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1967

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# PROGRAMME

**1967**

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"The Market Position"

THE WOOL COMMISSION AND WOOL PRICE FLUCTUATIONS


On 1st January, 1952, the New Zealand Wool Commission officially started in business. During the fifteen years which have passed since then, the Commission has been quietly and efficiently standing behind wool marketing in New Zealand, sometimes buying a little, sometimes quitting wool and sometimes as in 1957/58 and 1958/59 entering the market substantially in pursuance of its obligations.

Ultimately, and by the very nature of its existence, indeed by the very reason for its existing, the Commission was called on to act and it has done so with a smooth efficiency which has surprised many people closely connected with the trade. But like a peace-time army which has been engaged mainly in sporadic skirmishes and only one serious bushfire for most of its life, the Commission, is now subject to questioning — has it contained the initial shock; should it retreat; by refusing to retreat will it lose the war; are its reserves adequate; and even, is its policy soundly based?

These questions generally reflect the particular vested interests of those who ask them but they are given added force by the serious economic crisis which now faces New Zealand. The vital importance that wool holds in the New Zealand economy would at any time have required particular attention to be directed to any major recession in wool prices. This season the attention is accentuated. The issue ceases to be one of interest to the woolgrower and the wool trade alone and becomes an issue of national importance.

The Joint Organisation

What is the background to all of this? For some years prior to 1st January, 1952, the wool industry leaders had been preparing for the liquidation of the Joint Organisation — or to give it its true name — the U.K.-Dominion Wool Disposals Ltd. and its offshoot, the New Zealand Wool Disposal Commission. The Joint Organisation had inherited war time stocks of wool and the Disposal Plan agreed to call for a review of operations in 1950. As the time for this review drew near, it became apparent that stocks would be sold at an early date thereafter, and accordingly the review discussions centred around the form of marketing to be adopted in the Post-J.O. days. The experiences of the period of disposal had convinced the market countries — New Zealand, Australia, South Africa and Britain, that there were advantages in continuing this form of marketing and a plan to achieve this was formulated for submission to member Governments at a Conference held in London in January, 1950. There were subsequent discussions in Melbourne later that year and a comprehensive plan was agreed upon. New Zealand indicated its support of the plan, but after Australian growers rejected it in August 1951, the proposal collapsed.
The J.O. had been a particularly successful co-operative exercise in the orderly disposal of wool. The initial stock of wool consisted of 10,407,000 bales of which 1,777,000 was New Zealand wool. It had been feared that the disposal of this wool in addition to that being currently produced would disrupt the market. At the outset, the operation was one which involved risk for the participating countries and it was with concern for the burden placed on Britain as the country holding the wool, the Dominions had participated. Each Dominion was required to accept the financial responsibility for its wool — in New Zealand's case, the value after certain adjustments was £13.3m. — a liability accepted by the Government. In order to provide against loss in its initial stages, a Contributory Charge was levied on growers. The J.O. operation was not conceived as a charitable gesture towards Britain, or the Dominion woolgrowers, but rather as an exercise designed to share the risks and organize the disposal of a large wool stock — a supply equal to two full years clips of three Dominions.

I will not go into detail on the disposal, but it is worth noting that during the first year of operation (1945/46) demand recovered at a rate far in excess of that anticipated. The J.O. was marketing not only wartime stocks but also the current clip and in the words of its first report “refrained from exploiting its semi-monopolistic position at that time”. It seems that memories in some sections of the wool trade are short.

Post-J.O. Marketing

When disposals were finally completed, a profit of £20mn accrued to New Zealand, but before this, the Melbourne Conference referred to earlier set down its plan and in addition released a statement which could well be taken as the first principles of the New Zealand Wool Commission which was the only survivor of the scheme. Included in the statement were the following comments:

“It was agreed that the prevention of unduly wide fluctuations in wool prices was desirable in the interests of both producers and consumers, and that international action to modify such fluctuations was appropriate in times of both burdensome surplus and great scarcity.

“In view of the technical problems in the marketing of wool, including the auction method and the great variety of grades and types, a system of reserve prices which might be an adaptation of the Joint Organisation mechanism would be appropriate to modify sharp downward movements in prices. It would be advantageous to have such a mechanism in existence”.

It was further agreed that there would be international consultation if buying-in operations assumed substantial proportion. These consultations would consider the representations of producer or consuming countries.

Embodied in the proposed plan itself were certain guide rules for determining the reserve prices. These were:

“(a) In a market where prices are high, there would be a wide margin between market prices and reserve prices. It is not proposed to fix an upper limit to reserve prices. These, however, would not be set at a level higher than the
1950/51 general level of reserve prices of the Joint Organisation unless justified by a significant increase in the general level of commodity prices since the time of the determination of those reserve prices.

(b) In a market where wool prices are not unduly high nor unduly low in relation to general price levels, the margin between market prices and reserve prices would be more moderate, the objective being to stiffen the resistance against a possible fall in the market whilst leaving adequate flexibility for general market conditions to operate. In determining reserve prices for such a market, regard would be had to the trend of general commodity prices, the level of wool prices ruling during the preceding season, and an assessment of the future market trends for wool.

(c) In a period of low market prices, reserve prices would be set at a level close to those prices. In such conditions the objective would be to offer still greater resistance to any downward trend. At the same time in fixing reserve prices, regard would continue to be had to the trend of general commodity prices, the level of wool prices ruling during the preceding season, and an assessment of the future market trends for wool. The participating Governments would have further in mind that very low prices would have an undesirable effect upon the future supply of wool and upon the general economic position of wool-producing countries and general international trade”.

The New Zealand Wool Commission

When the Australian rejection of the Plan was announced in August 1951, the New Zealand Wool Board was ready with an alternative Plan. From the inception of the J.O. there had been close cooperation with the New Zealand Government, which had after all underwritten the whole venture, and which had caused the Contributory charge system to be set up. In an exchange of letters dated 27th August 1948, the then Minister of Finance, the Rt. Hon. Walter Nash, agreed that surpluses from the Contributory Charge and profits from the J.O. should be used as the nucleus of a fund for the establishment of a post-J.O. Marketing Plan for wool. On 15th June 1950, the Rt. Hon. Mr S. G. Holland confirmed this arrangement when writing concerning the opening of the Wool Industry Deposit Account.

The Wool Board had gone on record in support of a continuation of the scheme and in its 1952 report reviewed the negotiations subsequent to Australian rejection and stated “during all the discussions, the Board kept in close touch with the Government and it had the understanding and help of the Minister of Marketing, Mr K. J. Holyoake, who favoured some plan of price support”. The negotiations to which the Wool Board referred, were those with its Electoral Committee and with Federated Farmers. A number of schemes were suggested as alternatives, the Board indicating clearly its preference for what is now known as the Minimum Floor Prices Plan for Wool.

Substantial support was received and the Wool Commission Act 1951 was passed into law. Initially the Act was for one year (it covered the period 1st October 1951 (retroactively) to 30th September
1952) and the Minister of Marketing indicated that the Government would require the support of a substantial majority of woolgrowers before it would re-enact the legislation. The industry, through Federated Farmers gave overwhelming support and the legislation still stands.

Thus the Wool Commission can trace its origin to J.O. and its support from the Wool Board, Federated Farmers, the Electoral Committee and both political parties.

Adoption of Minimum Price Plan

The two main questions directed to woolgrowers in late 1951 were whether:

(1) The growers insisted on freedom to market their own individual clips at auction: or

(2) They were prepared to have an organisation of their own to buy or take over their clips and market them.

If growers favoured plan No. (1) they were offered: (a) a subsidy plan whereby grower receipts would be brought up to some previously determined over-all average. Payment was to be at a percentage on growers' receipts and there was to be no appraisal. (b) The Minimum Floor Prices Plan with which we are now familiar and which of course allows for supplementary payment up to the floor price level or at the discretion of the Commission, the purchase of wool at the floor price. All wool is appraised.

The alternatives suggested under the second Plan were: (a) a system of guaranteed prices on the lines of the dairy produce guarantee, whereby an authority would buy growers' clips at a price settled on the basis of costs of production and such other factors as were deemed relevant. Disposal was to be at Auction. (b) Purchase of clips on the basis of initial progress payments, plus a further amount at the end of the season based on sale results. In a poor season, a subsidy would be paid from a capital pool.

Acquisition was rejected by the great majority of growers who favoured individual marketing of clips and the continuation of the open auction system. The proposal for a subsidy in relation to the seasonal average was rejected because anomalies in prices were perpetuated in the payment of the percentage additional price and there was no appraisal of the clip.

The Wool Board advocated the minimum floor prices plan and stated that it was an underwriting plan to protect growers when prices were low with a floor price at a level which would keep the industry afloat and functioning.

Main Powers of Wool Commission

The principal function of the Commission is to assure minimum prices and it has the necessary powers to do this. Included are:

1. The preparation from time to time of a table of minimum prices. In preparing this table the Commission is directed to have regard to:

   (a) Current trends and prospects in international markets, and in prices of commodities generally, and particularly those commodities that enter substantially into international trade.
(b) The amount of available financial resources.
(c) The views of the Wool Board.
(d) The maintenance of production of wool in New Zealand.
(e) Other matters as the Commission from time to time deems relevant.

Before any table of minimum prices is effective it must be approved by the Minister of Agriculture, thus preserving the Government participation in the scheme which as I have already pointed out, has been a feature of wool marketing since 1945 through the J.O. and of course during the commando period of the war.

It is provided that the table may be changed but excepting in exceptional circumstances, no changes may be made so as to take effect during any period of twelve months. Thus, there is no requirement on the Commission to announce its Floor Price annually. The stipulation is that having set the floor price, the Commission should hold it for twelve months, the period to be shorter only if there are "circumstances" which are deemed by the Minister and the Commission to be unforeseen or exceptional such as substantial alterations in exchange rates, or widespread economic crises.

2. The Commission may supplement auction prices for wool up to the minimum price level as fixed or appraised. This power has not been exercised.

3. The Commission has always exercised its alternative power to buy wool at its minimum price. It is empowered to store wool and sell it in New Zealand or elsewhere. In this respect, the Commission's announced policy has been to sell bought-in wool at auction, although the Act does not prevent sales by other methods.

These then are the main powers of the Commission —
1. To prepare a table of minimum prices.
2. To support prices.
3. To buy wool at auction at minimum prices.
4. To sell wool.

Finances of the Commission

The Commission's initial capital was derived from

(a) Profit from J.O. ... ... £20,137,207
(b) Surplus from Contributory Charge 6,442,113

Total £26,579,320

Prior to the establishment of the Commission the New Zealand Government had withdrawn £19.6mn from J.O. and this money had been invested mainly in New Zealand Government Securities domiciled in New Zealand.

The Wool Commission Act states that the Minister of Finance shall authorise the investment of these funds.

In anticipation of discussion on the domicile of reserve funds, I wish to revert to the position as it was in 1951. Profits from the
J.O. were remitted from time to time to the New Zealand Government, which was in effect the owner of these funds. The Government initially transferred the money to the credit of the Wool Industry Deposit Account at the Reserve Bank and with the agreement between the Secretary to the Treasury and the Chairman of the Wool Board invested the balance in Government securities. This principle was referred to in a letter from Mr Holland to the Wool Board dated 15th June 1950, and published in the fourth annual report of the New Zealand Wool Disposal Commission. Subsequent remittances were dealt with similarly.

The Contributory Charge, being a deduction from sale proceeds payable to growers in New Zealand (the charge was also partly a stabilisation measure) was all invested in New Zealand Government Securities.

Initially, both the J.O. profits and the Contributory Charge represented holdings of foreign exchange. All of these funds became part of official reserves and were used by the Government of the day according to the requirements of the day. I do not have available the domicile of reserves on 1st January 1952, but by 30th June 1953, when the Commission's capital had increased by £800,000 to £27.4mn the disposition was as follows:

<table>
<thead>
<tr>
<th>Domicile</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.Z.</td>
<td>£24.3mn</td>
</tr>
<tr>
<td>U.K.</td>
<td>3.1mn</td>
</tr>
<tr>
<td></td>
<td>£27.4mn</td>
</tr>
</tbody>
</table>

The course of events is slightly involved. Technically, the Government as a partner in J.O., a venture involving a degree of risk, received profits of £20mn for its enterprise. In addition, the Government had withdrawn £4.6mn from growers, partly as a stabilisation measure, but also as a contribution towards any loss on realisation of stocks and towards running expenses. The Government recognised that these funds morally belonged to woolgrowers and agreed with the industry that they should be used in a function beneficial to the industry. The funds were accordingly returned to the industry, which in turn loaned them to the Government. In this way the Government received foreign exchange (for all but £3mn) and recognised its loan by the issue of New Zealand Government Securities domiciled in New Zealand. Most of the £3mn foreign based securities were New Zealand Government U.K. based stocks.

Thus the Government spent the borrowed foreign exchange for its purposes which undoubtedly contributed to New Zealand's development.

Attention is of course now focused on the fact that reserves are too low and that the pressures caused by the wool situation are accentuated by the lack of reserves to compensate for payments from the Commission. This is fair criticism, and it would have been prudent to hold foreign exchange reserves to meet some part (certainly not all) of the Commission's capital. It would have been unnecessary to earmark reserves specifically for the wool account, provided that in its consideration of the level of reserves required, the Government had recognised the probable liability. Unfortunately this aspect of the
level of reserves deemed adequate, has received as little attention as the level of foreign exchange reserves in general.

The Present Situation

I have given particular emphasis to the background to the New Zealand Wool Commission, including the factors influencing its policy, the support given by all parties, its powers and its financial policies.

The success of the J.O. in disposing of a large stockpile cannot be taken as a reason for assuming that such operations will always be successful. The only major consideration was the physical restriction in resuming textile production and this was greatly helped by Marshall Aid. Estimates of demand were too low and the stockpile was liquidated in less than half of the time originally estimated. In addition there was virtually no competition from competing synthetics.

The demand for medium to strong crossbred wool did not recover as quickly as did the demand for finer wools and in the second J.O. year, there was very extensive buying-in of New Zealand wool. This wool was removed from the market during a period of over supply and subsequently sold satisfactorily. These experiences in the value of a reserve price were not lost on the industry, hence the development of the present system.

The story of today is quickly told. Up to the Christchurch sale on 8th May the Commission had purchased 453,673 bales at a cost of £22,400,000. The scale of operations was perhaps greater than had been anticipated, but hardly more alarming than the 1946/47 situation. In that year offering at auction of greasy wool was 895,000 bales. A further 333,000 bales came from the stockpile while 106,000 bales were bought in. Stocks held on 30th June 1947 were 1,092,000 bales. Certainly the market situation was different, but there was disquiet about the demand for our wools.

In the event demand recovered and prices for medium to strong crossbred wools improved to a level far above the pre-war levels and induced farmers to increase production to the extent that we now have.

The Commission Activity

Total offerings of wool to 8th May 1967 were 1,470,608 bales so that purchases of 453,673 bales represent 31 per cent. The average price to 8th May was 35.83d per lb — there is a technical reason why this price is lower than the average floor price of 36d. There are more detailed figures available for the period up to 28th April 1967 as follows:

<p>| Offerings   | 1,409,595 |</p>
<table>
<thead>
<tr>
<th>N.Z.W.C.</th>
<th>415,170</th>
</tr>
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<td></td>
<td>994,425</td>
</tr>
</tbody>
</table>

The Commission made bids on 695,160 bales up to this date, so that of the 994,475 bales sold, 279,990 were sold at prices at least 4d above the floor price level, and without doubt some further sales were made at the floor price level, as buyers achieved knowledge of the floor itself.

It is purely guesswork to say to what level prices would have fallen without the intervention of the Commission, but at least the
Commission forced the price for a large volume of wool up to the floor.

The Commission is of course operating on an unprecedented scale, although total stock holding is not as large as it rose to during the war. Mr E. L. Greensmith, the Chairman, has announced that "the Commission is and will continue to be a firm holder of the stocks of wool it owns. These stocks will not be sold until the market is able to absorb them at prices not lower than the floor price for each type involved".

The stockholding policy is to hold wool in New Zealand. This policy is followed so that stockholding can be achieved as cheaply as possible in relation to the cash outlay and the expected return. The best storage is in Brokers' stores because wool does not require too much handling. Brokers' stores can only handle a proportion of the clip at any given time and during the course of a season require space for the regular flow of wool. The woolbrokers are co-operating fully in the provision of storage, as is the Government and from my observations so are those firms and organisations with space available.

Shipments to overseas locations have naturally been considered and the policy taken into account has been consistent — what is the best return for the cash outlay. Care must be taken to avoid flooding a market and also to obtain the greatest degree of competition when the sale is made. The only established location for sales to suit our requirements is London, although even at this centre competition from Japan and the U.S. is eliminated.

Scoured wools and star lots can be sent to London and some other wools have been shipped in order to establish an overall portfolio, so that wool is available when recovery occurs. To the end of March 25,425 had been bought in London so that shipments for portfolio purposes may not be very substantial.

When shipping is considered, we must weigh up the costs of shipment against the cost of storing wool here. It probably costs more to ship wool than it does to store wool.

The Commission has financed its activities by the sale of its securities. In his address to the Electoral Committee, Mr Greensmith said that sales were made in the first instance to the short term money market and then there was an arrangement with the Government for conversion of a large part of the Commission's remaining securities to a new basis, whereunder an interest rate of 4 per cent would be payable, but the securities would be encashable with the Government in amounts as required. This arrangement has facilitated the purchasing operations to date.

I do not have the Commission's analysis of wools bought to date, but understand that this will be published very soon. Up to the end of February when the Commission had purchased 210,000 bales, the following break-up was published:

<table>
<thead>
<tr>
<th>Quality</th>
<th>Purchases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>56's finer</td>
<td>2,006 bales</td>
<td>1</td>
</tr>
<tr>
<td>48/50's to 50/56's</td>
<td>22,543 bales</td>
<td>11</td>
</tr>
<tr>
<td>46/50's coarser</td>
<td>185,454 bales</td>
<td>89</td>
</tr>
</tbody>
</table>

It is easy to see that the major slump in prices has been for coarse wool.
An Analysis of the Present Situation

Before the opening of this season there were no clear indications that a fall in demand of the magnitude which we have seen, was about to occur. Consumption was at a high level and the increased New Zealand production of 11½ per cent during 1965/66 had been absorbed at satisfactory prices.

