing, owner's reward, taxation, capital and development expenditure and depreciation.

**Economic Farm Surplus/hectare** = $211.50

**Economic Farm Surplus/stock unit** = $11.25

**Total Farm Expenditure**

\[
\begin{align*}
\text{Gross Farm Income} & = 59,223 \\
\text{Total Farm Expenditure} & = 27,500 \times \frac{100}{1} = 46.4\%
\end{align*}
\]

**Economic Farm Surplus**

\[
\begin{align*}
\text{Total Farm Capital} & = 332,200 \\
\text{Economic Farm Surplus} & = 31,723 \times \frac{100}{1} = 9.5\%
\end{align*}
\]

This 9.5% again represents the return to the owner operator's labour, management, and capital, as no wages for management have been allowed for.
TABLE 9. SHEEP UNIT TO DAIRY - COST OF CONVERSION

Livestock change - net cost $58,300
Additional house 32,000
28 bail turnstile cowshed and milking plant including tanker track, electricity connection etc. 62,000
Development work (subdivision, stock races, culverts etc.) 6,000
Trough water supply 6,000
$164,300

The expenditure of this $164,300 capital, results in an increase in the economic farm surplus of $64,565 - $31,723 = $32,842. (Difference between dairy and sheep cash budgets E.F.S.)

Therefore the earning rate of this additional capital can be assessed as

\[
\frac{32,842}{164,300} \times \frac{100}{1} = 20\%
\]

If we take the total farm capital of the sheep unit example and add to it the capital cost of conversion to a dairy unit we arrive at a total capital value of

$332,200 + $164,300 = $496,500

This equates very closely to the total farm capital of $480,500 as used in the original dairy example.
The detailed examination of these two case studies can be summarised as follows:

<table>
<thead>
<tr>
<th></th>
<th>Dairy Unit</th>
<th>Sheep Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Farm Capital</td>
<td>$480,500</td>
<td>$332,200</td>
</tr>
<tr>
<td>Gross Revenue</td>
<td>105,865</td>
<td>59,223</td>
</tr>
<tr>
<td>Farm Expenditure</td>
<td>41,300</td>
<td>27,500</td>
</tr>
<tr>
<td>Economic Farm Surplus *</td>
<td>64,565</td>
<td>31,723</td>
</tr>
<tr>
<td>E.F.S. per hectare</td>
<td>430.40</td>
<td>211.50</td>
</tr>
<tr>
<td>E.F.S. per stock unit</td>
<td>22.90</td>
<td>11.25</td>
</tr>
<tr>
<td>Total Farm Expenditure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Farm Income</td>
<td>39%</td>
<td>46.4%</td>
</tr>
<tr>
<td>Economic Farm Surplus</td>
<td>13.44%</td>
<td>9.5%</td>
</tr>
<tr>
<td>Total Farm Capital</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This percentage represents the return to the owner operator's labour, management and capital as no wages for management have been allowed for.

Interest Surplus

| Total Farm Capital | Dairy Unit | 11.4% |
|                   | Sheep Unit | 6.5%  |

(This represents the return to total capital after rewarding management ($10,000).)

Cost of Conversion: Sheep to Dairy

- Resultant increase in E.F.S. $164,300
- Return to Conversion Capital $32,842
- 20%

It is interesting to note that the return to the development capital is only 20% and this is somewhat lower than one may have expected. However, it should be noted that with dairying there is both guaranteed production and price while with the sheep units price fluctuations of both meat and wool compared to butterfat can be quite marked from one season to the next. For instance, the return to this development capital, if last season's product prices had been used, would have been closer to 30%.

* Note
E.F.S. has to meet the following charges: debt servicing, owner's reward, taxation, capital and development expenditure and depreciation.
In conclusion, it can be seen that seasonal supply dairying on irrigated land under today's costs and prices is more profitable than traditional sheep production and it could be argued that it does in fact constitute the highest and best use for this class of land.
In looking into the future prospects for the marketing of New Zealand dairy products, a degree of speculation is necessary and so I will start with the rather more certain ground of the current situation which will also be helpful in providing a framework for what is likely to be the future situation.

CURRENT MARKET SITUATION

The world dairy trade could be described as being basically in balance with a continuing strong demand for all products. In New Zealand for the second year in succession we are likely to finish the season with virtually no uncommitted stocks - a sold out situation. Across the Tasman, Australia is in a very similar position. Although the so called "intervention" stock piles continue to dominate the scene, there has been some improvement in the past year. E.E.C. skim milk powder stocks, for example, have continued to fall (from about 1.2 million tonnes in 1976 to about 600,000 tonnes now) whilst in Canada stocks are at very low levels and in the United States of America are about 25% down on the peak a year ago.

On the other side of the coin however, E.E.C. stocks of butter remain at a high level of over 300,000 tonnes and given the high
domestic price of butter to the European consumer and falling consumption in Britain, where retail prices have progressively reached the general European level, there is little prospect of an immediate improvement.

Turning to casein, we see that during the past two years world stocks have virtually disappeared and New Zealand has found itself as the supplier of about 60% of the total world market. This is a situation which is not altogether comfortable in terms of our vulnerability to competition from other producers who may come into the market with subsidised prices, but at least it gives us a degree of control and an opportunity to demonstrate our stability as a reliable supplier.

In this happy situation of a strong market and relatively low stocks or, in the case of New Zealand and Australia, zero stocks, it would be reasonable to expect that there had been a corresponding firming of prices. Regrettably, this has not been the case. It is an unfortunate fact of life that although New Zealand is a leader in the world dairy trade, and could therefore be expected to be the price setter in the world, the practical reality of the situation is that we are largely a price taker. The reason is not hard to find when you look at the pricing mechanisms of our major competitors in the Northern Hemisphere.

In each of the large consuming markets of the Northern Hemisphere production, consumption and price levels are separately determined by individual government support mechanisms, which maintain producers' incomes and screen the internal market external competition. Imports are restricted and kept at insignificant levels - currently at around four percent of the total milk production in the E.E.C., and under two percent in the cases of the United States of America.

Under such systems, price levels are arbitrarily politically fixed and do not move in response to changes in demand or supply. In addition, governments guarantee to purchase total surplus production if consumption is inadequate. Thus, the normal process of price determination is distorted and production need not respond to changes in demand; in fact, both demand and supply can move independently which results in a structural tendency to produce surpluses which, with the aid of export subsidies, are then
exported onto the international market, distorting their commercial price structures.

In these circumstances prices reflect not so much the normal market supply and demand circumstances, as the consequences of the decisions of the European bureaucrats in respect of the intervention or support price and the restitution or export subsidy. These two figures taken together in effect set the ceiling on the general world trade price and whilst we can seek, as we do, to secure a premium on this level on account of our quality, reliability of supply and other related factors, there is a limit to what is practicable in these circumstances. During the past year therefore, we have seen a situation where prices have advanced in terms of the United States dollar to a reasonable extent - indeed to a satisfactory extent taking account of the fact that there has been no basic change in the European intervention and restitution prices during the period - but these increases have been barely sufficient to offset the effects of a fall in the United States dollar value and the rising costs that continue to beset the industry in New Zealand.