During the whole of 1966, world wool consumption was 3 per cent higher than in 1965. However, there were indications of a deterioration during the last quarter of 1966. Although actual consumption was higher, the daily rate of consumption was significantly lower. These statistics were not available until April, and at that stage could only confirm what was and what had happened.

It is obvious that wool purchases take place at some time preceding the production of a finished or semi-finished product. This the fall in demand which became apparent in real force in December 1966, was the first substantive indication of what was to follow. In the meantime wool has been exported from New Zealand at a level close to that of last season, indicating that users or merchants have been working off stocks. This explains why the reduction in the level of consumption has not been as great as the reduction in the demand for New Zealand wool.

As yet, there are no figures available for world consumption for the first quarter of 1967, but it is clear that a substantial fall has occurred. Figures for Britain, for example, show that the rate of consumption of wool in March was 10 per cent lower than a year ago and that production of man-made fibre tops was down by 7 per cent. The rate of production of wool and hair tops drawn for worsted spinning was down by 14 per cent and further along the chain, the delivery of worsted yarns was down by 16 per cent. Tops passing through the Bradford Conditioning House during the period January-April 1967 were 18 per cent less than during the same period a year ago; wool was down by 24 per cent and worsted yarns by 14 per cent.

The weekly rate of fibre consumption on the woollen and worsted systems in the U.S., and this included man made fibres, in February 1967, was 20 per cent lower than a year ago, with wool use down by 22 per cent.

These are substantial reductions in consumption. It should be noted that these results are not confined to coarse wools, but that they are spread right across the board.

There are clear indications that a major fall in the textile cycle has occurred. This has not only affected wool consumption, but has also spread to synthetics. Synthetic production has been increasing at a very rapid rate for many years, but there were actual declines in some categories during the last quarter of 1966 in the U.S. In addition to this, there have been a series of price reductions in the quoted prices for synthetics, both in America and Britain.

The result of these pressures needs no further explanation. Supplies of all fibres are exceeding the demand, prices are falling and the Wool Commission has moved in to protect our woolgrowers, which is what it was set up to do.
Before leaving this section, I wish to offer a comment on the competition from wools of other origins. Regularly we hear that Australia and the Argentine are underselling us by a large degree. I will readily admit that the quoted prices support this contention. But I must rely on the published statistics which show that neither of these countries produces sufficient of these wools to undercut us for any long period. It would perhaps be true to say that in the light of the reduced demand, some of these wools are selling. The facts of the matter are that Argentine exports of 46's and coarser were 22,751 tons* (153,000 bales) during the period October, 1966, to March, 1967, and that unshipped stocks were 41,349 tons (278,000 bales) compared with last season's figures of 27,239 tons (183,000 bales) and 36,261 tons (249,000 bales). Australian exports of 56/50's down were 21,649 bales. These exports are very small compared with those of similar qualities from New Zealand.

**Conclusion**

I have brought this section of my address to a fairly rapid conclusion. I had wished to speak mostly about the origins of the Wool Commission so that discussion could be taken with a clear understanding of the background.

To round off the discussion, I have a few comments to offer about the course of events which will follow during the next few months. I believe that the Floor Price scheme has admirably fulfilled the functions which it was set up to do. It has maintained farmers' incomes from wool at the floor with the objective of keeping the farmer afloat and functioning.

It has maintained the price of wool for 270,000 bales of wool at a level above the floor.

It has withdrawn wool from sale and so relieved the pressure.

It has proved to the trade that it is a firm stockholder at the floor.

I consider that we are in the course of a deep recession in the textile cycle, a recession caused by factors outside our control. There are some indication that restrictive pressures are easing as may be seen from the reduction in the British bank rate and just last week by a reduction in the German bank rate.

I consider that the long term demand for wool — type textiles will again be reinstated, but I will not hazard a guess as to when this will be. The long term demand referred to suggests that demand will increase by about 5 per cent each year. When this present down-turn passes, recovery will follow.

The Floor Price Plan is a plan which has been designed to cope with fluctuations in market prices. Inherent in it, is the assumption that prices will always recover. The limits to this kind of operation are imposed by financial resources, storage, and an assessment of any probable harm to the market, by the withdrawal of supplies.

I have shown that supplies are in fact being still forwarded to users and that the main shift has been a run down in stocks. To some degree, the stockholding function has been transferred to the Wool Commission.

*Converted to standard N.Z. bales of 333 lbs.*
The burning question — a question which has been debated at
length throughout the country, is whether or not to change the level
of the Floor, or indeed, whether the whole scheme should be scrapped.

I consider that the scheme should not be scrapped, because an up-
turn will surely come.

On the question of the level of the Floor there are some points
to consider:

1. What would be the effect of lowering the floor? Would
   this enable the Commission to sell all wool to be offered and
   what would the effect be on stock wool?

2. If it is considered that the Floor should be dropped, what
   would be the new level — would it be to 34d, 28d, 24d?  
   There is no proof that a fall in the Floor to any particular
   level would be to the right level. Further, this could well
   be what users are waiting for.

3. If the Floor were removed altogether, what would be the
   effect? Would any more wool be sold? If the wool were sold,
   would this not be to the buyers of speculative stocks, because
   in the light of present demand for textiles, there would be
   little hope that it would go into consumption.

Perhaps it is better that the Wool Commission should be the
speculator and then any profit would accrue to New Zealand.

Thus there are many imponderables involved in any prospective
change in the Floor and I feel that on balance there should be no
change.
DIVERSIFICATION OF MEAT MARKETS

C. Hilgendorf, Meat Producers' Board, Canterbury.

In New Zealand we produce less than 2 per cent of the world's meat but on the other hand we export 13 per cent of the meat which enters into world trade — a very significant proportion.

This season we should produce 840 or 850 thousand tons of meat; of this we shall eat rather less than 300,000 tons or about one third leaving some 550,000 tons for export. Of this in round figures —

over \( \frac{1}{2} \) or 300,000 tons will be lamb.
about \( \frac{1}{3} \) or 120,000 tons will be beef.
about \( \frac{1}{6} \) or 90,000 tons will be mutton.

Most of the remainder is offal.

Though we eat one third of our meat production the proportion of each type varies greatly. Thus we eat nearly all our pig meats; nearly \( \frac{1}{2} \) our beef; more than \( \frac{1}{3} \) our mutton but only \( \frac{1}{16} \)th of our lamb.

From the very beginning of refrigeration, through both World Wars and until the end of Bulk Purchase in 1954, the U.K. was the market that took nearly all our meat. At the end of Bulk Purchase Agreement the New Zealand Meat Producers' Board of the day made a momentous decision. Unlike the Australian Government, they declined a minimum price — guaranteed continuity of supply arrangement with the U.K. Government, thus leaving exporters free to sell where they wished.

The thinking behind this decision (and it remains valid today) was —

1. That, the population of the U.K. was likely to increase at something less than 1 per cent per annum.
2. That we could increase our share of the sales of imported meat — particularly lamb.

BUT

3. That our production was increasing at 4 per cent per annum.
4. That both political parties in the U.K. were committed to a system of support for British agriculture which would increase both the amount and the proportion of home killed meat marketed.

The population has continued to increase slowly: we have increased our share of the imported meat trade — our lamb has largely replaced Argentine and Australian — and also our own mutton: our production of meat has continued to increase at a high rate: imported meat has remained stable at a little over 1,000,000 tons: consumption of home-killed has risen from 800,000 in 1946; 1,400,000 in 1954; to 2,300,000 in 1966.

Since 1954 we have been fairly successful in diversifying our meat markets. At that time we were sending about 350,000 tons to U.K. and we have never greatly exceeded that figure, though the proportion that is lamb has increased greatly.
BEEF

Beef, in a way, has diversified itself simply because the price was better elsewhere. As has been pointed out we eat nearly half our beef production and, since in New Zealand we tend perennially to have more money than goods, we eat the best half. Some 60 per cent of the remainder is boneless beef, a good deal of it from dairy farms. Nearly all this now goes to U.S. to make sausages, hamburgers, and other processed meats at a price which often rivals cuts from much better quality beef. The relatively high price for this class of beef is a reflection of the greatly increased world demand for ‘convenience’ meats — meats which need little or no preparation.

Of the remainder some is of the very highest quality, e.g. some hundreds of tons are airfreighted to Hong Kong, Singapore and other places round the Pacific and is sold at very high prices. A good deal of it, however, sells readily at reasonable prices, as good but not really super quality meat in a variety of markets — Continental Europe, U.K., U.S.A. and West Indies. My own opinion is that our best interests are served by continuing to produce beef of this type which we can market very widely at moderate prices.

The weakness in the beef picture is that we have been so successful in diverting beef from U.K. to U.S.A. that the latter country now sometimes takes a proportion that is too great for our comfort and the possibility of active quota restriction is again worrying us.

MUTTON

With mutton, too, we have been successful in diverting the greater part away from the U.K. but this is rather a different story. Incidentally mutton, now, almost means ewe mutton since we eat nearly all our wethers.

After the end of Bulk Purchase ewe mutton became almost unmarketable and prices fell to low levels. The Board believed that a market could be established in Japan, and initially largely as a result of its persuasion of both exporters and shipping companies, this has come to pass. In 1957-58 we exported four tons of mutton to Japan, the next season, 3,500 tons and this year the quantity is likely to be between 50,000 and 60,000 tons. There is no doubt that this is a success story and even if it is not typical it does show what can be done by active cooperation and hard work by the exporters, the shipping companies and the Board, if the climate is favourable — and of course the climate was favourable — the wind was with us.

During the last ten years Japan has enjoyed a very rapidly rising standard of living and when the standard of living rises one of the first demands is for more protein and particularly more meat: first cheap meat and then we hope meat of higher quality. Japan is emerging very rapidly from a diet of rice and fish to one in which meat plays an important part. Further, some alternative cheap meats suitable for processing are becoming more scarce: both horse meat and whale meat is less readily available.

In a minor way we have expanded our sales of mutton to other countries with a rising standard of living; Eastern Europe, Singapore, the Pacific, the West Indies are all small but expanding markets — and it would be advantageous if they could be expanded faster. As
with beef to the U.:~., Japan now takes too large a proportion of our mutton for our own comfort. Nevertheless we can continue to supply mutton as a relatively cheap protein. I believe that we can sell it in many markets in the world.

**LAMB**

We have been surprisingly successful in diverting both beef and mutton away from the U.K., even if we have not achieved the breadth of diversification we should like.

With lamb we have so far been less successful. Last year some 93 per cent of our exported lamb still went to Britain. As well as the original reasons for diversifying markets for meat products, others have risen.

Whether or not Britain joins the E.E.C. now depends on one rather intransigent gentleman in France, since the great majority of both political parties believe that to join the community is the only long term solution to Britain's economic difficulties. In spite of the assurances (which I personally take at their face value) that New Zealand lamb will get special consideration, if Britain enters, there are likely to be some difficulties in our lamb marketing. If she does not enter; a Britain of declining prosperity, with continually recurring balance of payments problems might present us with even greater problems.

Further, though we have a very valuable agreement with the U.K., giving us the right of entry for lamb without restriction of quantity till 1972, there are some qualifications to this. One of these is that the U.K. Government may regulate imports (of lamb) from New Zealand — for the implementation of any arrangement for the purpose of orderly marketing designed to prevent market disruption or the threat thereof. Indeed, implicit in the agreement is the intention of New Zealand not to overload the U.K. market.

Lamb is of very great importance to us: it constitutes well over half our meat exports: it is of very high quality (the "best in the world" is not an idle boast): it is largely standardised: the grading system adds to the value of this. Our system of grading is obviously not perfect (since you will have noticed the Board is in the process of improving it) but it is better than that of any of our competitors.

Changing tastes produced complaints that some of it was too fat but the Board's prohibiting the export, in carcass form, of over-fat lambs has had a marked effect, and the amount of criticism, in the last few years, has decreased markedly. Lamb freezes well, better than beef. For at least two months, towards the end of the year, the average price per pound of New Zealand frozen lamb is actually higher in England, than home-killed.

In fact, when importing conditions allow, people with a high standard of living who are used to eating sheep meats and who know how to handle frozen meat, pay a very good price indeed for our lamb. Unfortunately there are, at present, not enough of these people: indeed they live largely in the U.K.

In 1960 the Board was worried about our extreme dependence on the U.K. market for the sale of lamb. In looking round the world for markets which most nearly meet the conditions I have just mentioned,
the Board's choice was North America — and it probably still would be.

The countries of Western Europe were prosperous but had restrictions of varying rigidity on the importation of lamb. The Middle East and Central Asia had a tradition of eating mutton but a low standard of living. The vast populations of the east would probably eat meat of any kind if it were given to them but were even poorer. Japan was emerging into a more prosperous condition and was using some mutton but was not yet a possible market for lamb.

The U.S. and Canada had a very high standard of living; allowed meat imports without restriction and in some places ate or had eaten a fair amount of lamb. The consumption of lamb in the U.S. had fallen from 7lb in the early 1930's to less than 4lbs; but some States such as Massachusetts and California still consumed over 12 lbs per head. However, neither the retailer nor the consumer was used to handling frozen meat (as opposed to turkeys) and this continues to be one of the biggest stumbling blocks to the expansion of our lamb sales.

During the late 1950's several exporters made significant sales in individual years: but exporters, naturally enough, operated only when the price was better than in London. This lack of continuity and some undesirable trading situations, such as unfortunate timing of shipments in relation to domestic supplies and meat selling by speculative operators, persuaded the Board to set up the Meat Export Development Company in cooperation with the New Zealand owned freezing companies — joined more recently by all freezing companies.

While the course of the Development Company has not been all plain sailing it has had some very considerable successes. The withdrawal of 700,000 or 800,000 lambs annually from the British Market has undoubtedly had some effect in keeping up the price of frozen lamb in London.

In Canada consumption of lamb has increased by 50 per cent and we have increased our share of the market: we have doubled our sales since 1960. Until the incursion of Australian lamb into the market, this year, the price was not unsatisfactory.

In U.S. the policy of avoiding a head-on collision with the American lamb producers has fitted in with other work of the Board and of Federated Farmers so that the opposition of the sheepmen in America is much less than it might otherwise be.

On the other hand, U.S. lamb consumption is still falling, our share of it is not rising and the price is not satisfactory.

Some of the reasons are that the Americans insist on taking lamb in cuts and this is very expensive (5¢d per lb): freight to East Coast of North America is higher than to U.K.: there is a duty of 3½ cents per lb: frozen meat is still not widely accepted and has to be sold at a price much lower than fresh: we have run into difficulties in lack of tenderness due partly to the housewives inexperience in handling frozen meat. Perhaps, most important of all, we have in the past not found a way to get those selling New Zealand lamb to adopt an aggressive selling attitude. However, in most, if not all these matters considerable progress is being made, e.g. this season all lamb going to
U.S. is aged and conditioned which we hope will mean that even when frozen lamb is mishandled in the thawing and cooking it will remain tender.

The Board is naturally disappointed that the market in North America has not developed more quickly but it remains convinced that both in Canada and U.S. we can sell lamb, in volume, at profitable prices. It is proving a larger and more costly job than was anticipated but I have no doubt we shall succeed.

Apart from North America there are a number of countries where lamb can be and is being sold. Small markets exist in Cyprus, Greece, the Pacific Islands, the West Indies and Malaysia-Singapore, and possibly this year in Australia. These are all slowly expanding and if not likely ever to become of overwhelming importance, are at least very useful.

It is worthwhile making a comment on Singapore. Apart from U.S. where Australia sells three times as much beef as we do because she has three times as much beef to sell, Singapore is one of the few places where Australia sells more meat than New Zealand. She is geographically better placed: she exports live animals for slaughter as well as meat and, until a few years ago, was in a more advantageous position in regard to the cool storage facilities available. The Board now helps to finance additional storage which puts importers of New Zealand meat in a better competitive position.

However, these are small markets: but there are two other areas where we believe we can sell lamb in significant quantities — given time. The first of these is Japan: the second Western Europe. As I have said Japan’s standard of living is rising very rapidly — so rapidly that it is difficult to visualise without actually seeing it. The Government has a clear policy of encouraging the consumption of more meat. Japan has very actively prospected all sources of the cheaper types of meat, and these seem to be already committed. It could well be that she will turn to more expensive types of meat and on of these could be lamb. Most of the mutton we sell to her is used in processed meats but some is eaten as meat. A good deal of the prejudice against the smell of sheep meat has been overcome. There is, in effect, a vacuum in the meat market which we hope we can fill with lamb, though there are still many difficulties in cooking and eating habits to be overcome. Last year about 1000 tons of lamb was consumed and there are a considerable number of butchers, supermarkets and restaurants which believe the sale of lamb can be rapidly expanded. I believe so, too.

The comment on the prospects in Western Europe, at this time, would obviously be foolish. It should suffice to say, that, here again, standards of living are rising rapidly; there is a shortage of meat: some countries already eat some sheep meats, e.g. France 7lbs: veal is a very popular meat and lamb has some similarities to veal.

Two years ago, the Board came to the conclusion that greater efforts were necessary to divert more of our increased production of lamb away from Britain. Not everyone believed this was necessary. Some people thought the logical procedure was to go on pushing lamb into the British market until the price fell sufficiently so that it could be readily sold in alternative markets. Neither the Board, nor most
farmers, nor the Government took this view and after a year's argument, a scheme to divert lamb compulsorily from the U.K. market was introduced. This has now been in operation for about half a season, and, though there are plenty of teething troubles, I am hopeful that it will eventually run smoothly and successfully.