FUTURE TRENDS

What then are the future trends in the world dairy scene? Obviously the situation in the E.E.C. must dominate the picture. In the immediate future, probably the most important event will be the decision on access to the British market for butter after 1980.

This is a political decision on which I am not qualified to comment, but we can look to the "Dublin Declaration" which provides that there will be certain access to the British market up to 1980, and that our tonnage entitlement after that date will be the subject of negotiation. Just what will result from these negotiations we will have to wait and see, but the Declaration includes these words:-

"As regards the annual quantities to be established by the Community institutions in the framework of the special arrangements after 1977 these should not deprive New Zealand of outlets which are essential for it."

This then is the commitment of the Community - the way in which it is exercised will, needless to say, be observed with considerable
interest by the New Zealand dairy industry and New Zealand as a whole.

During the coming year we expect two other events which will have a significant effect on our future business. These results from the GATT MTN discussions and will give us a renewed entry for cheese into the E.E.C. to the extent of 9,500 tonnes per year and an increase of our New Zealand quota for cheese into the United States of America to 17,400 tonnes or about double our previous quota. This figure for the United States of America is about the same as our actual imports during the last year, the reason for this being that we have been able to negotiate transfers of licences where these are unlikely to be utilised by the country in whose favour they have been issued, but the quota in our own name will give us an absolute entitlement for the future.

As part of the new import package, licence transfers will be no longer possible. The effect of these two new quota markets at relatively high prices, plus the existing quota for cheddar cheese into Australia, and the domestic market for cheese which has increased dramatically during the last two years, means that we now have secure markets for about half of our total available production in the coming year. We therefore have a base on which we can start to rebuild the cheese industry after the set-backs we suffered following exclusion of our product from the British market two years ago.

In looking to the slightly longer term, it is appropriate to consider broadly the position of New Zealand in the world dairy trade. In this regard there are several basic statistics that are particularly relevant. The first is the world production of milk, which is currently at a level of about 430 million tonnes per year. Of this total New Zealand produces only about six million tonnes or less than 1.5%. On the other hand, the international trade in dairy products amounts to only about 20 million tonnes out of the 430 million tonnes of total production or less than five percent and of that New Zealand accounts for about one third with about 80% of our total production being exported. New Zealand is thus in a unique position of having an industry which is heavily orientated towards the export market and producing a range of products specifically for the requirements of our export customers. This is in direct contrast
to all of our competitors who are producing principally for their domestic markets and exporting their surpluses. In many ways it places New Zealand in a weak position, but at the same time it can be appreciated that New Zealand has a unique role to play in stabilising the total world trade. This can be readily demonstrated by looking at the international market for butter.

Butter output in the E.E.C. is now around 1.8 million tonnes per year whereas the volume of butter imports in markets outside Western Europe at 200,000 tonnes is little more than one tenth of the E.E.C. production. Thus a three percent increase or decrease in production when exported or withdrawn from export could cause a 30% increase or decrease in supplies to markets outside Europe. Conversely, a three percent change in the volume of New Zealand production would cause only a one percent variation in the overall world market availability.

We can therefore say that in the long term New Zealand will continue to fill a vital place in the overall world trade by stabilising supply and pricing and producing premium quality products specifically manufactured against the requirements of customers around the world.

From all of this what conclusions can we draw in respect of the prospects for a dairy industry in South Canterbury? Obviously, the world market has the capacity to absorb the possible production of South Canterbury and the New Zealand Dairy Board has the organisation to sell it. The key question therefore is what price could be obtained for that extra volume and I believe that it would be fair to say it is unlikely that there would be any significant variation from the average return that would be produced by the New Zealand dairy industry in any case. In other words the scale of the New Zealand dairy industry is such that the likely increment in total production arising from possible developments in South Canterbury are unlikely to have a significant effect on the average overall industry return.

What this absolute level of return will be is, of course, the big question and regrettably international politics looms large and makes the answer particularly difficult to determine. There are few who would be bold enough to predict future returns, but this much can be said with certainty. The New Zealand dairy industry is amongst the most efficient in the world with costs equal to or lower than
anyone else and it has the organisation, a scale of operations, a willingness and the courage to take fair commercial risks. Inevitably there will be problems, but with its established resources and place in world trade, the dairy industry is better placed to survive and prosper in the long run than most others.
What I want to comment on concerns the landscape and how people influence the visual world around them. It is about diversity not diversification; we must work hard to maintain and develop diversity in philosophy, in jobs, in leisure, in our communities and in our landscape.

Much that is amiss today springs from a lack of diversity. Monocultures in our industrial, political and farming systems are costing us dearly. Our woolly national flock blinded us to other opportunities in animal breeding. Our British based animal and human stock should have been hybridised with the vitality of Europe's years ago. Our diverse New Zealand landscapes need to be developed to greater maturity especially at those points where man intrudes.

How many Hagley Parks or Tuileries Gardens have been created since the war?

Pioneering, clearing the bush, developing the land and buildings, and recent substitution of labour with capital have been features of several boom and bust eras.

Just as we watch a child grow, learn and mature so too it is interesting to watch a similar evolution of our landscape. The steps go from primeval to modified to established to sophisticated. I do not view sophistication as an artificial butterfly on the wall, the
chrome seal on the front lawn, or white painted concrete posts sitting in sterile soil. It is the careful matching of new structures, colours, designs and textures with old forms and masses in such a way as to improve or achieve compatibility with the original design by nature.

People are asking why a whole generation went by which hardly planted a tree other than straight rows of pines. Farming is emerging from the Romney - Angus - Radiata syndrome at last. Our younger generation is very conscious of its "environment" - a modern word for the landscape. There are signs that even Lincoln College is taking the hint and now giving a lead in exposing students to ideas that economics and chemistry are not all! The aesthetics of good design are important and so too is the reorganising of our social structures like employing more women in our male dominated rural community. Removing people and substituting them with capital is questionable. Not only for our farming communities, but also our farm production, the appearance of our countryside, our exports and national survival.

The community at large is now questioning man's impact on his landscape. A host of organisations are springing up expressing their views about conservation. They do not miss much, though their arguments are sometimes immoderate and unbalanced. The point that some of them miss is that the landscape, like man, is a constant state of evolution. It is never static. Drive along a road to work and every day you will see the scene is different. It is affected above all by man, but also by light, shade, colour, heat, cold, wet, dry, season, animal, disease, birth, life and death, all interacting in some way.

Generally speaking in the functional man-made landscape there is a reason for everything. In farming today we must accept the need for fast convenient access. The Greeks defined the straight line as the shortest distance between two points. It is the way we site our roads and fences at home. They also spent much time debating ideal proportions such as the Golden Section. The farm map above my desk is a mixture of my straight lines and nature's curves. When we study design we learn that curves are usually more pleasing than straight lines, that irregular masses are preferable to exact symmetry, that contrasts help, that colour is important. These are
basic instincts to anyone with an artist's eye, and contrary to what some people think, I believe an appreciation of them can be taught and certainly they can be assimilated by exposure to good examples.