It is in essence a simple scheme. The Board administers it, but is advised by a committee consisting of equal number of Board and Exporters. A percentage (10 per cent this year) to be diverted is set: together with a charge (3d this year) for any part of the 10 per cent not diverted. This applies to all owners of meat at time of slaughter so that all exporters are responsible for diverting 10 per cent.

It is obvious enough that some part of the cost (if short-term there is a cost) of this scheme is born by the farmer, but it has the advantage that the exporter is actively encouraged to seek new markets and I believe that some part of the cost is carried by those exporters who are less efficient in developing new markets.

There is no doubt that some meat has been sold, this year, at prices lower than was necessary and some exporters are said to have sold lamb at 4d below the equivalent Smithfield price. I trust that both the suppliers and shareholders of these companies will enquire into the reason for this curious procedure. I believe that the scheme must be improved and will become more sophisticated, e.g. each market may be treated separately; but, by and large, I think it has made a good start.

Some of you, perhaps many of you, no doubt consider that a method of selling similar to that carried out by the Dairy Board is the answer to the problem. The Meat Producers' Board does not believe this is so. Even if it is assumed that the principle of a single seller has been an unqualified success in the dairy industry this provides no parallel to the meat industry. One is selling a relatively small number of standardised products mainly in one market. The other is selling 60 odd grades of meat alone and in addition some 70 by-products with only a little over half the total going to the predominant market and the rest to almost every country in the World.

The very diversity of our meat exporters is, I believe, a source of strength (and certainly of comparison) in marketing so varied a product. Some own freezing works: some do not: some buy after the meat is already processed: some sell through agents, and some through their own wholesale outlets: some sell a large part of their meat to a single buyer at an agreed price: one owns its own retail butcher's shops: some are owned in U.K.: one in U.S.A.: some in New Zealand: some are predominantly farmer owned and some are purely commercial enterprises: some are cooperative — altogether a very varied picture. Nevertheless there are increasing complications in marketing (lamb) in new areas and the proportion of the value of our meat which is taken up in processing, freight and other distributive costs is steadily increasing. Some of these difficulties would be much reduced if there were a greater degree of integration or rationalisation within the industry and there is little doubt that this will come about. Some people in the trade think the alternative is between either doing nothing or cooperating with the Board, in working out new trading patterns and in standardising procedures, I
believe this is quite a mistaken view and that the real alternative is between cooperating with the Board, which may mean some loss of individual freedom, and the introduction of a single meat selling authority.

As I have said, at the moment, I am not in favour of a commission type system but I do treat the whole matter from a pragmatic point of view. If the arguments in favour of a commission become so urgent that I thought they outweighed the arguments against, I would change my mind.

One last point. I hope I have made it plain that we have been successful in diverting large quantities of both beef and mutton away from the U.K. and that we intend to use even more effort to reduce our entire dependence on the British market for the sale of our lamb. This does not, however, mean that we can avoid still sending a very large quantity of lamb to the U.K.: nor indeed would the U.K. Government wish us to do so: all we can reasonably hope to do is to reduce the annual increases which would normally have flowed to that market.

The U.K. Government and those of the 'six' have agreed that our exports of lamb are a case for special treatment. It would be very unjust indeed if our very considerable efforts to help ourselves (and them) should be used as an excuse to whittle down this undertaking.

In conclusion I should say that the Meat Producers' Board believes that increasing quantities of meat (including lamb) can be sold, to the world at large, at profitable prices: but that great efforts by all concerned will be needed — much greater than in the past.
THE IMPLICATIONS OF THE RECENT CHANGES IN THE MEAT SCHEDULE

L. Vogtherr, Secretary, Meat Producers’ Board, Wellington.

I have rather mixed feelings about being here today. On the one hand I am far from being a fluent speaker, having had little experience in this field. On the other hand, however, this is a topic that is of interest to both you and me — to you producers as reflecting part of the recompense for your year’s work, and to me as a facet of my work on your behalf.

As I see it the recent changes in the Fat Stock Schedules for sheep and lambs could embrace three aspects —

(1) The change in the Fat Stock Schedule price structure due to the elimination of wool.
(2) Reasons for the appreciable reduction in the lamb schedule from last season.
(3) The relative position of the Minimum Price or Support Price in the two seasons.

Although to a degree these three aspects impinge on each other, I think for the purposes of clarity I should attempt to deal with them separately.

I would guess that to most of you the structure of the Fat Stock Schedule Price is a bit of a mystery. I don’t know what you Producers do with the Board’s Annual Reports, but I could make a very good guess. However, those of you who don’t do what I fear the majority do, may have noticed that periodically we endeavour to give an inkling of the matter by publishing some sample costings. As I am not given to verbosity and as this carries through to the Annual Reports it is quite possible that even those of you who have studied the costings in the reports are still somewhat in the dark. If I can in the course of my remarks and your subsequent questioning help you to understand the system a little better, then I feel something will have been achieved.

To my way of thinking there is nothing profound in the change in structure of the Sheep and Lamb schedules. In its simplest form the change means that the producer is now receiving two payments instead of one for his stock.

Last season the Lamb Schedule included a payment for the bare meat, the pelt and the slipe wool. This season the schedule includes a payment for the bare meat and pelt, the wool being paid for separately on individual weight assessment of lines at the works.

The position is the same for Wethers and Ewes except that last season there was a basic wool pull built into the schedule with the Producer receiving an added payment if his assessed pull exceeded the basic pull or a reduction if the situation was reversed. A point to notice is that this year there are no deductions from the schedule price — only additions.
As I remarked before, there is nothing profound in the change. The new basis was requested by Federated Farmers and was acceded to by the Exporters.

The question that does arise however, is whether or not the change was beneficial to the Producer. Before I go any further let me hasten to add that what I have to say is my opinion and not necessarily that of my Board.

From one angle I feel that Producers as a whole have possibly lost something. As I see it, the more items you have comprising the Schedule structure the more chance you have of a little competition entering into the picture. I am not sure of the degree of competition there is amongst Exporters these days, but I would doubt if it is as great as it was years ago so that to lose something that could help promote competition may have been a retrograde step. Let me emphasise however, that in saying this I am speaking of the effect on Producers as a whole and not the individual.

The other angle is that of the individual Producer. Here now is quite a different story. Under the old system the Producer received, in theory anyway, the value of the average wool pull of all producers in the area affected by the schedule. This was of course extremely rough justice as in all averaging systems somebody must lose and somebody gain. The Producer with the greater pool pull or the better grade of wool was contributing in greater proportion towards what in theory amounted to an equalisation pool of all slope wool in the area. He was in effect subsidising the Producer of inferior wool or one with an inferior wool pull.

Today each Producer is receiving the average value per lb of all grades of slope wool multiplied by the assessed weight of the pull from each line of his stock that passes through the works. However, as an individual he could still approach a little nearer to theoretical justice if the Exporters refined the system to a stage where, in addition to paying actual assessed weight of wool pull, they also varied the payment according to the grade of wool in each line. I would assume that if Exporters ever pay for graded wool as well as weight, the assessment will also be done on the animal's back and not after pulling.

Under the old schedule system many Producers who were of the opinion that they had a line of sheep or lambs with a far better pull or value than average, approached the Exporter for an additional payment and in some cases were successful. Today the Producer is in a stronger position than before for such an approach. Previously he had no idea of the average wool pull used in the schedule or the value per lb. Today he does know his assessed pull and can easily work out the value per lb. This to my way of thinking is of value to the Producer and he should make use of it. I would think also it is of some value for his farm management records.

I am often asked whether I consider the system of assessing the weight of wool by appraisement is satisfactory. I would not like to get too involved in this argument, but I do understand that at most works the assessments are balanced out at least weekly, if not daily, against the actual overall pullings, and that very little discrepancy is apparent. Up to a point this is satisfactory, but it still
does not prove that each individual is receiving that to which he is entitled. He is assured however, that he is receiving something a great deal better than rough justice, and that is infinitely better than that which he received under the old system. To achieve Utopia in this field would involve Producers in additional costs and I for one would hesitate to suggest that they agitate accordingly.

From the Meat Board point of view, where the Board is charged with ascertaining whether or not the Producer is receiving reasonable justice in the schedule price and with assessing the F.O.B. value of the bare meat for deficiency payment purposes, the new schedule structure does simplify matters. A costing of the schedule today to decide what is being paid for bare meat at F.O.B. or at Smithfield is greatly simplified and is much more accurate than when wool was included. So much for aspect number one.

You are no doubt deeply interested in the reason for the considerable drop in the lamb schedule compared with last season.

We will take as a date of comparison the end of February in each year, as at this stage the difference in schedule was appreciable. The schedule for Prime Down Cross 2's at this time in 1966 was 22d. This year at the same date the schedule was 14½d, a difference of 7½d per lb. There were four reasons for this:

1) **Wool.** At the end of February last year the schedule included wool valued at approximately 3d per lb on a 32lb carcase. As wool is excluded from the current schedule and paid for separately, this accounts for nearly one half of the schedule reduction.

2) **Pelts.** There has been a positive slump in values of pelts this season. Last year North Island lamb pelts were bringing around 175/- per dozen at the end of February. This year at that date they were as low as 75/- per dozen. The reduction is estimated at about 3½d per lb on a 32lb lamb.

3) **Charges.** There has been an increase in charges this year amounting to nearly 3d per lb chiefly as a result of the inclusion of the standard charge for sliping.

These three items account for all but ½d of the 7½d drop in schedule between the two seasons. The fourth reason is the difference in F.O.B. meat values reflected by the tightness or otherwise of the two schedules in relation to the Smithfield price. So much for aspect number two.

This brings me to aspect number three, which is the relative position of the Minimum Price, or to use its popular term, the Support Price, in the two seasons.

Many Producers this season were of the opinion that with the low lamb schedule a Deficiency Payment would be payable. Now the Minimum or Support Price for lamb is based on the value at F.O.B. of the bare meat content of the schedule price for North Island Prime Down Cross 2's. This F.O.B. price as I will illustrate, differs appreciably from the schedule price. What we on the Meat Board have to do is to extract out of the schedule price the value of the bare meat at F.O.B. This is how we proceed:

A costing of the schedule is assessed from the viewpoint of a
Meat Exporter who is not the owner of a Freezing Works. Again using the end of February schedule of last season —

The exporter paid the Producer the Schedule Price of
He incurred Freezing Charges, Meat Board Levy and the administrative costs of his own organisation amounting to making a total cost of
He received for By-Products the equivalent of —
Pelt 5.0d per lb
Wool 3.0d per lb

Leaving the cost of the bare meat at F.O.B. as
The Minimum or Support Price was 

Doing the same exercise for this season we get —

<table>
<thead>
<tr>
<th>Schedule Price</th>
<th>Plus Charges</th>
<th>Less value of pelt</th>
<th>Leaving the cost of the bare meat at F.O.B. as</th>
</tr>
</thead>
<tbody>
<tr>
<td>14½d</td>
<td>4½d</td>
<td>19½d</td>
<td>17½d</td>
</tr>
</tbody>
</table>

Thus last season at the end of February there was a margin of approximately 2d per lb over the Minimum or Support Price, whilst this season the margin was around 1½d. The reason why, despite the low schedule, a Deficiency Payment was not payable this season was that in the main the reduction in the lamb schedule between the two seasons, arose from factors other than a drop in the F.O.B. price of the meat. Actually around the end of February there was a greater drop in the price of lamb on Smithfield between the two seasons than the difference between the two F.O.B. prices quoted, and you may wonder why this was not reflected in the costings. The reason was that this year the schedule was a good deal tighter than it was last year, or in other words the operators apparently took a more optimistic view of the lamb market than they did twelve months ago.

I think I have said as much as I can on this subject and in doing so have possibly strayed somewhat from the subject heading of this address. I hope however, I have helped you to understand a little more about the intricacies of the schedule and will be only too pleased to answer questions.
Economic Problems

A 20-25 per cent decline in revenue per sheep, together with a 3 per cent rise in sheep farmers' costs is not a particularly congenial situation in which to be asked to talk about farm development. In almost any other industry similar adversity would surely imply such a loss of confidence as to lead to retrenchment, or at the best consolidation. Sheep farmers in New Zealand however are particularly resilient to, and even philosophical about the kind of fluctuations in their terms of trade, illustrated in Figure I. The points for 1966/67 have not been plotted as the data is not yet available, and at any rate I should have had to lower the horizontal axis. The only consolation is that a higher proportion of this particular audience of farmers will have had a relatively better year than farmers elsewhere — namely those with good quality fine wool, or with high yielding wheat, or potatoes.

While it is difficult to generalise at this point, it seems clear that some slowing down in development plans is already occurring. Reduced fertiliser sales are a preliminary indication. History shows however, that stock numbers could continue to rise, in the short term, as farmers exploit the heavy investment in fertiliser and fencing which has been characteristic of the last five years. This is frequently done in an attempt to keep incomes at a normal level. However, it is also clear that overdraft restraints have had an effect on many farmers’ plans to withhold or purchase additional stock, even where they had capacity to do this.

Sheep farmers’ desires to continue to develop in the present situation will be largely influenced by their liquidity situation. If they have been developing rapidly in recent years then their liquidity is likely to be very low, and they will have most likely been under some pressure to reduce, or at least stabilize their overdrafts. It is my impression that the reaction of many to this situation has been to decide to consolidate on their existing stock numbers this coming year, in an attempt to improve liquidity. Where this can be done without endangering the balance of the development programme it would seem to be sound management. The equivalent military strategy is to dig in, regroup forces, and reconnoitre for a while before making another move. Digging in could imply some restraint in fertiliser usage, since the most common cause of imbalance in development is inadequate stocking in relation to fertiliser application.

Where the need, and the desire, to develop persists in the face of the current revenue situation, the availability of surpluses for development will depend upon the level of fixed costs per stock unit, par-
particularly debt servicing charges, including rent. Also important is the level of drawings in relation to the turnover of the farm business.

In recent years for example we have found that where the level of debt servicing (interest, principal repayments, rent) have been less than 10/- per reasonably productive ewe equivalent, then development from revenue has generally been easy. Where it has been above
it has been difficult, and where above £1, it has normally been impossible without further borrowing from external sources. Clearly if the reduction of 15/- in revenue per ewe sustained this year were to be permanent these figures would need to be revised. Over a large number of developing farms this reduction will leave no residual for development at all.

The question then remains, should those who will wish to develop, or who must because of the need to get on top of high overhead costs per stock unit, go out and borrow further? We must look at this on the basis of the additional returns which can be expected at current prices and the additional costs. The following figures relate to two classes of farms — fat lamb farming of average productivity, and store sheep farming on hard hill country. The gross margin is derived in the conventional way, by deducting from the gross revenue per ewe equivalent, the direct stock costs including shearing expenses, crutching, animal health, ram replacement etc., and the replacement costs. The gross margin is then the surplus available to meet feed costs, all overheads, and drawings, including taxes.

**TABLE I**

<table>
<thead>
<tr>
<th>Gross Margins Per Ewe</th>
<th>Fat Lamb</th>
<th>Store Sheep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lambing %</td>
<td>111</td>
<td>85</td>
</tr>
<tr>
<td>Wool Weight lbs</td>
<td>10</td>
<td>8.5</td>
</tr>
<tr>
<td>Lamb price 42/-</td>
<td>42/-</td>
<td>30/-</td>
</tr>
<tr>
<td>Wool price 38d</td>
<td>38d</td>
<td>38d</td>
</tr>
<tr>
<td>Revenue 78/-</td>
<td>78/-</td>
<td>58/-</td>
</tr>
<tr>
<td>Stock costs 10/-</td>
<td>10/-</td>
<td>10/-</td>
</tr>
<tr>
<td>Replacement 14/-</td>
<td>14/-</td>
<td>15/-</td>
</tr>
<tr>
<td>Gross margin 54/-</td>
<td>54/-</td>
<td>33/-</td>
</tr>
</tbody>
</table>

Let us assume that the development costs per ewe in each case is £10. (This is never very far out for any well implemented development programme — it includes the cost of the ewe). Also assume initially that the additional stock can be run with the existing labour and machinery. Therefore the only additional overheads are the interest charges on the £10 development cost, and the marginal increase in feeding costs (maintenance of the improved pasture and additional supplementary feeding). Under these assumptions, which are applicable to many kinds of development programmes it is clear that there is still a margin of profit even in the case of the low producing store sheep property. For the additional interest charges, even if the whole of the £10 is borrowed at 6 per cent, will be 12/-, and maintenance of the additional feed provision will cost 6/- to 10/- per ewe.

However, these observations assume a fairly simple development programme involving topdressing and oversowing, or regrassing and stock increases within the scope of the existing overhead structure of the farm. Where it is going to be necessary to put on additional labour, buildings, machinery, then a searching look would have to be taken in the light of the above gross margins.

Many farmers who have undertaken substantial development programmes in recent years are asking themselves whether it has been worth while, in view of the sharp downturn in revenue this year.
Some with whom we are associated were in a position to have continued to expand production and at the same time to have reduced their overdrafts, inflated by fast rates of development. It has been a disappointing year for them.

In such cases, however, it is usually consoling to compare the actual financial position with what it would have been had no development occurred. To illustrate this I have chosen four examples from our files, representative of contrasting farm types. I do not claim that it is possible to generalise widely on the results of four farms but nevertheless these examples will illustrate a principle. This is that a well implemented development programme can lead to satisfactory results, even in the face of sharp price declines.

On all the farms the development under review has occurred within the last three to five years. I have produced two sets of financial results for each of the farms. For both sets I have used current 1966/67 prices and costs. The first set assumes that no development had taken place. This means that I have taken the farm in its “status quo” position before development commenced, but altered the costs and prices in the accounts to those ruling this year. Therefore the first set of figures for each farm indicates the financial situation the farm would have been in this year, had no development occurred.

For the second set of figures I have taken the current financial situation, with this season’s prices and costs, for the farms as they actually are following the development. As some of these farms are still developing I have corrected the figures in order to have a comparable “status quo” situation. That is, all items of development expenditure have been omitted, including stock increases.