My own interest in the subject arose from being brought up by talented, observant parents amidst one of New Zealand's more spectacular coastal landscapes near Dunedin, where, as a farming family, we enjoyed riding and walking the hills and coastline and swimming at a number of local beaches. A century ago those hills were covered in luxuriant native bush with handsome Kowhais, Broadleafs, Matais, and Fuschias in the moist gullies. We learnt the hard way that there is a fine balance between survival and extinction of the remnant patches of native bush which were uncut in the pioneering times. Mob stocking with sheep and cattle in particular was as devastating to the native bush as it was beneficial to our closely subdivided pastures. The early settlers there were familiar with Kiwis, and native parrots, now gone forever. The whales offshore were caught and the seals hunted. They are now replaced by surfies and Oriental squid boats.

What used to be a fairly densely populated community of small farms has changed. Farms have been amalgamated into a few hands. The people that left the district now return for Sunday drives in cars they could not have afforded had they stayed. The houses and farmyards left derelict by the amalgamation since the war are now being filled again with people who commute to work in Dunedin or go to university there. This readjustment may be working for the good of this community in that it is bringing people back to live there from a much more diverse background than before. Though I was dubious about the changes when we left the district, I am fairly sure now that they are for the good.

However that may be a familiar story for rural communities within fifty kilometres of a major centre.

The human side of rural communities further out is in a much more fragile situation and one about which all in our New Zealand community should be concerned, especially the politicians. The diminishing resource of people is having its effect on the landscape.
Many farmers are so bound up by the problems of survival that they are too busy to refine their landscape.

This brings me to my next point. Many of the great manmade landscapes of the world are a function of land, people, prosperity and leisure. The converse of a survival based community has seen them eating their seed grains, using their trees without replacing them, overcropping and underfertilising their land which then loses its capacity to provide. When this happens the people suffer, and land is ruined, and the nation collapses. There are numerous international and local examples.

Let me turn now to a specific example which I hope will illustrate one person's approach to practical landscaping. In 1968 I moved my wife and young family inland from the coast to embark on the taming of a large area of substantially undeveloped foothill property. 'Dunrobin' is a grazing run nestling into the Eastern slopes of the Takitimu Mountains in Northern Southland. Until fifteen years ago the property was relatively undeveloped. It ranges from highly fertile river silts at one end up to beech forest and snow at the top corner. In between are a wide range of soil types, some dry, some swampy, some bleak and exposed, others sheltered and kind. They test one's ability to the full.

The overriding feature is the tussock dominated and almost treeless landscape. The tussock is the perfectly adapted local plant vulnerable to modern farming methods, and one must be particularly careful to manage its survival. The tussock plains may soon be a thing of the past, and with their passing will go the nearly perfect shelter for new born lambs and fawns, the delicate colourful and expansive foreground to a spectacular mountain backdrop. The tussock provides the only forage for many of our stock in the irregular deep snowfalls, the only shelter-giving plant which cannot be thrown by our hurricane force Norwest gales, the plant which is perfectly adapted to this tough climate but which takes as long to form as a tree and is even quicker to destroy. We are replacing it with grassgrub and porina fodder. In two hundred years I hope our nation's botanists will have to seek tussock seeds elsewhere in the world to revegetate our work of this century.

A considerable area of tussock country on Dunrobin has been ploughed to establish new pastures, and the whole physical appearance of the
property is changing fast. The design and building of several houses, siting of roads, and farm buildings is being carefully planned. Now the extra touches of ponds and plantations are being added with the aim to end up with a workable and enjoyable place to live.

Many farmers could be making better use of water for visual and amenity purposes. Ponds for boating, swimming, duck shooting, skating, fishing or even stock water supply and irrigation are a valuable addition to any property. Planted attractively they provide continuous year round pleasure. The results of our plantings will not be really apparent for another ten years.

The advent of new methods means that the landscaping part of the job is more easily and quickly completed than in the past whilst not compromising the effective management of such a large area. I must add that we are only doing now what most of our neighbours did years ago. The big difference of course is that we have the benefit of modern machines which the earlier pioneers would have appreciated probably more than we do. The change from wild nature to high production cannot be done without changes to the native state but it can and should be done with minimum change and maximum sympathy.

Our changing landscape at 'Dunrobin' lends itself to exciting possibilities. No longer do the tussocks of the flats fuse gently into the tussock hills. A stark line now marks the edge of the ploughman's handiwork. This starkness can be considerably modified by the breaking of the straight lines through leaving an irregular edge to the tussocks, the judicious siting and planting of large and small ponds, which if sited with care create new flight paths for the duck population. These flight paths can be encouraged too by planting cereal crops along them, though the yields may make the few ducks shot rather expensive.

The presence of tracks and culverts, so essential for land development, means quick access too for fencers and planting contractors. Installation of piped stock water schemes enables one to consider localised trickle irrigation systems so helpful for establishing trees in awkward dry corners. Large machinery enables jobs to be done speedily that used to be long and tedious.
Much is written criticising the bulldozer and scraper for the mess they make, but I often wonder if the same critics realise just what power they have to improve and enhance our landscape provided of course that the planner is one jump ahead of a very quick devastator. The energy of the bulldozer's work in New Zealand and elsewhere in shaping the wide fast motorways and hydro schemes has been harnessed in tidying up and replanting the edges with trees, shrubs and grasses. The result in many instances are new manufactured landscapes which would have appealed greatly to Capability Brown. Lakes Aviemore, Tekapo and Benmore, with their beautiful plantings and planning for recreational camping, boating and picnicing, have already become a new sponge area for droves of holiday makers. They are reducing human pressures on places like Queenstown and Mt Cook.

We have harnessed the bulldozer and grader to form new roads. I know from observation that the wear and tear is greatly increased wherever there are corners. Vehicles throw the gravel to the outside especially if going faster than they should. Skiers do the same.

We made ten kilometres of new road recently and one of the straight stretches will end up being six kilometres long. This will need careful patch planting to reduce the monotony of driving along it. We are avoiding wherever possible straight rows of Radiata by interspersing with Eucalypts, Willows (Golden and Booth), and Poplars where the ground permits. Key focal points are being created for work centres and housing. We are concentrating on the establishment of a colourful variety at these spots. In some instances one is also able to combine them with a geographical feature such as a gully, pond, or the crest of a small hill.

The option for commercial forestry is open to us, but we are making haste slowly. It is obvious that the economics of forestry favour Pinus Radiata almost exclusively, so we have been concentrating on learning how to grow them at this altitude (250 - 925m) and in this windy drought prone climate before embarking on a large scale planting. We have learnt that the hybrid Poplars grow at a fast rate along the sheltered wet gullies and soon become a pleasure to look at. It appears that the dreaded Poplar rust is not going to be a problem in our climate. We are also planting Eucalypts (Delegatensis, Johnstoni, Fastigata, Nicholi and Leucoxylon Rosea)
Rowans, Silver Birches, and Willows such as Golden, Booth, Pussy, but not Crack Willows, Alders, Douglas Fir, Larches and Poplars both hybrid and Lombardy. One problem was that it has been difficult to obtain sufficient numbers of these species for our requirements. The bulk of our tree planting, thinning and pruning is organised with the assistance of a professionally trained forester who procures and grows on forest grade amenity species in his nursery, and these are procurable at considerable savings compared with the traditional nurseries. One still has to make good use of the Radiata as the pioneer shelter tree to aid establishment of the more pleasant species later on.