The figures which follow are self explanatory, except perhaps those called “Retained Earnings”. This is the residual amount left after all farm running expenses, living expenses, taxation, and interest charges on mortgages, loans and overdraft. Thus “Retained Earnings” are available for debt reduction, some of which will be essential in the form of table mortgage instalments, depreciation of assets, and savings, or capital purchases. It should also be noted that no carry forward of losses is included in the tax assessment, again in order to ensure a strictly comparable basis.

Farm A

This is a substantial high-country property of 35,000 acres, which because of low indebtedness was able to be developed at quite a rapid rate out of revenue. The relevant figures are given in Table 2, illustrated in Figure 2.

These figures reveal that the additional running expenses required to sustain a 27 per cent increase in stock numbers are £2,000. There is a sharp increase in taxation, which absorbs over 60 per cent of the increased surplus, leaving an additional £1,000 over and above living expenses as “Retained Earnings”. What might appear high living expenses in this example is largely explained by multiple ownership with a number of beneficiaries.

But the important thing, particularly for this class of property, is that it is less vulnerable to even further falls in prices with the development, than it would be had no development occurred. Vulnerability in this sense can be represented by the ratio of operating costs including debt servicing, to total revenue. With no development the
ratio on this property would have been 70 per cent this season; with the development it stands at 63 per cent.

ANALYSIS OF GROSS REVENUE

FARM 'A'

35,670 ac. High Country Tussock

\[
\begin{align*}
\text{No Development} & \quad \text{(7560 BB)} \\
\text{Development} & \quad \text{(9640 BB)} \\
\hline
\text{£15,765} & \quad \text{£20,425} \\
\text{£760} & \quad \text{£1760} \\
\text{£3000} & \quad \text{£3000} \\
\text{£945} & \quad \text{£2715} \\
\text{£100} & \quad \text{£100} \\
\text{£11,960} & \quad \text{£12,820} \\
\hline
\text{5\%} & \quad \text{9\%} \\
\text{19\%} & \quad \text{14.5\%} \\
\text{6\%} & \quad \text{13\%} \\
\text{3\%} & \quad \text{2\%} \\
\text{63\%} & \quad \text{63\%} \\
\end{align*}
\]

Living Expenses

Taxation

Debt Servicing

Farm Running Expenses

Figure 2
Farm B

This was an undeveloped tussock hill block of under 1,500 acres, carrying about 1 ewe equivalent per acre. The surplus available was insufficient to trigger off development, so a development loan of £4,000 was raised. The results are given in Figure 3.

**ANALYSIS OF GROSS REVENUE**

Farm 'B'

1487 ac. Undeveloped Tussock Hill Country.

<table>
<thead>
<tr>
<th></th>
<th>No Development (1520 E.E.)</th>
<th>Development (2090 E.E.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>£2460</td>
<td>£750</td>
</tr>
<tr>
<td>Retained Earnings</td>
<td>9%</td>
<td>14%</td>
</tr>
<tr>
<td>Living Expenses</td>
<td>£1050</td>
<td>£760</td>
</tr>
<tr>
<td>20%</td>
<td></td>
<td>14%</td>
</tr>
<tr>
<td>Taxation</td>
<td>£260</td>
<td>£750</td>
</tr>
<tr>
<td>5%</td>
<td></td>
<td>10%</td>
</tr>
<tr>
<td>Debt Servicing</td>
<td>£530</td>
<td>£260</td>
</tr>
<tr>
<td>10%</td>
<td></td>
<td>10%</td>
</tr>
<tr>
<td>Farm Running Expenses</td>
<td>£2930</td>
<td>£3995</td>
</tr>
<tr>
<td>56%</td>
<td></td>
<td>52%</td>
</tr>
</tbody>
</table>

Figure 3
Without development this property would have been caught firmly in the squeeze of rising costs and falling prices. The surplus for required debt reduction and depreciation above moderate living expenses would have been insufficient, with the result that overdraft would have gone up, or necessary maintenance expenditure would have been avoided. Although the present level of development does not place the property in an entirely viable position, it is nevertheless able to carry, with this year’s low prices, the increased debt servicing charges, a substantial increase in taxation, and to have sufficient surplus to meet required debt reduction and to carry on with a small amount of development. The need for further development, particularly an expansion of stock numbers, on this farm is indicated by the fact that the ratio of operating costs to total revenue has declined only marginally.

Farm C

On this easy hill country property of 950 acres, production was already at a reasonably high level, by local standards, when the present development was initiated. A development loan was raised, increasing interest charges by £300, and stock numbers were increased by 80 per cent in three years, despite a severe drought in the first year.

The relative position of this farmer with 1966/67 prices had he not developed, is shown in Figure 4.

This has been a particularly successful programme, and it is reflected in a substantial increase in the amount available for debt reduction, and further investment, despite the sharp increase in taxation, and in the farm running expenses.
This light-plains farm is a clear example of the necessity for a highly indebted farmer to develop rapidly with external finance, if he is to get himself into "the clear". Following purchase three years ago,
the level of debt servicing per ewe equivalent was 22/-. The analysis shows that had he not developed, the 1966/67 result would have been either further increase in debt, or, as would be more likely under the current credit restrictions, a cut in living expenses and in essential operating expenditure.

The very rapid rate of development has placed the farmer in a strong position, with capacity even at this year’s prices for overdraft reduction and/or further development. However, one factor which is highlighted by this example is that as soon as a farmer who has developed in this manner attempts to consolidate, in order to reduce current indebtedness, he faces up to a massive increase in his tax bill, which can impose further stresses on his current account situation.

The financial analysis for this property is shown in Figure 5.

As I have previously indicated, it is not valid to generalise widely upon the results from only four selected farms. Nevertheless some important principles emerge. These are that in the face of a continuous 2 to 3 per cent annual increase in costs, and a sharp decline in prices, soundly implemented development plans ensure that the sheep farmer can at least maintain his economic position. For the heavily indebted farmer, with high debt servicing costs per stock unit, development may be crucial, even though it implies additional external borrowing. But even for the well established farmer with relatively low indebtedness, it can be demonstrated that his financial vulnerability can be reduced through development.

Financial Problems

I have previously indicated that a serious problem facing developing farmers this year is their inability to reduce overdrafts. The more rapid and imaginative their development has been in recent years, the more likely it is that their liquidity position is tight. Under these circumstances many developers have had pressure on them by stock firms and bank managers to conform to the general pattern of credit restrictions. In some cases it seems to have been necessary to indicate that payment of mortgage principal or tax instalments could not be guaranteed if this resulted in overdraft levels being above last year’s. Clearly stock firms derive no joy from such measures, and of course, for the developing farmer there can be no stronger disincentive. To what extent it is possible for stock firms and banks to discriminate in favour of the successful developers in the implementation of their policy, will, I hope, be discussed later in this session. But there is no doubt at all that potential development has been arrested this year through problems of credit and liquidity.
ANALYSIS OF GROSS REVENUE

FARM 'D'

959 ac. Light Plains Fat Lamb

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Expenses</td>
<td>£1300</td>
<td>£5,100</td>
</tr>
<tr>
<td>Debt Servicing</td>
<td>£1530</td>
<td>£6,070</td>
</tr>
<tr>
<td>Farm Running Expenses</td>
<td>£2760</td>
<td>£11,665</td>
</tr>
<tr>
<td>Retained Earnings</td>
<td>£1735</td>
<td>15%</td>
</tr>
<tr>
<td>Taxation</td>
<td>£825</td>
<td>7%</td>
</tr>
<tr>
<td>Debt Servicing</td>
<td>£1735</td>
<td>15%</td>
</tr>
</tbody>
</table>

Figure 5
On the developing farm the difficulties of financial management and control are of course much more acute than where the situation is static. To me it has always seemed essential that the developing farmer should do all that is possible to understand and control his financial transactions.

Faced with price fluctuations of the nature we are now experiencing, the need is even greater.

A full understanding of the financial transactions of the farm business basically means knowing how much cash flowed into the business, in an accounting period, and from what sources, how much flowed out, to what destinations. Such a statement is called by accountants “Cash Flow” or “Flow of Funds” or “Sources and Disposition of Funds”. These are now being added to the conventional accounts by a number of accountants, but are by no means widespread. Farmers who want to evaluate the financial picture of their business should insist on such a statement with their accounts. If they find that it is still beyond their comprehension then they should ask for a clearer presentation, because there is bound to be one. The following is an example:

Table 2
Cash Flow Statement (£)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheep Sales</td>
<td>5,918</td>
</tr>
<tr>
<td>Cattle Sales</td>
<td>121</td>
</tr>
<tr>
<td>Wool Sales</td>
<td>2,946</td>
</tr>
<tr>
<td>Cash receipts from farming</td>
<td>8,985</td>
</tr>
<tr>
<td>Sheep purchases</td>
<td>2,036</td>
</tr>
<tr>
<td>Working Expenses</td>
<td>7,548</td>
</tr>
<tr>
<td>Cash deficit from farming</td>
<td>9,584</td>
</tr>
<tr>
<td>Other receipts</td>
<td>699</td>
</tr>
<tr>
<td>Plant</td>
<td>176</td>
</tr>
<tr>
<td>Insurance</td>
<td>169</td>
</tr>
<tr>
<td>Development loan</td>
<td>3,432</td>
</tr>
<tr>
<td>c/f</td>
<td>3,777</td>
</tr>
<tr>
<td>Total funds available</td>
<td>3,078</td>
</tr>
<tr>
<td>Personal</td>
<td>1,179</td>
</tr>
<tr>
<td>Insurance</td>
<td>163</td>
</tr>
<tr>
<td>School fees</td>
<td>617</td>
</tr>
<tr>
<td>Tax</td>
<td>75</td>
</tr>
<tr>
<td>Capital items</td>
<td>2,036</td>
</tr>
<tr>
<td>Plant, Shed</td>
<td>921</td>
</tr>
<tr>
<td>Reduction in overdraft</td>
<td>121</td>
</tr>
</tbody>
</table>
This gives a clear picture of where the money came from and where it went to. If the previous year’s figures are also given at the left-hand side this is also useful. Above all it enables the farmer to see clearly how the accounts can be reconciled with the change in overdraft or credit balance.

The statement however does not give a full picture of the progress the farm is making. For example, in Table 6, while the farmer was able to more or less break even on the cash analysis, his fixed indebtedness increased by £3,400. But this was compensated for by an increase of 500 sheep, an increase in the value of plant, and substantial investment in productive capacity included in the farm working expenses. It requires the cash flow statement plus a review of the net investment to give a complete picture of the farm business for the year.

I have placed this emphasis on cash flow analysis because I believe it is basic to financial planning of developing farms, which Mr Crawford will be dealing with in the next paper.

The point I wish to emphasise is that some of the problems of developing with fluctuating prices can be better met when a full understanding of cash transactions is used as a basis for planning ahead.

**Taxation Problems**

For the static farmer, the provisional and terminal tax system often causes difficulties, because of its see-saw effects when prices fluctuate. The developer, when he consolidates and utilises the last of his carried forward losses, will be caught (see Figures 2 to 5), but during the development process careful manipulation of exemptions and losses can lead to significant tax savings.

For example, when the farm begins to run at a profit at some point in the development programme, sufficient income should be left after deducting carried forward losses or development expenditure, to absorb personal and special exemptions. Unused exemptions can not be carried forward. In some cases it may even be wise to allow the taxable income to run up to £500, on which, what some accountants call the bargain rate, (2/9 in the £) applies. This may enable additional accumulated losses or development expenditure to be carried forward to future higher income years.

Another measure available in a low revenue year is to reassess provisional taxation for the March payment. A number of farmers have done this in 1967, although I understand very few in Canterbury.

Farmers rely heavily on their accountants to initiate decisions on taxation management. For the developing farmer, faced with fluctuating prices it is particularly important that full advantage of all taxation concessions and flexibility be taken. This can be more assured if he is prepared to do some careful planning, and to revise the figures at strategic points during the financial year.
Summary:

I have attempted to make the following points for farmers who are developing.

1. Where overdrafts have led to stress and anxiety it could be sound management to make 1967 a year of consolidation.

2. Where however, it is still necessary, because of the incidence of fixed costs per stock unit, or the stage the development programme has reached, to continue to press on, there is still a reasonable margin of profitability at current prices.

3. This applies particularly where the development can proceed without "lumpy" costs, such as additional labour, buildings, heavy plant. Where these are required, the programme should be subjected to a searching review.

4. Successful development in the face of fluctuating prices requires careful forward planning, based on a thorough knowledge of the full flow of cash into and out of the farm business and the farm household.

5. Flexibility within the taxation system permits significant savings to be made by the developing farmer when he and his accountant are able to anticipate the effects of fluctuating revenue.
STOCK FIRM CREDIT AND FARM BUDGETS

J. M. Crawford, Mercantile Manager, Canterbury Farmers' Co-operative, Timaru.

Farm budgets do play an important part in the planning of farm finance, but all those of you who have worked with budgets will know that unless a farmer is prepared to use the budget himself, then it might as well be not drawn up. A farm budget is a cooperative affair with the lending organisation providing the money and the farmer carrying out the programme. If there is no cooperation then the system is bound to fail.

In assessing the use of budgets by a Stock Firm there are two factors that dominate the situation. These are (1) The volume of finance provided by Stock and Station Agents and (2) The annual requirements of farmers.

Taking the first of these I have used the information made available by the Government Statistician to produce a graph. Graph I shows the amount advanced to farmers as at 31st December for the past three years. The information I have in The Canterbury Farmers' Co-op, indicates that this is about the period where advances are at the lowest point during the year. The advances made rise from £48.0 m in 1964 to £59.6 m to £62.8 m. This of course is a substantial sum and does include advances made by Banks, Dairy Companies or other lending agencies. Trading Banks play a vital part in this because not only do they lend to farmers, but also to the Stock and Station Agents. Stock Firms depend on Banks to provide some of the funds to use in advancing to farmers.

It is interesting to note that of the £62.8 m advanced to farmers by Stock Firms, no less than £36 m is unsecured in any legal way. This emphasises the importance of the personal relationship between the farmer and the stock firm. The firms are prepared to lend £36 m on the security of the personal factor alone and I would suggest that there is no other lending institution or organization which venture to lend so much so successfully without legal security.

Beside the column of advance will be seen the column showing the funds held by firms as farmers' credit balances. This represents
the group of farmers who operate a credit account and use advances from stock firms to a limited extent only.

The proportion of farmers in this category is not easy to assess, but after discussions with other Stock Firms I have come to the conclusion that there are about 30 per cent of farmers in Canterbury anyway who use little or no stock firm credit, but use their own funds. It is these farmers that are represented by the smaller column.

While talking of credit balances it is as well to point out that clients deposit funds with stock firms on fixed terms. On 31st December, 1966, funds so held amounted to nearly £12 million. The lending policy of stock firms at any particular time is determined by the economic position of the industry and of course by their own financial position.

We must not forget that stock firms are highly competitive and that as the result of making an advance the income of the Company itself rises. This competitive aspect is a vital one and it says much for the Management of Stock Firms that it is rare for firms to over lend. I personally do not know of any case where a capable, efficient farmer has been handicapped by a Stock Firm debt. The good farmer soon reduces his liabilities.

In a year like the present one when income is dropping, there is naturally a tendency towards caution in lending. This tendency is strongly supported by Government inspired requests through the banking system to reduce overdrafts and eliminate new capital advances. This typical credit squeeze applies to capital expenditure such as new plant, land development and so on. Expenditure for strictly seasonal operations is not affected.

One result of this is to reduce to a minimum the number of land sales. Finance is the key to the selling of land and if both long and short term loans are hard to obtain then sales are slow.

It becomes a holding operation — normal seasonal expenditure and farm maintenance can carry on as before, but new work, new plant and farm sales are heavily restricted. This procedure is inevitable — not only can farmers afford to buy less, but the demand is also reduced by restricted credit. By far the majority of farmers restrict expenditure without being asked to do so.

To all farmers financial planning is most desirable. Many are the farmers who have found that their credit balances have been reduced alarmingly by not reducing expenditure in line with a reduced income. The use of a budget to "show the way" has great merit and more and more farmers are finding that with the large investment they have in their farms that planning and accounting requires more than a five minutes' study of their stock firm statement at the end of each month.

To digress for a moment it has always amazed me that many farmers with an average turnover of £100 to £200 per week should expect the accounting of this to be done for 7/- to 15/- per week. And this at a time when farmers readily pay 10/- per hour or more for unskilled workers in the woolshed.

Turning now to Graph 2, this represents an actual year's finance required by a group of South Canterbury farmers. It represents a
fair picture of what a stock firm must provide to keep farmers supplied with cash for working expenses.

Starting from January when advances are at their lowest it shows the rise in the demand for funds until the decline at the end of October. Over a period of many years the month of October has proved to be the peak demand. What I am trying to convey here is that advance accounts require as much in seasonal funds each year as the original advance.

Some farmers have a peak demand at a different period, the main determining factor being the Wool sales. All firms will agree that even in Canterbury where so much cropping is done that wool has been by far the greatest effect on income.

The importance of grain growing in Canterbury cannot be over emphasized. There has been a marked increase in the area of crops sown in the past two years and this has been a big help in compensating for lower wool prices. This does not apply to the North Island and much of coastal Southland where the dependence of sheep farming is much greater.

It is significant that in budgets that we have drawn up recently the proportion of the income to come from grain has been as much as 25 per cent to 30 per cent. Canterbury farmers are indeed quick to take the opportunity to diversify.

Planning for the October peak requirement is the main function of the use of the budget. The main purpose is to prevent the expenditure becoming so high that it cannot be recovered from the year's income. Having this background, a written budget for each farm is a most useful tool not only for the lender, but for the farmer. You will see on the budget form that after allowing for farm expenditure, interest charges and personal expenditure, that a surplus is available for debt reduction or for next season's working capital. In cases of advances a reduction of the debt should be the aim as Stock Firm advances are designed to be temporary, a regular reduction made each year. Most farmers aim for this also.

In times of high income the aim in preparing a budget must be to balance three items. These are development expenditure, debt reduc-
tion and taxation. Too much development means no debt reduction, too much debt reduction means high taxation and a low rate of development.

In times of lower income, such as 1967, the main aim in some farms is to balance the budget. Frequently some items crop up that prevent a balanced budget, such as new tractor, cars, completion of development programme. All these things must be assessed by the man on the spot and a budget prepared in the best interest of all concerned.

The items which are most liable to be pruned in order to produce a balanced budget are:

1) **Labour**
   
   You are to hear tomorrow a lot about the labour problem, but generally if development is reduced the labour requirement is much less. However, our farms are now geared to so much off-farm labour that it is beyond the power of the average farmer to do anything about it. In this group are cartage contractors, harvesting machines, gorse cutting machines, bulldozers, and so on. Every time a machine comes on the farm a man comes too and the largest part of the contractor's bill is the labour cost. Some day soon there will be a reduction in shearing rates.

2) **Repairs and Maintenance**
   
   Buildings and fencing improvements can be postponed till some future time. This is admittedly undesirable because farms should be maintained, but over the past 10-15 years so much improvement work has been done in times of prosperity that many farmers can coast along for quite a while.

3) **Topdressing**
   
   Although it is an accepted fact that fertiliser sales and production go hand in hand, the fact is that topdressing is one of the easiest items in South Island farms to be reduced. Not only can it be reduced, but in nearly every case that I have seen this year, less fertiliser is in fact being applied.

4) **Personal Expenditure**
   
   Most farmers understandably want to lower costs and are thinking more carefully about personal living costs. While the basic requirements would be unchanged, there is an immediate tendency to postpone the purchase of household labour saving devices, furniture and overseas tours. These savings can apply only to those farmers already in a position to contemplate such luxuries. For the young farmer trying to make his way, it is doubtful if any savings of any significance can be made in personal expenses.

5) **Capital Expenditure**
   
   This must be the first item to be cut. New plant, development work, new buildings and fences — these go before anything else.

   Let us not pretend that development of farms can continue under low prices. By far the most development of farm land has been paid for from surplus income. If there is no investible surplus there is no development.
While state lending institutions may have funds available for development, the demand on them will not increase, because with lower farm income farmers are not only reluctant to spend, they are just as reluctant to borrow.

There are two key personnel in the administration of a budget system. These are the field officer who visits the farmer and the clerk who analyses the farm expenditure. The field officer must of course be familiar with farming practice and the requirements of the farmer. He is assisted in a Stock Firm by using the knowledge of Stock Agents, Grain and Seed Agents and other personnel of the firm.

The importance of the training of a field officer can be gauged by the fact that in 20 Stock and Station Agents in New Zealand there are between 65 and 70 men who are graduates of Agricultural Colleges or the Institute of Valuers Examination. This is a substantial number of trained people and is more than are employed in either the State Advances Corporation or the Valuation Department.

The other expert in this budget work is the clerk who analyses farm expenditure to each budget item. If correctly done, a monthly analysis improves immensely the usefulness of the budget, as it allows both the farmer and the firm to be continuously aware of income and expenditure. The usefulness of financial planning by the budget system, particularly in periods of lower income, cannot be denied. Its greatest advantage is that it creates an awareness of the financial situation before it has happened.

Perhaps in the past farm planning and budgeting has been associated with financial control carried out for the benefit of the lending institution. This is correct to a degree, but today for a farmer to use a budget indicates that he is progressive and forward looking. The successful establishment on farms of thousands of ex-servicemen since 1945 was due probably to two major features. Firstly, was the adoption of the principle of the economic unit and secondly the control established by financial planning based on a budget.

However, I have tried to assess the number of farmers who actually use written budgets. This seems to be impossible to find out, but my guess would be between 10 per cent and 20 per cent. (And of these by far the majority would be under 40 years of age). This leaves 80 per cent to 90 per cent of farmers who use other methods of financial planning and most of these use their Bank or Stock Firm balance as a barometer of success.

Planning is done in the farmer’s mind and major decisions are made after discussion with the Bank or Stock Firm Manager. Some Stock Firms employ very few men to operate budget accounts and in fact have no regular budgeting procedure.

In all aspects of farm lending the vital factor is personal management of the farm. A capable and thrifty farmer will succeed under any system, but under financial planning by the use of a budget he will be more successful, because of his more complete knowledge of the vital business side of farming.
"Efficiency Of Labour Use"

INCOME AND PRODUCTIVITY IN AGRICULTURE

R. W. M. Johnson, Senior Research Officer, Agricultural Economics Research Unit, Lincoln College.

It falls on me to open today's discussion on the role of labour productivity in New Zealand farming. I propose to call your attention to the importance of increased productivity in all sectors of the New Zealand economy, and to the particular part farming can play in this. I want to emphasise the importance of scientific research in agriculture. I shall call attention to the part prices pay in determining the level of farming income and present to you some facts about the behaviour of prices and productivity in the past. Finally, I want to look into the future and make some guesses about the years ahead.

It should almost go without saying that all people are interested in higher incomes. Through a bigger national income, or more accurately, through more income per head of the population, the community can enjoy better houses, tarmac roads, instant telephone service and many other things. Most people would agree that we have more of these things than we used to. It is important to understand that a large part of these extra elements in our standard of living is brought about by changes in productivity. What do we mean by productivity?

The economist likes to distinguish between technical productivity and economic productivity. An example of the former is more grass per acre or greater horse-power per gallon of fuel. Economic productivity, on the other hand, refers to actual income per acre or returns per labour unit and these depend on both technical productivity and on prices. As everyone knows, lower wool and meat prices can cancel out any gains in lambing percentages and wool weights very quickly indeed. It follows from this distinction that technical productivity changes in the economy tend to be going on all the time as new machines are installed and better methods worked out for doing given jobs. But these technical changes are not necessarily reflected in farm income, for example; because prices fluctuate far more than changes in technology and tend to be beyond our control.

All sections of the community can contribute to increased technical productivity. We should be interested in promoting mechanisation of the work on our wharves as much as on our farms. Faster all-weather loading of ships will increase the number of voyages a given ship can make in a year and hence allow the ship to be run more economically. More economic ships will continue to carry our products to overseas markets without raising their charges to us. A good road system leads to higher productivity and so does a good educational system. Large industries tend to have higher technical productivity than small industries and in such things as motor-cars,
mass production has achieved a more and more refined product at little extra real cost over the years.

Science can play a large part in increasing technical productivity. New Zealand has a reputation all over the world for the quality and advanced nature of its scientific work in agriculture. But it is important that all sections of the economy are subject to the same scientific spirit of inquiry as exists in agriculture. I would therefore argue that the scale of scientific work in New Zealand needs to be greatly expanded, not only to keep her agricultural industries some of the most efficient in the world, but to step up the use of the most advanced methods of technology in manufacturing, service industries, and transport and communications. Lest I be misunderstood, I would like to make it clear that I do not envisage a vast increase in university scientists carrying out their fundamental experiments, important as this is, but a vast programme of training for technologists who will put the latest scientific advances into effect, and who will in turn become the managers in the next generation of industrialists paying far more attention to technology than the present generation of managers ever can. There will be difficulties, not least of them the attitude of organised labour. It is our task to convince their leaders, too, of the importance of technology in the years to come.

Finally, there will be some conflict between the needs of the present generation and those of future generations. Under the political democracy we now enjoy, we are tempted to spend our resources on things that will benefit us now. Tarmac roads and fancy intersections on our roads may be examples of this. Subsidised electricity consumption is an example where the present generation is getting a benefit at the expense of the future, and food subsidies allow us to divert resources from uses where they may be more important. In general, it is imperative that education and scientific endeavour be placed before all other forms of social capital if a society like that in New Zealand is to increase productivity in the future, and hence continue to enjoy a rising standard of living.

Turning now to economic productivity, we introduce the complication of prices to the discussion. Here, economists distinguish between the volume of output, such as wool weight, and the price received per unit sold, i.e., auction prices. Taken together the two make up gross receipts. This distinction is also applied to the goods farmers use in producing the wool; that is, we separate out the weight of fertiliser and the price per bag we pay for it. The total volume of goods used, multiplied by their respective prices, gives us total farm costs. Now it can be seen that if the number of goods used in farming stays the same, but their price per unit rises (like fertiliser) then costs rise and net farm income (other things being equal) must fall. If prices of wool fall, and physical output and inputs stay the same, then again net farm income will fall (as you already know).

Thus the price element in farm income can be very important. Prices for the products we sell overseas are largely governed by the state of demand in international markets. We have no control over them. Some sceptics have suggested that the present wool-holding
scheme of the Wool Commission will have no effect on future prices. This would be most difficult to prove. But by floor price schemes such as we have for wool, and by guaranteed prices as for dairy products, we can moderate these overseas fluctuations in their effect on farm incomes.

Prices of goods used in production are partly determined overseas and partly within New Zealand. Import prices again tend to be out of our control, and we have to judge our needs in the light of what we can afford to pay. But the general movement of prices within New Zealand is caused by internal inflationary pressures arising out of full employment, the protection of industries, and price-linked wage arbitration. If these prices rise faster than the export prices our produce receives, then we are worse off in terms of net farm income. If the movement is in the other direction then we are a great deal better off with no effort on our part at all.

Professor Philpott and his co-workers have estimated both of these trends in recent years and the following propositions summarise their findings. Since 1949, the year just before the wool boom, prices received by farmers have increased by about 38 per cent. Over the same period prices paid by farmers have increased by 59 per cent. On balance, therefore, the price element of costs in farming, have risen faster than the price element in products sold. In fact the amount of fertiliser, one lamb or lb. of wool will buy has fallen by about 13 per cent in the last sixteen years. This phenomenon is often referred to as the cost-price squeeze in farming.

<table>
<thead>
<tr>
<th>Year</th>
<th>Prices Received</th>
<th>Prices Paid</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1949-50</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>1950-51</td>
<td>156</td>
<td>107</td>
<td>146</td>
</tr>
<tr>
<td>1951-52</td>
<td>117</td>
<td>126</td>
<td>93</td>
</tr>
<tr>
<td>1952-53</td>
<td>134</td>
<td>132</td>
<td>102</td>
</tr>
<tr>
<td>1953-54</td>
<td>139</td>
<td>132</td>
<td>105</td>
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<td>1954-55</td>
<td>139</td>
<td>137</td>
<td>101</td>
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<td>1955-56</td>
<td>136</td>
<td>139</td>
<td>98</td>
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<tr>
<td>1956-57</td>
<td>147</td>
<td>143</td>
<td>103</td>
</tr>
<tr>
<td>1957-58</td>
<td>133</td>
<td>148</td>
<td>90</td>
</tr>
<tr>
<td>1958-59</td>
<td>121</td>
<td>150</td>
<td>81</td>
</tr>
<tr>
<td>1959-60</td>
<td>134</td>
<td>151</td>
<td>89</td>
</tr>
<tr>
<td>1960-61</td>
<td>125</td>
<td>152</td>
<td>82</td>
</tr>
<tr>
<td>1961-62</td>
<td>120</td>
<td>153</td>
<td>78</td>
</tr>
<tr>
<td>1962-63</td>
<td>124</td>
<td>156</td>
<td>79</td>
</tr>
<tr>
<td>1963-64</td>
<td>141</td>
<td>157</td>
<td>90</td>
</tr>
<tr>
<td>1964-65</td>
<td>138</td>
<td>159</td>
<td>87*</td>
</tr>
</tbody>
</table>

* Provisional
How have farmers responded to this situation? Over the same period Professor Philpott shows that the volume of output has increased by 52 per cent. The volume of inputs employed to produce this output has only increased by 33 per cent. In other words, farmers are now getting fourteen per cent more output out of the inputs they use, than they did in 1949. The reasons for this most of you know. Grass grub control, better crop and pasture seeds, better management systems, better milking techniques.

TABLE II

Output and Gross Productivity of New Zealand Farming, 1949-65.  
(1949-50 = 100)

<table>
<thead>
<tr>
<th>Year</th>
<th>Index of Gross Output</th>
<th>Index of Aggregate Inputs</th>
<th>Output per Unit of Aggregate Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>1949-50</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>1950-51</td>
<td>102</td>
<td>121</td>
<td>84</td>
</tr>
<tr>
<td>1951-52</td>
<td>102</td>
<td>98</td>
<td>104</td>
</tr>
<tr>
<td>1952-53</td>
<td>107</td>
<td>114</td>
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<tr>
<td>1953-54</td>
<td>107</td>
<td>112</td>
<td>95</td>
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<tr>
<td>1954-55</td>
<td>110</td>
<td>115</td>
<td>96</td>
</tr>
<tr>
<td>1955-56</td>
<td>112</td>
<td>118</td>
<td>95</td>
</tr>
<tr>
<td>1956-57</td>
<td>114</td>
<td>120</td>
<td>95</td>
</tr>
<tr>
<td>1957-58</td>
<td>122</td>
<td>111</td>
<td>110</td>
</tr>
<tr>
<td>1958-59</td>
<td>127</td>
<td>113</td>
<td>113</td>
</tr>
<tr>
<td>1959-60</td>
<td>128</td>
<td>118</td>
<td>109</td>
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<tr>
<td>1960-61</td>
<td>134</td>
<td>110</td>
<td>122</td>
</tr>
<tr>
<td>1961-62</td>
<td>136</td>
<td>115</td>
<td>118</td>
</tr>
<tr>
<td>1962-63</td>
<td>144</td>
<td>122</td>
<td>118</td>
</tr>
<tr>
<td>1963-64</td>
<td>148</td>
<td>137</td>
<td>108</td>
</tr>
<tr>
<td>1964-65</td>
<td>152</td>
<td>133</td>
<td>114</td>
</tr>
</tbody>
</table>

The advantages of herring-bone milking sheds have been studied by the New Zealand Dairy Board. Farms in the North Island were visited before and after this type of installation had been completed. It was found that before the herring-bone type of shed was installed one man was milking an average of 49 cows; after the change-over the number of cows milked per man rose to 56.
TABLE III
Herring-bone Milking Shed Survey.

<table>
<thead>
<tr>
<th></th>
<th>Before.</th>
<th>After.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total men milking</td>
<td>155</td>
<td>147</td>
</tr>
<tr>
<td>Total cows milked</td>
<td>7581</td>
<td>8181</td>
</tr>
<tr>
<td>Cow per milker</td>
<td>49</td>
<td>56</td>
</tr>
</tbody>
</table>

The Manpower Working Party of the 1964 Agricultural Development Conference examined a similar kind of figure for the livestock industry. They found that in 1952 there were 483 ewe-equivalents per person employed in agriculture and that by 1962, this ratio had risen to 654 ewe-equivalents per person employed.

TABLE IV
Livestock and Labour Productivity in New Zealand.

<table>
<thead>
<tr>
<th></th>
<th>Ewe Equivalents.</th>
<th>Total Workers.</th>
<th>E.E./man.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1945/46*</td>
<td>55.8mn.</td>
<td>137,000</td>
<td>407</td>
</tr>
<tr>
<td>1951/52</td>
<td>62.2mn.</td>
<td>128,678</td>
<td>483</td>
</tr>
<tr>
<td>1961/62</td>
<td>79.6mn.</td>
<td>121,641</td>
<td>654</td>
</tr>
</tbody>
</table>

* 1945/46 data calculated by Mr D. Hussey.

On a national basis these productivity trends show up as a 67 per cent increase in labour productivity since 1949. By labour productivity I mean the volume of gross output per man employed in
farming. Thus while gross output of New Zealand farming has increased by 52 per cent since 1949, the labour force on the farms has declined by nearly 10 per cent. The amount of farm products produced per man has thus increased quite spectacularly.7

Labour productivity is only one measure of technical productivity, of course, but it is the most important one for New Zealand farmers. This is because labour is a scarce factor in agriculture, and the best use must be made of the farmer's own time and that of his employees. There is great competition for shepherds, ploughmen and tractor-drivers coming from new industries in our towns who find the rural labour force often has special skills they need. Finally, labour productivity is important because the farmer's own income depends on it. After the farmer has paid his wages, fertiliser bills and mortgage commitments, he has what is left to spend on himself. If more products can be obtained by given amounts of his labour and other inputs, he will be better off.

Let me sum up the argument so far. I have suggested that technical productivity is a slow but sure process that changes all the time. Economic productivity, on the other hand, relates to the income actually received after both technical productivity and prices have had their effect. In recent years, these two factors have tended to move in opposite directions, where gains in technical productivity have been off-set by adverse price changes. Farmers have had to produce more to maintain the same level of net farm income. Some wit has coined the phrase in this connection that farmers have to run fast to stand still!

I now turn to a consideration of past trends in prices and productivity and then I want to finish up by looking into the future.

The Agricultural Economics Research Unit at Lincoln College will shortly be publishing an analysis of farm income and productivity trends for the last 43 years.8 I want to use some of the data in this analysis to illustrate the trends we have examined so far. The long-term trend in technical productivity is measured by the volume of output produced by a given amount of farm inputs. The farm inputs concerned include land and buildings, the labour of the farmers and their employees, and the amounts of fertiliser, seed and other materials they use.9 Now in the period since 1922, this measure of productivity has improved by 43 per cent; that is, we now get nearly half as much again out of the work we put into farming as we did in the twenties. Let me repeat that this is due to better seeds, better pasture, better livestock and better farm organisation. It is the best measure we have of improvements in farming technology. Putting this increase in yearly terms, we can say that every year the technical efficiency of farming increases by about 1 per cent over the previous year.10 Thus in 50 years we can expect a 64 per cent increase in farm efficiency, and a doubling of
farm efficiency in 70 years. I believe that these increases will be achieved and may well be exceeded.