One has to be constantly alert to technical developments. There are a few which have greatly helped the tree planting efforts of the last few years. I have mentioned trickle irrigation which in the small areas we have been working has given us one hundred percent survival rate in two of the driest, and successive summers on record. Spraying new tree areas with Roundup, Permazone SDA, Paraquat, or Caragard with Simazine has greatly reduced the problem of smothering by grass or weeds. Fertilizers have been used and so has the controlled grazing of animals in one large area. However good the intentions, it is notable how often one neglects to trample that Coxfoot down in mid summer. We have been very pleased in particular with the benefits of riplines pulled in by either the bulldozer ripper or the mole plough. The trees are easier planted, the ground is cultivated in effect, survival rates are good and growth rates greatly improved.

I believe one should concentrate on a few key focal points wherever possible and develop them to please and function from all angles. One must start at the homestead and yards then other building points making good use of trees in particular and of natural features like rivers, mountains, hills, creeks, rocky outcrops or clumps of native bush. Views can be framed with trees, close intimate landscapes created, and contrasts of space developed.

Whilst it is easy to enthuse about trees and landscaping, it is paramount that one is practical. The basic layout has to be carefully considered, and be one which is entirely functional for efficient movement of stock, men and large machinery. Their efficiency is critical to a farm's prosperity, and the farm's prosperity
is a prerequisite to providing the means whereby one can design and build attractive housing, ponds and plantations. Likewise on a national scale the healthy appearance of our landscape depends largely on the prosperity of the farming community.

I personally dislike the attitude of many farmers who regard their farm solely as a place to earn money which they spend elsewhere. The satisfaction in designing and achieving areas of high amenity value on one's own plot of land is considerable. New Zealanders could learn a great deal from British and European experience at cultivating a totally balanced rural way of life. Their 'huntin', 'shootin', 'fishin', outlook has developed over the centuries out of a need for relaxation both for the landlord and tenant and well before the age of the motorcar. Thus their hedgerows and woods were carefully designed for the nesting and feeding of game, whilst lakes and ponds were carefully managed for the fish and waterfowl. Their much admired landscapes usually had functional origins, such as coppicing, growing Oaks for the navy shipbuilders or Walnuts for furniture and the kitchen. It appears to me that rising fuel and holiday accommodation costs will make our communities much more attentive to their immediate environs in the future.

Never before has the need for good design been greater. Both our urban and rural communities must demand sensitive placement and design of new buildings. They should insist that the farming community get its new houses, barns and tracks in order too. The planners' efforts to date have tended to be confined to the urban scene. They must look outside their city and even national boundaries.

Eight years ago, I argued provocatively with our mercenary minded farm consultant about the need to hide farm tracks in order to leave the foothills unscarred. After years of pulling my leg, he has now seen the merit of this and the mess made by many of his clients. He is now pleading with them to think before they let the bulldozer loose again. We could all have prevented much of the visual mess had we been introduced effectively to the need to consider the landscape appearance when being trained at Lincoln College or elsewhere. It horrifies me whenever I make this point to visiting farmers or students, it is almost invariably a totally new idea to them.
I would suggest to you that the farmed landscape whose characteristics we control, has a lot more people concerned about its visual and spiritual nature than we realise. It is always changing but nevertheless its appearance over the next hundred years is greatly influenced by what we do today. It will be our own memorial. The more aware and involved people are with the landscape the more they will be rewarded with the treasures it can offer. If we cultivate our rural communities as carefully as we do our land, the vitality of the landscape will to a large extent take care of itself.
LONELINESS AND ISOLATION IN RURAL AREAS

This session consisted of a series of four brief addresses and was followed by general discussion.

The four speakers were:

Dr S.P. Lay, Medical Practitioner, Kaponga, Taranaki

Mrs S. McCrostie, Secretary, Wairarapa Community Action Programme, Masterton

Mr D.W. Azelbie, Part time teacher and rural resident, Karamea, Westland

Mrs L. Avery, farmers wife, Wairau Valley, Marlborough
When first asked to come down from Kaponga and address you on this question of loneliness it was not very difficult to persuade me because I feel that this subject is of vital concern, and besides I always enjoy visiting this area. My qualifications to address you on this subject are no better than those of many other rural G.P's who have served their communities for many years.

After leaving hospital service I was in practice for two years in Collingwood, and since then I have practiced for eighteen years in Kaponga, which is a small town in South Taranaki. When trying to enlighten strangers as to the whereabouts of our small town I like to think of it as being the southern gateway to Mount Egmont or the northern lights of Kapuni.

The town itself has a population of 500, and in the surrounding rural area there are about 2,000 people and they are mostly dedicated to the Jersey cow! However, in the area we also have the natural gas industry, a big lactose factory, and, at the moment a lot of discussion is going on about the proposed urea plant to be established in the vicinity of the natural gas plant. Therefore after 20 years of practice in country communities I feel that I have gained some insight into the problems of loneliness which may beset rural people.

In the brief time allotted to this wide-ranging subject one can only hope to cover it generally, and to give some indication perhaps of
the means to cope with the problem. One must therefore admit that there is a problem. Different perhaps from our suburban women, but nonetheless present.

Loneliness is the noun of the adjective lonely, and means, lone, solitary, without company. It also means destitute of sympathetic or friendly companionship or relationships. Here then is the meaning and also the clue to solving the problem.

Lonely also means remote in a physical sense from people or places of human habitation, and this, I think, is very relevant to some of the audience here today. We must distinguish between aloneness and loneliness.

There are times when in the midst of the hurly-burly of life we scream "Give me a moment's peace and quiet, let me alone ..." but there are times when the wish is granted too fully and the peace and quiet stretches from aloneness down into the bottomless chasm of loneliness. It is this negative side of the coin which concerns us here - the destitution of the human spirit, the lack of sympathetic friendly companionship and relationships, the physical remoteness, the inability to communicate.

Loneliness I think is a very individual thing, it varies from generation to generation, and means very different things to each person and each age, although they all have in common lack of people sympathetic to their needs. With imperceptible slowness or blinding suddenness we can find ourselves alone in the aloneness of sudden crisis, the solitariness of the romantic adolescent girl, the numbing loneliness of bereavement, the sudden emptiness of the home when the children have departed, the aching loneliness for the letter that never comes, the loneliness of sickness and pain and disability, the silent turning back on oneself in old age when you belong to no one and no one wants to be bothered with you, the problems of a broken marriage or those associated with alcoholism. Each and every one of us at some time will go through one, some, and maybe all of these experiences.

Let us examine some of these more closely. The newlywed young woman. If she had been born and bred in the country she will probably cope very well for she knows the ropes and what may be expected of her.
However, the city girl who happens to fall in love with a young farmer, and no knowledge of what is in store for her may very well fail miserably, and if she has not got the sense to adapt quickly or leave quickly she could soon be a nervous wreck. In the area in which I work I see lots of girls from this last situation. From being a 35 hours a week worker in an office job or some such they are thrust into a sharemilking position with only their husbands and themselves to do the work, going from 5 a.m. in the morning to 6-7 p.m. in the evening, and very soon beginning to wonder what life is all about. They may be surrounded by people but do not have the time and energy to meet socially with these people. Many of these girls soon go home to mum, or some other man who can provide at least some freedom and social life. It is important that these girls are told by their husbands-to-be what to expect, how to cope with the impending situation, and once love's first rosy glow is beginning to fade, should then sit down and analyse the situation long before they ever commit themselves to it.

The teenage girl with no close friends readily available. Parents and siblings no matter how understanding cannot completely fulfil this individual's needs. From time to time threats to leave home, tantrums about not being allowed to have the car, not being allowed to go to parties, arguments about the latest in vogue hairstyles, tatty jeans worn around the place, boyfriends who never come up to one's parents' expectations - these are reflections partly of growing independence but also of loneliness. A close female friend is a boon - they can bitch to one another for awhile about non-understanding parents and so on, eventually calm down and all is well until the next crisis comes along, and of course in a young teenage girl's life they appear to be endless.

The mother whose children have left home. Most of us from time to time have said "It will be a blessing when the kids are off our hands ..." but in actual fact when this time comes most mothers do not know how to cope. They have a home which is too large, a cooking-cleaning-washing load which is too small and unless one has prepared for this event in life, loneliness once again becomes a problem. Selfless devotion to one's family is not necessarily good, and in fact becomes a disaster unless one has prepared in various ways for this eventuality.
The widowed farmer's wife. I guess depending upon the man you have been married to, this may or may not be a lonely state. Assuming though that the marriage has been successful; the number of times I have heard "Oh, so-and-so has been left well enough off financially" so that after the initial condolences nothing further is done to help this particular person. The woman who is alone is also very lonely and fair game to all sorts of "con tricks". How many women really know how to cope with estates, large sums of money, how to approach bank managers, accountants, lawyers, even how to change a fuse - these people need close friends in their lives. Likewise, of course, the widowed person who is left with very little in the way of financial support - she can be too proud to admit that there are problems, and likewise she should be sought out and helped.

Professional men's wives. Here I include lawyers, bank managers, school teachers, accountants and doctors. On this I can speak with some authority. Most small rural areas do not have many of these people but for some strange reason they seem to be put apart or on pedestals, and as a result their wives suffer terribly. I find this a very sad state of affairs, and also wonder why this should be. Doctors after all are human beings, and they have their problems, failures, their ups and downs, difficulties with children, in the same way as do the rest of you; and it is a continual source of puzzlement to me as to why we should be isolated. We are accepted on to committees, local bodies, hospital boards etc. but we are often not accepted socially. Fortunately in our area one can get away from this and make friends outside the community. Speaking with other professional people in rural areas they likewise have the same problem.

Another problem is the lone elderly person of sound mind and body. Personally I think such people should be left in their familiar communities with their relatives and friends as long as possible, and in many instances as long as possible means until they pass on. I do not think the answer to these people is to place them in hospitals or old people's homes. How often do we hear the story "Well dad (or mum) I think you will be far better off in an institution with people of your own age", but if you talk with these old people you will soon find that they for the most part
do not like the situation in which they are placed and would be far happier in surroundings which they know and with people they know. I think it is an appalling state of affairs when we see fit elderly people placed away in institutions. I fully realise, of course, that there are many who need to go to these institutions where they receive specialised help, but this is a vast problem and outside the scope of this discussion.

Now then, how can we try and cope with the problem of loneliness. Let me say here and now that I believe that loneliness should not exist apart from a few special cases involving remoteness in the physical sense. The fact that it does exist is a direct reflection on our society, on the way we live, think, and/or do not think. It seems to me that possessions have taken pride of place over people in our thinking. We now have no time for people, let alone their problems. At the beginning of the century most people lived in close-knit communities which did not move out of the area very much, and the pace of living was such that nearly everyone knew everyone fairly intimately, and it was soon apparent to all when problems were starting and most were soon dealt with locally. Social workers, doctors, psychiatrists, psychologists and so on were not available, yet the problem of loneliness, minor mental problems, and social problems were dealt with promptly by the community.

Today when things are not right and most of them are recognised too late, the cry is to get the doctor, priest or whoever, and pass the buck, and in a lot of cases all could be easily solved by a little caring and common sense. It is no good saying after some suicide "If only I had known". In this respect our forefathers can teach us a lot. Writing letters, keeping in contact with friends and so on seems to be going out of fashion. So then, get to know your neighbours. When a new person comes to the district or you meet a person who may have been around some time but not met, get to know this person. If you just discuss the weather, babies, or nappies and leave it at that you will really have found out nothing - ask a few direct questions. What do you do, do you like this place, are you lonely, have you any hobbies, have you any problems, how are your husband and children, would you like to come and have a meal with us? Having found out a bit
more about this person you may decide that you would like to see more of her, or you may decide 'No, I don't think this person is for me, but I think she would get on very well with so-and-so'. Somehow or other if she falls into the latter category try to arrange an introduction, preferably I should think over a cup of tea or over the dinner table. Introduce Mrs X to the person whom you think she may get on with, and explain why. Be direct, show an interest, care about people. This I think is the best way to combat loneliness at all levels.

Next, we must look at ourselves as individuals. We should look over very carefully the treasurehouse of our own inner resources. Loneliness does not only affect those in the country; in fact I think most country women are better equipped to find answers to their problems than their suburban cousins. I can but salute those amongst you who from their own personal resources can find a work plan for coming to terms with their problems of loneliness. One calls to mind the writings of Mona Anderson and Mary Scott - their experiences in remote country districts; entertaining reading they make of it but it must have taken great inner resources and personal endurance to come to terms with it as it was happening. In my own area I have a champion spinner and weaver whose hobby claims many totally absorbing hours which could have become a deadweight of depressing loneliness had she let them, and she tells me "You never see an unhappy spinner or weaver - it is so creative!".

I see stress, therefore, the importance of having an absorbing hobby. It does not really matter what one does - writing, reading, stamp collecting, an interest in the garden, tramping, natural history, photography, handcrafts - anything so long as it holds your interest and gets you away from the humdrum activities of everyday life. Better still, if one is able to share one's hobby with husband, children and friends.

At the community level, get involved with some of the organisations which abound in most rural communities - sporting activities, drama clubs, school committees, your own Women's Division of Federated Farmers, and so no. And do not be afraid to do so. One must do one's bit in the community and put into it some of the things we expect to get out of it.
Other ways in which one can help to avoid loneliness are by educating our children to care, and trying to get them to marry wisely. I have maintained for a long time that parents could pick the best spouses for their children, but of course this is not acceptable to the younger generation who are all screaming for independence. However, a lot of future trauma could be avoided under this system.

To marry within the community would be an advantage particularly from the point of view of the woman. To have friends and relatives around I am sure makes life a lot easier, and the advantages of this set-up in my opinion outweigh the disadvantages in most instances.