Farm returns have not increased by as much as this owing to the influence of prices. How do the 1960's compare with earlier decades in New Zealand history? By working out the average levels of prices received and prices paid in each of the five decades since the first war we can obtain the following comparisons:

1. Compared with the 1920's; the 1960's are 14% worse off.
2. Compared with the 1930's; the 1960's are 10% better off,
3. Compared with the 1940's; the 1960's are 21% better off.
4. Compared with the 1950's; the 1960's are 21% worse off.

**TABLE V.**


(1920's = 100)

<table>
<thead>
<tr>
<th></th>
<th>Prices Received</th>
<th>Prices Paid</th>
<th>Ratio*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1920's</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>1930's</td>
<td>69.5</td>
<td>87.0</td>
<td>79.5</td>
</tr>
<tr>
<td>1940's</td>
<td>104.8</td>
<td>122.0</td>
<td>84.9</td>
</tr>
<tr>
<td>1950's</td>
<td>226.8</td>
<td>216.9</td>
<td>105.5</td>
</tr>
<tr>
<td>1960's</td>
<td>223.6</td>
<td>255.2</td>
<td>87.1</td>
</tr>
</tbody>
</table>

* Average of individual ratios in each decade.

In some years, of course, the price ratios may have been much better or much worse than the average for the whole decade. But over the whole period since the first world war the present level of prices in New Zealand farming is better than the thirties and forties, but worse than the twenties and fifties. I do not believe, on this evidence that we can say that there has been a permanent deterioration in the New Zealand farmers' relative price situation. There are clearly great changes in the price ratios, and further investigation is required to determine whether the position is any better or any worse than it ever was.

What of the future? We must assume that the consumers of our overseas exports will inform us of their requirements through the price mechanism. If we send increasing quantities of lamb into the British market we are vitally interested in the price the British people are prepared to pay for it. We have to remember that it may still pay us to accept a lower price per lamb, as long as we can continue to add to our foreign exchange reserves. Beyond that point we would have to restrict exports to prevent market saturation. We want to know on the one hand what the future requirements are of our overseas customers, and the prices that they will be prepared to pay. On the other hand, we want to know how to control or modify the effects of inflation on the New Zealand economy.

Apart from essential imports, this problem rests firmly in the hands of the Government and the electorate of New Zealand. The
price we pay for full employment, an eight hour working day, and repeated wage awards, is a steady erosion of our cost structure and a decline of our competitive position in international markets.

New Zealand is a producer and exporter of primary products. Our products either provide food for overseas consumers or raw materials for their manufacture. Economists have recognised for many years that consumption of primary products does not increase much faster than population growth. We say they exhibit a low income elasticity of demand. In addition, items which are not such necessities but which are consumed more as incomes rise, tend to have a low proportion of primary production materials in them, such as worsted suits. The net result of these trends is that a smaller and smaller share of the total international income comes to primary producers. In a recent article, Seers has shown that these factors are reinforced by several others. I will mention some of them.

If the primary content of the final product gets smaller, then the share of income is smaller. This would apply to the modern food processing industry.

If population growth is higher in the primary producing country, then the share of income per head is smaller.

If primary production content has wide substitutes, like synthetics and wool, then the primary producing countries' share of income is adversely affected.

If importing countries protect their local agriculturalists, then the demand for imports falls.

If world price trends favour exports of industrial countries rather than primary producing countries, then again primary producers suffer.

I mention these factors because they are the realities on which New Zealand's future rests. British economists have recently completed a study of the export prospects of various members of the sterling area, based on a number of these propositions. Taking our main products of meat, butter, cheese and wool, they estimate that the anticipated growth in total demand in the main industrial areas up to 1975 is less than 3 per cent per annum. This can be compared with the Agricultural Development Conference's target rate of 4 per cent per annum, for instance. For butter and wool alone the projected increase is only 1 per cent. Within the United Kingdom, the rate of growth for each product varies from 1.1 to 1.6 per cent and the demand for wool actually declines. On the other hand, the rate of increase of demand for all four products in Japan is quite high.

In the view of this authority the growth prospects for agricultural primary products are relatively poor, especially at the price levels of the 50's. This qualification may be very important, of course. As I have already indicated, some fall in price of our export products may well sell the increased quantities we intend to send in the remainder of this decade. We would still be better off than if
we had not expanded our agricultural industries at all. New Zealand has really no alternative in this matter but to expand.

My own view of the future is one of cautious optimism. Current events within the country are providing a check against rising internal costs, and world-wide political and military disturbances may well disrupt the above prognostications of the "dismal science"!


2. Present electricity consumers are benefiting from past investment in electricity generation, but the rising cost of further generating plants means that present prices for electricity may still be too low.


4. The cost-price squeeze should really be called the input-price-output price squeeze as it has nothing to do with total costs.


7. This should be qualified somewhat as the shift occurs from employed labour to contract labour. The best gross measure of productivity is the volume of output per unit of gross inputs, which include the labour element in contracting.


9. Farm inputs are defined as the total of all land, capital, and working expenses used in farming. The annual input of capital is measured at 5 per cent of the value of land and capital; all men occupied in farming at the standard wage for 1949/50 (£350 per man); and total non-factor expenses for each year.

10. The increase is actually more than 1 per cent; as more factors are applied to the same area of land, increased productivity also has to counteract a diminishing returns effect. Mr B. J. Ross has pointed this out to me.


THE LABOUR POSITION ON THE FARM

J. L. Morris, Assistant Lecturer in Farm Management, Lincoln College, and R. G. Cant, Lecturer in Geography, University of Canterbury.

Over the last two years the Agricultural Economics Research Unit has carried out a series of surveys to collect information about the farm labour position. It is our intention this morning to give you some of our initial conclusions and to tell you about some of the new developments that are taking place. Before we do this there are three things I would like to say about the research programme:—

1. Its initial stimulus came from the very careful work done by the Manpower Working Party of the Agricultural Development Conference in 1963. (Those of you who were at the Farmers' Conference two years ago will remember a very lively paper given by Mr N. S. Woods, the Chairman of the Manpower Working Party.)

2. It seeks to find answers to a range of questions which are raised by the drive for greater efficiency and greater production in agriculture:—
   "How great is the shortage of farm labour?"
   "Are wages and conditions adequate?"
   "How many trained, skilled workers are leaving farming?"
   "Why do people leave farming for other jobs?"

3. We seek to collect our information from as wide a range of sources as possible. Since neither the Department of Statistics nor the Department of Labour are able to collect annual information about farm employment we have carried out a number of small scale surveys in selected districts. In two of these we have gone direct to farmers for information, in two others we have worked with groups of people who have recently left farming, in a fifth we have established direct contact with farm employees.

Today, we want to look at three questions. Firstly, how do wages and living conditions for the farm employee compare with those available to the city worker? Secondly, what are some of the steps being taken to make farm employment more attractive and more secure? Thirdly, what steps can be taken to increase the productivity of labour?

Wages and Living Conditions

To answer the first question (about wages and living conditions) we have made surveys in two counties. Don McClatchy interviewed farmers in Patangata County, Hawke's Bay, and we did the same in the Cheviot County. The answers we have obtained apply specifically to those counties but the conclusions we reach have a relevance for most sheep and mixed cropping districts.

In the Cheviot County we looked closely at wages and living conditions for married workers. We found, first of all, that the housing provided was generally good. Almost every house had three
bedrooms or better, was in reasonable order and had a septic tank, electricity and electric hot water. Farm workers, in this district at least, were provided with housing which was not unsatisfactory by city standards.

We found, secondly, that wages were better than most people realise. We took the average wage before tax, we added the value of bonuses paid and we gave extras such as house, meat and telephone a cash equivalent. Over half the married men employed in the district received, by these calculations, a gross weekly wage between £23 and £25 per week (table 1).

Table 1: Weekly Wage for Married Men, Cheviot County, 1966.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average wage, excluding bonus and extras</td>
<td>£17 12 0</td>
</tr>
<tr>
<td>Average value of bonus</td>
<td>1 1 0</td>
</tr>
<tr>
<td>Average value of extras</td>
<td>5 3 0</td>
</tr>
<tr>
<td>Average gross wages, before tax</td>
<td>23 16 0</td>
</tr>
</tbody>
</table>

The results of the Patangata Survey were very similar. The average wage, excluding bonus and extras, was £17/10/- and the average bonus ten shillings per week. Had extras been valued on the same basis as for Cheviot the average gross wage would have been £23/4/-.. In both cases a cash equivalent of £23 or £24 per week before tax and a tax payment that could be a pound a week less than for a city worker who received no allowances in cash or kind.

The fairest way to describe this average figure is to call it an adequate wage. In most cases it is neither better nor worse than the same type of employee would receive in a city job. This is a generalisation—with all the risks that generalisation involves—but we bring it forward because it makes a critical point. Where other aspects of farm employment are satisfactory the man who receives £18 a week plus free house and extras has no need to move to the city. Conversely, if other aspects of his employment are not satisfactory, the man receiving these wages has no need to stay on the farm. The real crux of the situation is not so much the wages as the conditions under which the farm employee works. The wages shown in the table are adequate to hold him—if other aspects of his employment are satisfactory.

In the case of single adult workers wages and conditions were not quite as good. Gross wages (including bonuses and an assessment made up to £4 per week for full board) averaged only £18/10/-.. This is much less, for example, than that received by an unskilled worker in the building industry. In most cases the accommodation provided is a single room which gives the employee little opportunity to entertain his friends or live an independent social life.

The remaining group of farm employees are boys or youths in the 15 to 20 age group. As yet we have little detailed information about wages or living conditions. The conclusions I give here come not from the Cheviot or Patangata surveys but from discussions with people concerned with the placement of boys on farms—Careers Advisers, Vocational Guidance Officers and other Liaison Officers. The average wages paid are, as they must be, well above the figures
set when the award was last revised fifteen years ago. The average figures for workers in these age groups conceal wide variations. A small minority of farmers do the industry a great disservice by recruiting boys direct from school, working them long hours and paying them wages which are little higher than the 1952 award. It is unfortunate that the wages and conditions of employment recommended by the Farm Training Cadetship Schemes are not accepted as a guideline by all farmers who employ labour under the age of 21.

**Improved Employment Conditions**

As background to the second question—that about new developments aimed at making farming more attractive and more secure—I want to mention briefly the men who leave farming. Much of our research in the last twelve months has focused on these men who move to other jobs. We are not concerned here with the misfits or the incompetent; the men who drift in after an unhappy experience in some other occupation and then move out again more rapidly than they arrive. We are concerned here with a sizeable body of men who are skilled, experienced and reliable, who leave farm employment and take up jobs in the city. In the last three months we have written to or interviewed over 70 adult workers who have left farming since 1963. In most cases they were an asset to the farm labour force which we can ill afford to lose.

Such men leave farming for a variety of reasons. Each decision to move involves many different factors. One of the research projects we are working on at present is designed to measure the different factors which make people satisfied or dissatisfied with their jobs. It is not my intention to discuss these today. Instead I want to talk about developments in farm employment which may help to slow down the drift to the city; to pass on to you some of the ideas which farmers are considering and which may be appropriate for you in your situation.

First of all one which concerns the single employee. We have heard from Gordon Lyall about two farmers who have built motel style accommodation; detached units consisting of single bedrooms, a lounge, a bathroom and a fully equipped kitchen. Such a motel can be designed for one, two or more single men or youths. The economics appear to be sound where new accommodation is required anyway. The total outlay is less than for a married man and the labour you employ is more flexible; it can be increased or cut back and the building does not become redundant. The social advantages are considerable—the men prepared their own breakfasts and weekend meals and were able to spend their free time in pleasant surroundings without being thrust in upon the farmer and his family.

Or instead a possibility to attract the married man whose family has reached secondary age and will soon be looking for employment—we lose a lot of good farm employees at this stage. The suggestion made here is to build a house for the married couple not on the farm but in an established settlement.

We know of one farmer who employs three men, none of whom lives on the property. They all live in a township and travel 13
miles to work each day in a vehicle provided by the farmer. This works well and has numerous advantages for employer and employee.

The first is that the farm worker has the opportunity to own his own home if he so desires—this is increasingly important as married farm workers get older. It also obviates the possibility of the farm becoming highly capitalised with buildings for farm workers.

Secondly, schooling, especially secondary schooling, is less of a problem.

Thirdly, it has social advantages—there is less social isolation. Moreover, by allowing them to live completely independently, it removes the possibility of friction between the farmer’s wife and the employee’s wife.

Another advantage is that it gives the farm worker’s wife the opportunity to take a job of her own. In this modern age more and more married women are interested in employment.

In practice it has also been found easier to get casual labour from the township concerned—for example, schoolboys on Saturdays and during school holidays.

This idea of non-resident farm labour is particularly appropriate where there is a sizeable township within 10 or 15 miles of the farm and it assumes that the farmer is willing to pay either a weekly travel allowance or a mileage allowance. The cost of this to the farmer is probably not greater than many bonuses which are paid at present and will be more highly regarded by the worker since it is tax free.

Two other items I want to mention this morning involve no capital outlay and do not necessarily imply greater cash expenditure. Both are based on the principle that farmer and farm employee alike should get maximum value from the money which passes from one to the other.

In the first instance there are a number of farmers up and down the country who have taken a long and critical look at bonuses and made some changes. Some have done away with bonuses altogether and added an equivalent amount to the weekly wage. Others have converted the bonus into an incentive payment and related it to increases in stock numbers or butterfat production. One farmer we have heard of has a waiting list of prospective employees—he has cut out the bonus and delayed increases in the weekly wages in order to introduce overtime payments. The result is a much more satisfied workforce; Sunday afternoons now you will find two contented people; the boss sitting inside by the fire and one of his employees going out round the sheep—at double rates he is glad to be out for the extra couple of hours. The key point we are making here is not that bonuses should be done away with but that money should be spent in the way that will give maximum satisfaction and maximum return to all concerned.

Secondly, we note that more farmers and more farm employees are realising the importance of life insurance, superannuation, or building society schemes. Unless the farm employee participates in such a scheme he is at a serious disadvantage where home ownership
is concerned. His counterpart in the city can capitalise the family benefit and pay off a mortgage out of weekly income. Many men who entered farming without the opportunity to participate in such schemes leave again in mid-career to take a city job and buy their own home. Of the 70 people I mentioned before over 40 have purchased their own home since moving to town. Not all youngsters beginning their career realise the value of schemes which lead to home ownership and it may be necessary for the farmer to take the initiative in many instances.

**Increased Labour Productivity**

In the third part of this paper we shall look at the whole question of labour productivity or efficiency of labour use at the farm level.

With the shortage of experienced farm labour, the drop in sheep farmers' incomes this year, and the general degree of uncertainty with regards to prices and profits in farming this is perhaps a time when all farmers could re-examine their efficiency of utilisation of farm labour, that is, their output per man. Can more be produced with the same labour force? It could be that some of our farm labour has been employed on traditional grounds rather than on the basis of present-day physical necessity.

As Mr Johnson has said, and I quote, "... labour is a scarce factor in agriculture and best use must be made of the farmer's own time and that of his employees..." He also suggests that the future trend must be for increased labour productivity. While there is no one answer the work we have done so far suggests several possible ways of achieving this increase. However, let me point out that by an increase in productivity we do not mean more hours worked, nor necessarily harder work per labour unit but rather more efficient work per man hour or per day, resulting in a greater output for the time spent. Our aim should be for reduced hours, less drudgery and a better way of life, but at the same time achieving greater productivity. That is, more satisfaction for all concerned.

We think the key to this lies in organisation—both farm organisation, meaning such things as layout, access, etc. (which Mr Inglis will no doubt mention later) and also labour organisation, which basically means doing each job in the best possible way. (This is what Mr McArthur calls method study and he will be talking about this later today.)

Thus, all farmers, whether they employ labour or not, should look at their farm and labour organisations. This may necessitate a revision of some of our attitudes, especially about such things as work capacities.

For example, stock units per man. In Great Britain the accepted figure is about 400 ewes per man. In New Zealand in 1962 the national average was 654 stock units per man. On the hill country of the Cheviot County each man handles approximately 1500 stock units on an average. There are a number of farmers managing 3000 stock units or more; in fact, we know of one man running
4000 stock units besides doing a considerable amount of development work, including three miles of new fencing, all on his own. He still seems to have time for some of the pleasure of life—he’s here at the Conference today.

Those of you who were here last year will no doubt remember Hugh Clifford’s paper in which he quoted the example of the dairy farmer milking 132 cows on 126 acres on his own in one and a half hours.

Another example—this time from the mixed cropping world. There is a farmer in this district, with a property of approximately 230 acres, who runs 500 ewes, as well as doing all the necessary cultivation and harvesting of 220 acres of crops, by himself. He is aiming at 300 acres of crops per year for best utilisation of his large tractor and machinery, bulk harvesting equipment and also the optimum use of his own time.

No doubt there are many farmers achieving greater productivity than these examples and advancing technology may lift our horizons even higher.

However, the basic solution rests on forward planning and overall organisation. These are the keys to success. Perhaps in some situations such increased physical productivity of labour may require sacrificing a little per animal performance. However, if the cost of this sacrifice is less than the saving in not having to pay extra wages then increased economic productivity also results. In other words, the farmer is “better off” financially. Perhaps this is best summed up by one farmer who said, “Broadly speaking, men are getting dearer but sheep aren’t.”

This of course requires some reconsideration of our measures of output. Where labour is a limiting factor of production then should we not be thinking in terms of production or output per man rather than production per animal? For some farmers, achieving this increased output per man may require some adjustment of the seasonal demand for, and supply of, farm labour. Firstly, the peaks in seasonal demand. There are several established management practices which alleviate this problem. For example, pre-lamb shearing reduces summer labour demand and less shepherding is required at lambing. Also it is well known that changing from breeding ewes to dry sheep or beef cattle lowers labour requirements.