Let me try to summarise. In all aspects of loneliness the missing ingredients are human contact and human understanding. I know of no magic touchstone to give us an instant remedy. The only therapy I know is to try and put back into our lives a feeling of caring, of concern for people, and involvement with people, and the simplest approach is to talk - just plain honest-to-goodness talk, just being a good neighbour and talking with its corollary of being a good listener. Develop an absorbing hobby or hobbies, and do your own thing.

Lastly, involve yourself in some of the broader community affairs which interest you. If some of these suggestions are followed I am sure most of you will never have time to be lonely.

Let me finish with a quotation which St. Paul said to the Hebrews -

"To do good, and to communicate, forget not, for with such sacrifices God is well pleased."
LONELINESS AND ISOLATION IN RURAL AREAS

D.W. Aislabie

Karamea
West Coast

My experience has been one of frustration as I attempted to integrate myself into a tightly knit isolated community in the north of the West Coast.

In retrospect the biggest blunder we made in our move to the country three years ago was to turn up in an old kombi van with psychodelic paintings emblazoned upon it. We were unaware at the time of the affect this would have on the people of Karamea, and of the conclusions about us they would make.

We got to work on our rough but beautiful 40 acres trying to establish a small market garden. In those first few months our hopes and spirits were high. We were finally doing what we had long planned and saved for. It was then that we became aware of the wild rumours that were circulating about us; rumours of hippies, communes and even drugs. It seemed that in a community where gossip is a way of life, that "judgement had been pronounced" - we had been found guilty without a trial. Suddenly the isolation of this community became more real. We began to have serious doubts about the wisdom of our move. I then had to leave to teach in Westport for three months to replace a teacher who had died. This left my wife alone in a small caravan back in Karamea. We had by then made a few friends and they helped us through this rough patch. We began to hope that our frustrations would pass as the community got to know us. We had built a large packing shed and we applied to the Buller County
Council for a permit to build a house - and permission to move from the caravan to the packing shed in the meanwhile.

I imagined that acceptance would be a mere formality, but the Council made it clear that there may be some problems. Six months, two hearings and a change of use application later, the door was slammed in our face. Their official explanation was "That they doubted if a market garden could become an economic unit". There seemed no logic in refusing a man the chance to try and set up a market garden in a region which has always had to bring its fruit and vegetables from hundreds of miles afield. Perhaps logic is the first thing the Council threw out the window when they thought they were dealing with hippies.

Our financial and emotional commitment to our place was too great to concede defeat, so we took our case to an appeal court. We won the case easily which brought us some satisfaction and the Buller County Council a bit of discomfort. But the $800 cost and the senselessness of it all left me bitter towards those responsible. The majority of the community while still sceptical, - were convinced that our intentions were sincere. We made friends rapidly after this and the community began to make us feel welcome at last. Our feelings of isolation and loneliness - which at times had been intense - largely disappeared. We have worked hard the last two years and gained the respect of most of the community. It is obviously possible, given an effort by all, to overcome the superficial differences which tend to divide people in rural areas.

The geographical isolation of communities like Karamea tends to mould peoples attitudes. The presence of a more uniform group of people than the cross-section you get in urban areas tends to reinforce the values and prejudices of like-minded people. This can produce a narrow view of what is normal.

Many rural communities are very intolerant towards new people, with different backgrounds, attitudes and lifestyles. In Karamea there seems a real fear of such people in the district. They are derisively labelled as hippies and treated as aliens, a threat to the established normal way of life. Attitudes to them range from fear and loathing through to "They're all right but I wouldn't want my
daughter to marry one".

This frustrating attitude would be a little more understandable if people were less indiscriminate about who they label hippie. In my case I was labelled a hippiedespite having a university degree, teaching in secondary schools for five years, and washing behind my ears every night.

On the West Coast at least, the criteria for membership of the hippie club are very broad. The slightest deviation from a narrow accepted norm can make you eligible for life membership. This entrenched attitude would be laughed at in urban areas. But believe me, it is not a laughing matter when you are on the receiving end in a rural community where acceptance by that community is so important.

We are all familiar with rural depopulation and the decline in community vitality and services which accompany it. This decline will no doubt continue as farmers combat rising costs by farm amalgamation and replace labour with machines. However the present trickle of people like myself moving into rural areas will snowball and may even reverse the present exodus away from the country. Generally these young people will be from middle class city backgrounds and often highly educated. They will be seeking a rural lifestyle and many will accept a lower standard of living in order to achieve this. Some will be more interested in subsistence and self sufficiency than conventional farming. Others will be prepared to farm marginal and "uneconomic" land and accept relative poverty as a reasonable sacrifice. There will also be many part time and hobby farmers who will have different attitudes to the land and how to farm it.

The different attitudes and values of these more cosmopolitan people will no doubt change the nature of many rural communities. I believe they will add diversity and flavour to some otherwise bland communities.

No doubt many rural people will feel threatened and resist these changes. The competition for land between existing full time farmers and these newcomers will become intense. The potential for conflict
and extreme polarisation of rural communities exists; and will largely depend on the attitude of existing landholders. More than just a few farmers seem to feel that as existing land owners they have an exclusive and God given right to more land. They justify this attitude in the name of increased production per man which they wrongly equate with efficiency. In their attempt to place New Zealand's precious land resource into fewer and fewer hands they are aided and abetted by government agencies such as the Rural Bank, the Department of Lands and Survey - and some County Councils. I am hopeful that as the political powers of farmers declines on both a national and local body level this cosy arrangement will end.

I ask that farmers accept that these changes will be inevitable as they are due to social pressures too strong for them to resist. This acceptance will go a long way towards preventing a permanent rift in rural communities between the various interest groups. Such polarisation can benefit no one, and will only further weaken rural communities in their struggle to maintain essential services.

I am sure that many young and energetic New Zealanders have been permanently disillusioned by illinformed prejudice metered out to them by an unsympathetic community. Their loss has also been the community's loss.

I therefore appeal to farmers to live up to their rural reputation for warmth and kindness extended to others and assist these young people who come into their districts. Suspend judgement on them until they are known better. Look for the common ground between established members of the community and the newcomers rather than look for the differences. If casual labour is needed, offer them a job. If farmers have land they do not really need they should not be so reluctant to sell it. I am sure the sale will make someone very happy and the extra people will strengthen their community; it is through people that we measure a community's wealth.
I guess my qualification for talking about isolation and loneliness in rural areas is the fact that I have for five years been the wife of a farm worker, and, more recently, my appointment as secretary-bursar of the Wairarapa Community Action Programme (C.A.P.) These experiences have taken me to many rural areas and brought me in close contact with farmers, their wives, farm workers and their families, and has introduced me to many of the employers.

One of the farmer's main problems, as told to me often, is the continual worry of keeping farm workers for any great length of time. With that problem in mind, I would like to comment on loneliness, isolation, and frustration - not in the geographical sense, but in the farm and working sense. These three feelings - loneliness, isolation, and frustration, - between employer and employee do exist; isolation need not necessarily be geographic, but is more often psychological and emotional.

My own married life started as a clergyman's wife in Southland, where we spent five years in a rural farming area. More often than not we mixed with farmers and their wives; very rarely, I realised much later, with farm workers and their wives. After a full three years we met and became friendly with a farm worker and his wife. We listened patronisingly to their problems; we now realise that we didn't even begin to understand what they were talking about, or just how important our supposed support was at the time to them.
Their problems were:

* a cottage that needed attention
* not enough wages
* how were they going to cope with boarding school fees when that time arrived, and so on

They were unable to broach these or many other problems for fear of upsetting working and living relationships on the farm.

This then was my summary of our conversations. "Moaning, unfair, certainly very ungrateful, and obviously very, very jealous of their employer, the farmer", I thought. Little did I know then what was ahead of me!

For eight more years my husband, family and I worked for the Church until he decided to quit his job and wanted to try his hand at something completely different. He chose - farm working.

We moved to a Wairarapa stud and cattle farm consisting of 1,000 acres of beautiful, fertile land. We moved from a large house to a 900 square ft. cottage. First shock - just how do you when you are really faced with it, move into a very limited space - two or three times smaller than your employer's home. I wonder whether that difference in size is even thought about; and the small cottage type accommodation is still being built for farm workers in many places. I wonder how many have lost their farm worker because of inadequate housing - be it for reasons of space or inferior conditions? Maybe a few changes in these conditions would have prevented their going.

"Well for heaven's sake", I can hear you saying, "there's no problem there. If that's one reason why farm workers leave - why don't they discuss it with their boss?"

Why not indeed!

I know from my own personal experience, that although we had extremely good relationships with our farmer and his wife, it was always hard to bring up and discuss issues that inevitably meant more money - or more of their finance to be put towards making our lives and conditions slightly more comfortable.
Another problem that comes up, particularly when someone is new not only to the job of farm worker but also to the area, is a lack of understanding from the already established farming community itself; and it's almost unseeming lack of forgiveness to forget early errors by the newcomers. For example, one farm worker's wife told me that after moving into their new area and position - very, very green - she acted completely out of character, out of sheer loneliness and frustration, and a need to be accepted, by talking to one family about another. What she had failed to realise was that although they had different surnames they were actually related as indeed most of the district was. Because she had been told that these two families did not get on well together, she had not thought it important to be discreet. Needless to say, the old say "Blood's thicker than water" turned out for her, to be so very true, and to this day, (nearly 18 months later), she is still paying to some degree for her error. Belonging, I have discovered on talking to people within my job, seems to be very important - along with being able to contribute. In fact, being able to contribute is a very important way of being allowed to feel you belong.

Let me ask how your local school committee is made up; is it made up of only long-standing farming families, or is there a good balance between farmer families, and farm worker families? I know of an area where the entire school committee is made up of different members of the one family group, in spite of repeated efforts of farm workers and wives to make the committee.

I met a farm worker recently who felt very aggrieved about the lack of understanding he received from his farmer. It had got to the stage where he had left farming. If he had been able to discuss these issues he would, I think, still be happily employed in agriculture.

As a farm worker he resented

* Not being a good security risk with the bank manager. Cheques were bounced on three separate occasions because wages were late in coming - through the farmer's negligence. The cheque bounced was always the one presented to the grocer.
Not being a good security risk with the garage, where for example he was asked to pay cash for his trailer's warrant of fitness - in case he left the district without paying the bill.

Having to ask for time off or even having to ask for a change in work timetable.

Having to ask for his next issue of supplied meat.

Having to ask for his next supply of firewood.

Having to ask for a new issue of wet weather gear.

He resented the fact that his wife had to work so that they could make ends meet. He resented it when his boss did his home garden on a weekday or took weekday time off to do business in town - neither of these privileges were made available to him.

Perhaps at the root of all this is a lack of empathy, and this is a basic cause of isolation.

For example - does the farm worker have any real understanding of the responsibility on the farmer's shoulders - the responsibility to maintain the profitability of a half million dollar enterprise? And does he resent the farmer's freedom to decide how so much money can be spent from week to week?

Does the farmer have any real understanding of the frustration within the farm worker, as he attempts to cope with the day to day needs of his family? Does he envy the farm worker's freedom to pack his bags and move on when the mood takes him?

In case you now think that the whole farmer, farm worker scene is completely negative, let me tell you about an event which I had the privilege to take part in - the "Tuturumuri Road Show". It was organised for the first time by our Community Action Programme (C.A.P.), after a group of Tuturumuri residents had mentioned to us that, because of their geographic isolation they could not take part in city based courses. Their interests included instructional courses,
educational and hobby type classes. We decided to take tutors to the pupils - for a change - with about twenty wide ranging subjects - from hairdressing, butchering, guitar playing, basket weaving and human relation type groups to reading groups, gardening and breadmaking. C.A.P. organised and ran the first weekend but the second year saw Tuturumuri running their weekend themselves apart from some small help from us.

The terrific sight of both farmer and workers and their families involved in organising and planning and finally sharing the weekend together is something that will stay with me for a long time.

The experience showed quite clearly that some of the so called barriers I have talked of earlier need not exist - with lots of patience and a genuine desire from all people the situation can be very different.
My account starts at the point where, after two and a half years of marriage and being a married couple on a North Canterbury property, my husband decided to apply for a farm managers position. But he quickly discovered that his lack of experience with beef cattle would be a big hindrance. Hence the hunt for a suitable job in order to gain that knowledge, a hunt which eventually led us to a job in Marlborough - outback, no school, isolated. Never really giving the matter serious thought, I travelled to 'Glengyle' with my husband, bumping, jolting and swaying along an atrocious road for an hour and a half to spend a pleasant afternoon with the owner. We ended up with the position and two rather frantic weeks later we were there. For me that began the most demanding, frustrating years of my life.

Qualifications for Coping with Isolation

What qualifications does one need to cope with isolation? Mine were definitely lacking - as a matter of fact they were non-existent. Born, bred and educated in Christchurch I was very much a social city type, a keen theatre goer, involved in repertory, a former training college and part-time university student, seven years teaching in mostly district high schools, living in hostels with other teachers, participating in many activities including Country Girls Clubs, all the time surrounded by people and involved in many spheres, even for the first two and a half years of marriage. Despite this great track record, there I was, before I seemed to have a chance.
to blink, moving into a tiny, pink, two bedroomed dolls house at
the very end of a shocking road over forty miles from Blenheim,
eleven miles on a goat track from our mail box, twelve miles from
my nearest female neighbour and overawed by the magnificent
scenery surrounding me.

Adaptation to my new situation was the next hurdle. At first every­
thing was novel and there was a lot to be learned about the farm.
The two men were friendly, good to us and my little son, and had
even asked the woman on the station across the river to ring and
make me feel welcome. This she did a couple of days after our
arrival, and that was the beginning of a marvelous friendship, even
though it was months before I actually met her in Blenheim and the
voice became a warm, concerned human being. In the years to follow
she was to prove herself a substitute mother, sister, 'granny' to
my children, marriage guidance councillor, mentor, and general
listening post. The first local woman I met invited me to attend
W.D.F.P. in order to meet others who lived in the community. As a
result I drove out in all weathers to enjoy the company of other
adult females every six to eight weeks. The family travelled to
Blenheim every month to buy groceries and other shopping, and I
quickly became adept in planning ahead to cater for birthdays,
mother's day and visitors. Baby number two duly arrived and I was
busy with my small ones. Walks about the house area provided a
break from my small home which was becoming confining at times, and
did wonders for me mentally and physically.