Secondly, the seasonal supply. Many farms have traditionally employed a permanent man who was fully utilised for only part of the year and was carried for the remainder. This luxury could be afforded when wage rates were lower but with the continuing cost-price squeeze alternatives must be examined. Many of these farmers have turned towards casual labour which, however, is becoming more difficult to obtain in many areas. Group farmer labour schemes or the increasing number of agricultural students and farm cadets may help to meet this seasonal demand in the future.

Alternatively, since there is less heavy physical work on farms today, girls could be encouraged into farm work as a vocation. It is said that a woman who is good with stock is better than a man.
This would also have the beneficial effect of helping to restore the balance of the sexes in rural areas.

It is clear that contract services already play an important role in equating labour supply and demand in most areas. This is likely to increase.

Much of our modern farm machinery, while being more efficient, also involves high capital costs. Thus to make best use of it specialised contractors are often required. Some of these services available at present include development cultivation, weed spraying, grain harvesting, mobile sheep dips and mobile sheepyards.

However, there is still a place on the individual farm for machinery which increases labour productivity. We will hear more about this from Mr Crosbie and we will see examples this afternoon.

Suffice to say at this stage that such labour saving devices as bulk grain handling machinery, post and stake drivers and the like have considerable possibilities in assisting the increase in output per man.

Concluding:

All in all we are confident that farm labour problems can be solved. There is, however, no single answer which will meet the needs of every farmer. Each must assess his own situation and adopt those approaches which best suit his needs. In broad terms there are two approaches which should be followed simultaneously; on the one hand we must retain more of the best workers while on the other hand we must continue to increase the level of productivity per worker.
FARMING METHODS FOR HIGH LABOUR OUTPUT

J. A. H. Inglis, Farmer, Woodville.

This is a fairly wide subject which could fill a whole thesis rather than 20 minutes of speaking, so let us run through some leading principles and then look at how the farm in which your speaker and his sister are partners, is conducted. From this I hope some of my audience will be prompted to do some constructive thinking for themselves; the value of any education, particularly after one leaves primary school, is not so much in the facts one learns, as in learning to think for oneself.

My knowledge of Canterbury farms and farmers is not great. It is less than of most other parts of New Zealand, so I am not sure whether the cult of ancestor worship is as common here as in some other areas. We all know the types who do everything according to grandfather's diary, and never think for themselves. To truly honour our forebears, however, we must start from the base they have given us and progress from that.

My thoughts today are not directed at the ancestor worshippers, or those who regard farming as a way of life rather than a business. A group such as I see here will comprise people who want to improve their farming and their finances; a very obvious way to improve finances is to make better use of the farmers, be they wage-earners, salary earners, or self-employed. Let us have one fact clear—I am not suggesting working long hours. On our farm, Ratahiwi, we start work at 7.30 or in the winter 8 a.m., and finish at 5 p.m., except for Saturdays about noon. If stock work, particularly shearing, requires some long days, we take off equivalent time; as lambing requires seven days a week work for four weeks, the partners and the shepherd each take a week's holiday after docking in addition to annual holidays. We do not work much longer days during lambing—breeding and more particularly feeding management help in this.

I do not expect you all go home and fire one of the staff—they are usually scarce, anyway, so improvement in labour utilisation really will mean more and better work is done. If you will all apply some guiding philosophy such as I use, this is more important than any "bright ideas".

Any person must be prepared to justify himself to himself for anything he does or believes. (Justifying oneself to others is merely face-saving.)

For anything which is to be done, there is always a better, an easier, or a cheaper way to do it, and however much we improve our methods, this truth will still apply.

We have used these principles for a long time and I do not feel it necessary to apologise to anyone who has heard me often. Once one can start to look critically at oneself, one is commencing to use one's head as well as one's hands and feet. Whether this leads us to spend more or less time sitting on our tails is immaterial.
Work Planning

It is necessary to have the work requiring action fairly well planned out in advance, just as most of us plan our grazing and feeding management of the ewe flock in winter and spring.

This really should be drawn up in much the same way as our livelier accountants draw up cash budgets for us. Whether a person does this for himself, or calls in a farm advisory officer, an improvement club instructor, or a private practitioner, is a matter of personal choice. I must confess that as my partner and I are always searching for those “better ways”, our work budget is often altered somewhat and tends to be carried in our heads rather than neatly drawn up for others to see.

We must classify forthcoming tasks in two ways:

1. for urgency—
   (a) Stock work of a seasonal nature, and cropping and harvesting. These must be fitted together.
   (b) Those tasks such as attending sales and lectures, which must be done to other people's timetables.
   (c) Work which requires action, but in less seasonal, mostly maintenance and improvement work.

2. According to the weather condition required; in the high rainfall areas this is much more important than in Canterbury. We approach the matter in this way—
   (a) If the sheep are dry to handle.
   (b) If the weather is likely to be dry for at least half a day.
   (c) If the weather is likely to be showery, or failing this
   (d) If it will rain.

I have not included harvesting, as our farm is by reason of contour and rainfall quite unsuitable for cropping as you know it. You can make up your own lists of priorities. Incidentally, the preparation of this paper came under (d) “wet weather work,” but as we have had a wonderfully dry autumn, time ran out and much of it was done on a weekend, on the Sunday of which we saw a rainstorm coming so mustered some hoggets and put them in the shed for crutching on the Monday; obviously we have to be flexible.

Recently I was talking to a friend whose job consists of calling on farmers as an employee of a stock and station agency. He suggested that most farmers spend till ten o'clock trying to decide what to do with their day, by which time it looks like rain so they stay indoors. This may be an extreme view, but there must be something in it, even if it does not apply to my home area.

Labour Use on Ratahiwi

We at Ratahiwi can claim some reasonable showing on economical use of labour, as in the period 1949 to 1965 the two partners were the whole permanent labour force, with fencing contractors averaging half a man per year, and other contractors being called in for aerial topdressing, and for shearing and winter ewe crutching. We do not attempt to do our own cartage.
From winter, 1964, to winter, 1965, we went from 950 acres running under 5,000 ewes plus hoggets, to 1,150 acres running over 6,500 ewes plus hoggets, so at that time we engaged a salaried shepherd. The three of us are coping happily with the work, doing quite a bit of fencing ourselves, and our assistant does not seem to feel overworked. I gather work is started more punctually in the morning than at his previous job, but that he likes being able to finish work punctually.

I submit this suits both him and his wife.

I see some cases where farmers work all the hours of daylight, but if they keep it up for long they do not get much done—a chronically tired person performs his work slowly and inefficiently. A more serious aspect is that he becomes slow in his reactions and thus accident-prone, as well as being more likely a subject for illness such as 'flu'.

In hot weather we happily start specific jobs of sheep work at daylight for the sake of the sheep and dogs, rather than just the workers, but we finish work at an equivalently early hour in the afternoon.

By applying the approach of justifying to oneself what one does, we have found quite a number of minor jobs can well be eliminated as being not worth doing. A very obvious one is the house cow which disappeared from Ratahiwi many years ago.

Where to Economise

The major headings under which we execute the work perhaps better than average come under several headings:

1. Farm layout, including yard construction and paddock size.
2. Transport around the farm, particularly of persons.
3. Grazing system (partly dependent on layout).
4. Breeding policy, where modifications enable more sheep to be handled.
5. Having more than one responsible person working on the farm.
6. The manager (owner or otherwise) should be capable of doing any task, and also be prepared to sack a worker if necessary.

Let us look at these rather more fully.

1. **Layout**

Until recently the dairy industry seemed to be the only branch of farming where intelligent layout based on a system of internal roads, lanes or races was much used. Sheepfarmers for some reason appeared to prefer a collection of square paddocks where the only way to get stock to the yards was through all the other paddocks and usually there was only one set of sheepyards. In cases where a breeding herd existed there might be a stockyard.

Those of us whose farms are subject to severe winter wetness have rather more incentive to improve layout, as in wet conditions driven stock do a great deal of damage to pasture. Therefore, for ease of driving stock as well as consideration of pasture, a system of lanes, metalled where necessary, becomes imperative. If paddocks
are the shape of a sheet of paper they are easier to muster and can be subdivided if required into two paddocks of the same shape. Where a sheepfarm is much over 200 acres more than one set of drafting yards is indicated if time taken droving is of any value, and where three or four paddocks join, a simple holding yard is essential whether connected to a lane or not.

Our conception of paddock size is that a paddock should run not more than 200 ewes, set stocked through winter, lambing and up to weaning. The grazing is more efficient, but for the purpose of present discussion, we can take it that easier and more efficient handling of sheep is sufficient to pay for the fencing costs.

All these ideas on layout are obviously very easy on flat or near flat land, and we find they can be adapted to fit almost any hill country quite satisfactorily; it would be very rare to need to tear up many existing fences. Of the nearly 70 paddocks on Ratahiwi’s 1,150 acres very few do not connect to a lane and most of these soon will be connected. We have six sets of drafting yards plus one on the way, as well as a number of simple holding yards which are invaluable for docking and dagging with the aid of several portable hurdles, and of course for dagging a couple of light portable shearing plants are needed.

A fairly elementary set of sheepyards can be built based on common patterns as designed by the Department of Agriculture, and suitable for working two or three thousand sheep, for quite a low cost. The design must of course be varied to fit awkwardly-shaped sites, and anywhere from two to five yards can feed into the diamond. The only point which is often missed is that two crushes must run parallel to each other between diamond and race; one should be three feet six inches wide for fat drafting and regular racing, while the other must be two feet four inches for dosing and vaccinating by one man. This latter must have a gate in the side right by the filling gate, so that dosed sheep never crush back behind the operator—each goes out to a yard as it is handled. Obviously a crush inside the woolshed is also needed.

There are a few tricks for making fences easier to build, such as wire fences across swampy dips and gorges, and attaching boards to posts for yards.

2. Transport

We as a community are catching up fairly well on this one now. If anyone customarily rides a horse to town instead of taking the car, we are inclined to tap our heads behind his back, but when I scrapped the horse barely ten years ago and started using a motor-cycle on a 20 mile shepherding beat, as well as for mustering, I know some head-tapping was done; one of our local farm advisory officers told me I would not be able to afford that luxury for long.

The three of us do the lambing beat on a tractor plus sheep crate each (actually one uses a Gnat) and the rest of the shepherding is done on the three motor-cycles. We have run a pickup for years, and it can get over quite a bit of the farm. Recently we acquired an old Landrover, and it is quite handy under dry
conditions. When the ground is wet it is rather good so long as we stick to metalled tracks.

It will be quite obvious that quite a lot of bulldozing and metal­ling has been done, and in our case many culverts have been put in, as well as two bridges 50 feet long, one 25 feet, and several smaller ones.

3. Grazing Systems

Unless one has some reasonable fencing layout, one just doesn’t have the scope to do anything about grazing control; we have found by doing something like set stocking or what I prefer to call util­isation stocking, we can save a great deal of time which would be needed for constant shifting of our sheep, which vary in number from 8½ to 14½ thousands according to the time of year. Of course sheep do better when they have a home. The size of the flock is regulated to match grass growth—we do this by putting off surplus ewes and lambs at suitable times. In our climate the wet summer make grass control difficult from December to March, but in a Mediterranean type climate the seasonable growth pattern is different.

By making sure the ewes do not have any old straw or even Yorkshire fog stalks as they come to lambing, we eliminate most bearing trouble—it takes quite a time to sew up one case. By seeing the ewes are not actually putting on condition as they lamb, or pre­ferably are losing at a rate which does them no harm, we can keep down the birthweights a bit—this is a help from the labour angle.

4. Breeding Policy

Ratahiwi has been in the habit of running two flocks; about three-quarters Romney ewes and one-quarter Perendale. The Perendales are left alone at lambing, and are run on the higher and less accessible country, across a mountain stream which floods but cannot easily be bridged. They need just as much work for the rest of the year, but make it easier to handle the actual work of lambing. There are no doubt other crosses which help in this way, but the Perendale has suited us.

Nowadays some of the better Romney breeders are prepared to keep sufficient records to enable us to select families which have a record of no assisted births; it appears reasonable to suppose these rams which we are now using will impart some of these char­acteristics to their daughters. I submit constructive breeding of stud sheep should be going more in this direction, but it will not until the flock ram buyers start asking for this. I am confining my comments to longwool sheep—we do not see many fine-wools in the North Island.

5. More than One Person.

As regards size of holding and labour force, I am convinced one person running 2,000 ewes alone will be fairly well extended; we found two of us could cope with well over 4,000 and three of us are happy with 6,700. In other words a holding for efficiency should be large enough to need more than one of a permanent staff. It
is worth noting most professional businesses have two or more partners at the head, and while no doubt each has his special skills, the main reason for this is the same as that which makes two sheep-worrying dogs much worse than one—what one doesn't think of the other does. This principle applies to farming, too, and in my case I am fortunate to have my sister as partner. We often develop ideas by argument and our shepherd is starting to be useful in this way, too. If the farmer has a wife who is interested in the farm, or a responsible and intelligent salaried assistant, they can carry out the same function of helping to develop ideas.

6. Ability of Manager

I am using the term “manager” to apply to the boss, whether he is owner, part owner, or salaried employee. The subject does not need much hammering; we all know how effective it is when the manager complains about a shearer's work—if the shearer thinks the manager cannot shear he says, “O.K., boss, you show me how.”

Sackings of contractors, or instructions to them to sack staff, have ben extremely rare at Ratahiwi, but everyone knows that could happen.

Conclusion

In conclusion I wish to make one reference to financial considerations, which will apply, more in these times of tight money than it used to do. Our roading, fencing and motor bikes cost quite a bit, but in the farming industry we have to provide employee housing and two more houses on Ratahiwi would be costly to build, maintain and service.

The preparation of this talk is not waste time to me, although of course I do not get paid for it. It has forced me to examine again some of the facets of our work, a most necessary exercise. If my audience can offer some useful questions I shall go home with some more thoughts, whether or not I have given the answers you want.
WORK STUDY AND MECHANISATION

C. J. Crosbie, Farm Advisory Officer (Machinery), Department of Agriculture, Christchurch.

Because there has never been an abundance of labour on New Zealand farms, we have been well ahead of other countries in economy of labour and this factor together with our climate, has enabled us to export to a market 12,000 miles away. The attitude of mind of our farming community has always been a progressive and an enquiring one—an attitude that enables early acceptance of new ideas and discard of the redundant. This attitude was inherited from our forebears who only a little over 100 years ago tied their belongings within the four corners of a blanket and travelled for three months in a sailing ship, living on stale water and salt meat. Truly theirs must have been an attitude of vision, foresight and progress to enable them to surmount their hardships in a new land to be broken in out of the raw.

Today the prices on the overseas markets are on the decline and farmers have been asked to increase their production and livestock numbers to a level 40% above that pertaining in 1962—this target to be achieved by 1972. In the main, these extra 40% of animals will be handled by the same farming crew as in 1962. Currently this target is being met and even surpassed.

Can we continue with the target, bearing in mind the small annual labour input into our farming industry? I believe we can and I believe that work study will do much to make this possible.

Work Study

The purpose of work study is to make work easier, simpler and less fatiguing so that the farmer and his workers can accomplish more in a day while still working at an ordinary pace and to cut out unnecessary drudgery.

There are two main branches of work study—Method Study and Work Measurement. The aim of Method Study is to analyse work and find ways in which the methods used could be improved. In farming, this is by far the most important point. Work Measurement aims to measure the work content of any job and whilst simple measurements can be made by anyone, the more advanced techniques require a lengthy training course. Mr McArthur will enlarge on these aspects in a later paper.

Work study (or work simplification as it is known in U.S.A.) may result in savings of time, energy or cost, or any combination of these. Time and energy saved, if applied to other productive work, can result in an increase in farm business, volume and income.

Of equal importance to many farmers may be the benefit of shorter work days, reduced fatigue and elimination of drudgery in farm work. Farmers in future will enjoy shorter working hours and lighter work—much the same as those enjoyed in cities. Research in work study can help achieve this goal.
The largest single item of cost in farming is labour (33% to 22% of a dairy farm costs budget from 1950 to 1960 and 17% of a sheep farm costs budget in 1958-62—this includes no allowance for the farmer or his wife). Labour is the major item a farmer has to sell. The return for labour is how much he produces—not the time spent on the job. One way to increase profits is to get more products for each hour of labour. Work study helps do just that—it reduces time taken to do work.

Work study may be summarised as a systematic study of work methods in order to:

(1) Eliminate all unnecessary work.
(2) Simplify the hand and body motions used in doing work.
(3) Provide a more convenient arrangement of work areas and location of materials for doing the work.
(4) Improve on the adequacy, suitability and use of equipment needed for the work.
(5) Organise the work routine for full and efficient use of men and machines.

Work Study and Mechanisation

In New Zealand, Work Study and Mechanisation go hand in hand as it must do in a country where labour is in short supply and wages are high (compare N.Z. farm labour at £20 a week and Central Africa, where farm wages for native labour in 1965 were 4/- per day). Machines can involve high capital cost with consequent high hourly running costs and the economics of their ownership is often in dispute in economists' discussions. But a feature often overlooked is the increased output per man hour employed.

Table I shows that in 30 years, the cows milked per man hour in New Zealand has increased four to five times if the exceptional case quoted is ignored. Only in this way could the large herds of 300 to 600 cows presently being milked in the North Island, be handled.

Here as a result of new building design, work areas (cows) have been placed closer together to reduce walking, the work (udders) have been arranged at a more convenient height and unnecessary work has been eliminated (stripping).

In the harvesting field the use of bulk headers in the last six years has halved the crew, nearly doubled the throughput of grass seed per hour (see Table II) and in addition ends up with the seed in the granary at night instead of in rows of sacks still in the field. With wheat, the position is even more spectacular. In the last 35 years the tons of wheat harvested per man hour has increased over 20 times. Today 100 to 200 acres of wheat is easy for two men with full bulk facilities and farm storage.

Here two processes have been combined—the cutting and threshing of grain in the one machine (the header), and stooking has been eliminated. In bulk headers unnecessary sacking off has been eliminated.
Even in ploughing (Table III) the output per man hour has increased markedly and this must not be overlooked when the question of large tractors is being considered.