Confrontation with aspects of isolation began during my third
pregnancy, when I experienced chronic depression for the first time
in my life. It was accompanied by a painful physical problem in
the second three months, and the two combined brought me to the
brink of insanity. My reaction was to take it out on my innocent
children and many a time I wept after being far too harsh on them.
I felt so ashamed of myself but also powerless to control the depth
of feeling welling up inside. Many a time I grabbed that phone in
order to regain my sanity with a quick reassuring chat to 'over the
river'. In the end I begged my parents to come for a couple of
weeks and as a result of their loving care, I managed to pull myself
up the hill to better health. It was at this time that I seriously
started to query my marriage relationship, my ability to mother
children, my worth to the community and my adequacy to cope with our
lifestyle. However with the arrival of the baby and all the family excitement at the wonder of it all, those queries were pushed aside. I was too busy coping with three children under three years of age to give serious consideration to anything.

Desperation in isolation seemed to creep up on me so very quickly that to this day I find it difficult to pin-point the down turn, but in the third and fourth years of living in this area, the loneliness, the separation from my closeknit family, from normal community life, the frustrations of existing in a small house, the limitations and ponderous responsibilities of three small children, and my own pigheaded independent attitudes toward marriage culminated in the start of a nervous breakdown. The night of realisation is still fresh in my memory. It was both frightening and a tremendous relief. For some time I knew something strange was happening to my mind but did not confide in anyone because it would have meant admitting defeat and I was too proud to do that. I could not tell my doctor, who is a tremendous person; how could he understand the crippling effects of living in cramped conditions when he had just moved into a two storey architecturally designed house. How could he understand the financial burden of having to buy a large car which would take the stress and strain of our dreadful road when our wage of $40 a week was barely adequate to live on; he had just bought himself a new station wagon and his wife had her own little car to use. Naturally I kept these things bottled up.

My husband who was always so helpful and considerate just could not see why I was upset, he was thoroughly enjoying his work and in the constant company of men. I kept quiet at home until 'that night'. It changed everything, because next day after a long tearful phone call across that river I started to think very seriously about the causes and what I had to do in order to survive in isolation, as well as consider those close to me who were suffering. Revelation came slowly. It was obvious to me that we were destined to stay at the end of the road for longer than I had anticipated. Therefore, in order to be happy I had to make life bearable, interesting and challenging, so I looked for alternatives and let my mad sense of humour run riot. Instead of regretting the lack of theatre participation, I drew out some meagre savings and started a piggery, even though I knew nothing about pigs. This has created a hobby which has developed into a challenging business and a source of
income - all mine! I accepted the office of secretary in our W.D.F.F. branch and became more involved; this meant extra trips out, but I was finding another alternative. All of a sudden life took on new meaning and I became elated at making success out of what had been failure.

Childrens Education in Isolated Areas

Education in isolation of course meant, for me, correspondence school. With the arrival of the first sets of work I was like the phoenix rising from the ashes and began to feel that, at long last, I was making a very real contribution to society. Now I was back in harness, but oh what a rude awakening in the years that followed! School in the home was so completely different from school in the classroom. The dual role of mother/teacher creates extra tensions and stresses which develop further frustrations. I am totally involved with school for at least five hours a day, and constantly with my children twenty-four hours a day, seven days a week and fifty-two weeks a year. It seems as though life will never be my own and that my true identify has completely drifted out the window. If that is not enough, I have to feed two or three single men together with others like the shearers who live in, and also cope with all those casuals who are constantly interrupting my school days. Then and now when I feel myself sliding again into the abyss of fatigue, I find strength and courage to battle on, through my association with some tremendously understanding teachers, more phone calls 'across the river' and the sold basic help my husband offers whenever possible.

My relief from this constant pressure of school was to enjoy the Parents' Association, where I later took office, and met other women facing the same problems. I developed a staunch belief in the need for financial recognition by government to the all important role of teaching mothers, especially those women like myself faced with educating our children during those formative years of primary and sometimes secondary level. As a result of my vociferous outpourings on this subject, I very happily attend political meetings and campaign vigorously around parliament on every convenient occasion.
Communications in Isolated Areas

Communication in isolated areas is another problem facing us. Our road can be blocked so quickly by flash floods or landslides, our telephone contact with the outside world washed away in a matter of hours - and it may take two or three months to restore the line. Quite frankly I do not know what I would do without the phone as over the years it has proved my lifeline, keeping me going to face another day. It also provides contact with the rest of New Zealand and our dwindling local community. Forest now covers a large area of our nearby farmland and only a few families remain to work the land. All the women attend W.D.F.F. as it provides both an opportunity to see each other regularly and a chance to hear stimulating speakers. Outings are rare but in recent years, with the children growing older, we make an extra effort occasionally as a family group. Naturally I appreciate the kindness of friends and take pleasure in having them visit; I really enjoy entertaining. Recently church services started on a monthly basis at the local hall - twenty three miles away - and have provided our family with the opportunity to worship together, thus enriching our lives and breaking down yet another isolation barrier. To me it is so refreshing to participate. My problems have strengthened by faith, and God, who had seemed so distant, has become an invisible but close friend continually helping me remove those formidable frustrations.

Reconciliation

Reconciliation with my isolation came nearly four years ago when a large company bought the farm, and another sixteen miles away, as part of an afforestation programme. They asked my husband to manage both properties. I am so thrilled about his new position and the chance for him to prove his ability as both farmer and administrator. It did not send me scuttling for cover at the prospect of living where we are until retirement. As a matter of fact, the whole idea left me full of exhilaration, anticipation and a new awareness of my own potential inabilities to cope with the challenges the years ahead will hold. At long last I moved into the roomy, redecorated homestead, a new woman, my dream realised. I know my children love the farm and our way of life; they enjoy
their days at school, when we go to town, and they look forward to school camps where they meet other children from isolated areas and different backgrounds. They are enthusiastic about lone cubs and brownies, and they so unselfishly help around the house and farm, with the odd moans of course, something which also makes life easier for me.

Conclusion

I look back on the last nine and a half years for evaluation. The whole experience has been one of lifes most difficult but rewarding lessons. I came to isolation young, overconfident, illprepared, convinced of my mental and physical prowess, rather materialistic and ready to show the world how it could be done, only to discover a few home truths about me, my attitudes and inadequacies. However, like other New Zealanders who have been prepared to take the gamble of living and working in isolated areas, I stuck it out for the sake of the love of the land which stirs deep in my heart. With a fascinating future ahead, a wonderful, loving rock of a husband at my side, three healthy, effervescent children to raise and a stable solid marriage strengthened by the considerable strains of the past, I look back on those first five years of trials and adjustment with affection and deeper understanding. Part of me still remains in that little house, what survived of my youth and single life, my vanity and my utter selfishness. On the other hand I have taken from it something I had not comprehended before - the beauty and joy of being alive, the strength of the family unit, the wisdom of God and a humble set of values.