Here animal power has been replaced with motive power with consequent elimination of early and late hours of work, feeding and grooming horses. In the most recent years the large tractor now pulls wider ploughs at faster speeds, but until the discovery of a high speed plough, there is a limit to speed ploughing depending on soil type and terrain.

Often of importance is the interplay of a new farm operation with those that follow. Consider the advantage of immediate cultivation and early autumn drilling of grass following a bulk harvest, or the new bulk whole grain winter sheep feeding now possible because of cheap farm silos and grain augers. These advantages are often hard to assess in terms of hard cash, but are nevertheless of great importance to the people concerned.

Contractors

In England in 1961, a farmer in discussion with me criticised the output of New Zealand farmers saying in effect "No wonder it is high—they employ contractors to do half their work, e.g., shearing, topdressing, drain cleaning, hedge cutting, heading, hay baling and the like".

I see nothing incompatible in our attitude to contractors when one considers their relationship to a work study conscious farmer. Each recognises the worth of the other so that they work in harmony to mutual advantage.

The contractor is a specialist in his field who through long training is more efficient at his particular job than any farmer who engages in this operation only periodically. He has specialised equipment for the job and because he engages in this work for long periods, can afford more powerful, heavier equipment without resultant rise in overhead rates.

Contractors are found principally in districts of small farms where few individuals can economically afford to own the requisite machine and in these areas are a valuable asset to the farming community. On large farms, the same machine is often individually owned for the scale of work warrants its ownership.

Contracting functions best in work that can be carried out over a long season, e.g., shearing, fencing, building, topdressing, etc., and difficulties are encountered in such work as harvesting, where crop quality or quantity can suffer when delays occur in the arrival of the contractor. In land development contracting services have proved most beneficial in New Zealand. Here the specialist with his knowledge, skill and correct machinery has done a job that could be
surpassed by none on land that is often too steep or too rough to be tackled by average operators.

**Industrial Parallels**

Work Study has long been recognised in industry and is used in all efficient factories to advantage. A work study conscious farmer would be well advised to visit a factory to study the methods employed there.

Many parallels can be drawn between the method of work of a factory worker and a farm worker. Both have their labour to sell and their worth is measured by their work output. Consequently under efficient management a study of the methods used in a factory can be worthwhile.

The neat arrangement of the machines, raw materials stored near by, minimum travel for the worker, clear and defined passage ways, benches well lit and of correct height for the individual and the use of trolleys to minimise manual carrying are all features that could be introduced to farm work to advantage. When these adjuncts to work are as common on farms, then work output will be raised without the worker labouring any harder.

**Automation**

A study of the complexity of some of the machines used in factories leaves one wondering when some of their features will rub off into the field of agriculture. The degree of automatic control used is amazing yet the actual devices used to achieve this can be quite cheap—a matter of a few shillings for limit switches and time switches. Yet they have still to make their impact on agriculture. They are used only in a few fields—the fail safe switches and timers used on spray irrigation plants, automatic level switches for flood pumps and time and pressure switches for some water supply pumps. Why is it that automation is just being fitted to border dyke irrigation when watering is recognised as the most lonely, boring job on the farm? A pit to receive the bulk grain and a time switch on the auger will eliminate one man at the granary and speed up the truck turn round, yet few farmers have installed this cheap fitting. The same time switch wired to a yard light will enable a mechanic who has been working in the workshop at night to navigate safely to his home and switch the light off after he gets inside, yet few farms have them.

There is a vast field here for a few mechanics trained in modern methods and agriculture would benefit from their efforts.

**N.Z. Agricultural Engineering Institute**

After 140 years of farming in N.Z., this Institute was set up to bring the benefits of agricultural engineering science to the farming community and its need can be amply demonstrated in many fields.

Consider fencing. For over a hundred years we have been digging holes and filling them up again. But fence posts can be rammed into the soil with a machine that has only recently appeared in
N.Z., but which was known overseas 10-15 years ago. People have been straining up fence wires for years with no clear indication when to stop before the wire breaks. Clearly, some type of strain gauge is needed. With increasing stock numbers to be carried through the winter, attention is required in field of winter feed—are the conventional stacks of hay and silage and further south, the fields of swedes, sufficient for the future?

The Institute is working on these subjects and others of similar vein and given the facilities will make valuable contributions to the fields of work study and mechanisation.

The Position in New Zealand

There are no Work Study Specialists in Agriculture in New Zealand and there won't be unless some are imported, for the subject is not taught in our Agricultural Universities. Yet every inventor is a student of work study, for how else could he evolve an improved method or machine? Untrained in the subject—the name of the study not even known in most cases—he has invented a better way to drive in a stake or a post, a better method of dipping, footrotting or shearing sheep—or a better system of milking cows; to quote a few of the current ideas that are presently engaging the attention of farmers. These men with no formal training in the subject have done wonders.

If ever a course is offered in our Universities in this subject, then many of them deserve honorary doctorates. In many fields New Zealand leads the world in output per man hour, but more can be achieved when work study methods are adopted.

Application

Work Study in New Zealand agriculture will find its first rewards in fields which:

(a) involve lengthy operations or repetitious ones—here even small savings can be worthwhile because of repetition;
(b) occur at peak periods—time saved here is really valuable;
(c) involve overtime or which occur at weekends.

Misconceptions and Criticism

It is important to dispose of certain misconceptions.

It is sometimes said that work studies are merely a method of persuading the farmer and his men to work harder. On the contrary work study aims to eliminate unnecessary work so that more can be accomplished with less fatigue. In U.S.A., this subject is frequently called "work simplification" and this is in some ways more accurate.

Some feel that work study is solely a matter for the large farm. Whilst the larger farmers may be the first to appreciate the possibilities of work study, it holds advantages for the smaller properties also.

Work study has been criticised as being simply a matter of common sense and that faults in labour use can easily be corrected.
This is partly true—once a wasteful use of labour is recognised, the remedy seems obvious, but until the necessity for change is recognised or pointed out, the wasteful methods may continue for years without being noticed.

Conclusion

This has been a broad address with few figures and details but I am sure that work study has much to offer agriculture and that time spent on it will be well rewarded.

Recently I commented on the despatch with which a bowser attendant gave me my change after a fill of petrol (he had a till installed between two pumps) instead of undergoing the usual delays while he walked back to the office. He smiled and said, “It saves mileage”.

Work study can save mileage for you, too!

References

A most useful text on the subject of work study is:—“Planning Farm Work,” bulletin 172 of the Ministry of Agriculture Fisheries and Food, which can be obtained on firm order in approximately three months from the Government Bookshop, 130 Oxford Terrace, Christchurch—price approximately 9/- in New Zealand.

TABLE I

<table>
<thead>
<tr>
<th>Year</th>
<th>Shed</th>
<th>Cows</th>
<th>Men</th>
<th>Time</th>
<th>Cows/Man/Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>1937</td>
<td>3 Cow plant</td>
<td>50</td>
<td>2</td>
<td>2 hours</td>
<td>12.5</td>
</tr>
<tr>
<td></td>
<td>3 Sets cups</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hand strip</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1962</td>
<td>4 Cow plant</td>
<td>108</td>
<td>2</td>
<td>1.5</td>
<td>36.0</td>
</tr>
<tr>
<td></td>
<td>8 sets cups</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No stripping</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1966</td>
<td>14 Aside</td>
<td>300</td>
<td>2</td>
<td>2.75</td>
<td>54.5 *</td>
</tr>
<tr>
<td></td>
<td>Herringbone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1967</td>
<td>&quot;</td>
<td>338</td>
<td>2</td>
<td>3</td>
<td>56.3 *</td>
</tr>
<tr>
<td>1967</td>
<td>Angle Park</td>
<td>105</td>
<td>2</td>
<td>63 mins.</td>
<td>50.0</td>
</tr>
<tr>
<td></td>
<td>10 bails 10 cups</td>
<td>86</td>
<td>2</td>
<td>76 mins.</td>
<td>34.0</td>
</tr>
<tr>
<td>1967</td>
<td>14 Aside</td>
<td>222</td>
<td>2</td>
<td>149 mins.</td>
<td>44.4</td>
</tr>
<tr>
<td></td>
<td>Herringbone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1967</td>
<td>50 Aside</td>
<td>600</td>
<td>4</td>
<td>1.5 hours</td>
<td>100.0</td>
</tr>
</tbody>
</table>

* Same Farm.
### TABLE II

#### HARVESTING

**A. GRASS SEED**

1950-61 2 tow type headers, 2 tractors, 4 men harvested 2.5 ac/hr. Sacks still in field.

1967 1 self-propelled bulk header, 1 man harvests 3.5-4 ac/hr plus 1 tip truck and 1 man—bulk grass seed in granary.

**B. WHEAT**

<table>
<thead>
<tr>
<th>Year</th>
<th>Harvest Tons/Man/Hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1930</td>
<td>Wooden mill, 8 crew plus 4 in field</td>
</tr>
<tr>
<td></td>
<td>200 bush. = 5 ton/hr.</td>
</tr>
<tr>
<td>1945</td>
<td>Tow type header, tractor, 2 crew</td>
</tr>
<tr>
<td>1955</td>
<td>Medium bulk header, 1 man</td>
</tr>
<tr>
<td>1967</td>
<td>Large bulk header, 1 man</td>
</tr>
</tbody>
</table>

### TABLE III

#### PLOUGHING (1 MAN)

<table>
<thead>
<tr>
<th>Year</th>
<th>Plough Type + Horse/Cart</th>
<th>Acres per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1860</td>
<td>Single furrow plough + 2 horses</td>
<td>1-2</td>
</tr>
<tr>
<td>1917</td>
<td>3 furrow plough + 6 horses</td>
<td>5-6</td>
</tr>
<tr>
<td>1945</td>
<td>3 furrow plough + 30 h.p. tractor</td>
<td>8</td>
</tr>
<tr>
<td>1967</td>
<td>6 furrow plough + 70 h.p. tractor</td>
<td>18</td>
</tr>
</tbody>
</table>
A. T. G. McArthur, Senior Lecturer in Rural Education, Lincoln College.

Introduction

Today we have heard from people who have a natural flare for dreaming up new ideas and gadgets to save work. However, I do not think that it is wishful thinking to believe that many of us have some ability to find easier ways to do jobs if we put our minds to it.

The natural sportsman just picks up a racket or a club and belts the ball as though he had been doing it all his life—he plays a good game the first time. The rest of us need some coaching before we become proficient. By training and by thinking about the game it's possible to be just as good as the natural sportsman.

It is not stretching the analogy too far to say that you can train people to create new ways of doing work. This training is called method study. People who are steeped in method study don't find it hard to see better ways of working.

It is not my purpose to turn you into method study experts in 15 minutes. This would be impossible. Method study is more a change in attitude which take time to acquire. However, I hope to introduce you to some of the techniques used by method study engineers, to show that it is a worthwhile form of study.

Method study is a common sense procedure for analysing work. From this analysis you try and find ways to make the job easier. The techniques are very simple and straightforward.

Recording

Method study engineers substitute reliable written information for unreliable memory. In other words their first job is to record what is being done. This is often the key to finding better methods. I will give two examples of recording.

The first example is the problem of the two sided (now redundant) toaster. The job is to make 3 pieces of toast. The present method is to make two pieces first and then make the third piece. The problem is to find a more rapid method of making these three pieces within the restriction that there is no money available to buy a pop-up toaster.

Now the way to go about this problem is to first record the present procedure. Here is one way of recording such a job on a
multiple activity chart, in which the operation of the left hand side of the toaster is recorded alongside the operation of the right hand side.

Diagram I.

Multiple Activity Chart of Two-sided Toaster Toasting 3 Pieces of Bread.

(Present Method)

<table>
<thead>
<tr>
<th>Time (secs)</th>
<th>L.H.S.</th>
<th>R.H.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-</td>
<td>SIDE 1</td>
<td>SIDE 1</td>
</tr>
<tr>
<td>20-</td>
<td>SIDE 1</td>
<td>SIDE 2</td>
</tr>
<tr>
<td>30-</td>
<td>SIDE 2</td>
<td>SIDE 2</td>
</tr>
<tr>
<td>40-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-</td>
<td>SIDE 2</td>
<td>SIDE</td>
</tr>
<tr>
<td>60-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70-</td>
<td>SIDE 1</td>
<td>IDLE</td>
</tr>
<tr>
<td>80-</td>
<td>SID 2</td>
<td></td>
</tr>
<tr>
<td>90-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100-</td>
<td>SID 2</td>
<td></td>
</tr>
<tr>
<td>110-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An examination of this chart shows that the right hand side is idle for half the time. "If some way could be found to use this idle . . ." Diagram II gives the answer to the problem.
### Diagram II.

**Multiple Activity Chart of Two-sided Toaster**

**Toasting 3 Pieces of Bread.**

*(Improved Method)*

<table>
<thead>
<tr>
<th>Time <em>(secs)</em></th>
<th>L.H.S.</th>
<th>R.H.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-</td>
<td>SIDE 1</td>
<td>SIDE 1</td>
</tr>
<tr>
<td>20-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-</td>
<td>SIDE 1</td>
<td></td>
</tr>
<tr>
<td>40-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-</td>
<td>SIDE 2</td>
<td>SIDE 2</td>
</tr>
<tr>
<td>60-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70-</td>
<td>SIDES</td>
<td></td>
</tr>
<tr>
<td>80-</td>
<td>SIDE 2</td>
<td>SIDE 2</td>
</tr>
<tr>
<td>90-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

By taking out the first piece after its side one has been done and holding it until both sides of the second piece have been done on the right hand side and then doing its other side on the right hand side, 25% of time can be saved.

This example will appear trivial to you and of limited practical importance. I chose it because it is easy to demonstrate. However, you can easily see how it would be possible to have a multiple activity chart of the simultaneous operations of a header and the trucks servicing it in order to try and have both working to capacity.

The next example concerns feeding calves with reconstituted milk on the College dairy farm. I had allocated students a whole list of projects for them to study and thought I had better take one myself to show that the instructor could find a better method. For all I knew the dairy farm manager might have found the optimum method. But I was optimistic enough to believe that there must be a better way—an act of faith among those interested in method study.

An office attached to the dairy had the barrel for milk powder in it. Forty yards away was a calf shed and the paddock where the calves were on this occasion was about 180 yards away. One of the ways in which this job was recorded was with a string chart. This is shown in Diagram III.
The man feeding the calves filled up to two buckets with water and milk powder at the dairy where there was a hot tap and walked to the calf shed. Here he left the two buckets and went to the calf paddock to get the calves. He sent the dog into the paddock and walked (by habit) 50 yards into the paddock. He then baled up half the calves and fed them. He returned to the dairy and made up two more buckets of milk and fed the second lot of calves. They were then returned to the paddock.

The length of string gave us the distance walked. It was not difficult to improve the method of work. By keeping the powder down at the calf shed, trips with buckets of milk between dairy and shed were eliminated. This did mean that the calves were fed cold milk as there is no hot tap at the calf shed. Parenthetically, Mr Percival, at Ruakura, showed that calves rear just as well on cold milk, a discovery which also holds true for babies. We also suggested that they buy more calf buckets so that the calves could be fed in one batch instead of two and that the calf feeder refrain from walking into the calf paddock but merely open the gate and let the dog do the rest. The length of string now gave us the new distance walked with the improved system.

This string method is not only useful for recording existing methods but it is most useful for trying out new methods before the expense of the change is made. For instance, if you want to show your skill at method study try replanning your wife’s kitchen with a plan, some pins and some string. Draw a scale plan of the work area and take a sequence of events (say, cooking the breakfast). Wind the string round the pins to find the distance walked. Now replan the kitchen and see if you can reduce the distance walked. You can try the same method for planning the positioning of your wool shed, houses, fences and roads on a farm.
Diagram IV.

FLOW PROCESS CHART

Man Type

Chart Ends: Second cow washed. Date: 11.5.67.

<table>
<thead>
<tr>
<th>TIME</th>
<th>DISTANCE</th>
<th>DETAILS OF METHOD</th>
<th>CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Walk back to first cow</td>
<td></td>
</tr>
<tr>
<td>00</td>
<td></td>
<td>Pick up hose</td>
<td>O ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>02</td>
<td></td>
<td>Hose first cow's udder</td>
<td>O ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>03</td>
<td></td>
<td>Massage udder with soap with right hand</td>
<td>O ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>Squirt four teats to look for Mastitis</td>
<td>I ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>24</td>
<td></td>
<td>Hose soap off udder</td>
<td>O ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>26</td>
<td></td>
<td>Hose second cow's udder</td>
<td>O ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>29</td>
<td></td>
<td>Massage udder with soap with right hand</td>
<td>O ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>39</td>
<td></td>
<td>Squirt four teats to look for Mastitis</td>
<td>I ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>47</td>
<td></td>
<td>Hose soap off udder</td>
<td>O ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>49</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The time, distance and "details of method" columns are self explanatory. Something must be said about the other columns.

Work study engineers have found that it is useful to classify the steps in work into four classes. Symbols for these classes are shown in the column headed classification.

An "O" means an operation. This is any step which produces, accomplishes, and/or furthers the process.

An "I" means in inspection, those steps which verify the quantity or quality of the product are put in this class.

An arrow (→) means a transport. In Diagram IV the man walking back to the first cow is a "transport" on his part.

These techniques—multiple activity charts and string charts—are most useful not only in recording what is happening at present but also in predicting results of new methods. This is true of most recording methods.
Analysis.

The flow process chart is another method of recording and predicting. However, it also analyses how a job is being done at the moment in a systematic but commonsense way. Diagram IV shows a Man-type flow process chart because it records the activities of a man. If it was a material type flow process chart it would record the activities happening to a material. If it was a machine type chart it would record the activities of a machine. This particular recording concerns the washing procedure of a milker in a herringbone shed.

A “D” is a delay. If during the process of milking the man has to stop while he waits for cows to finish milking, then this would be a delay and would be classed accordingly.

The reasons for this classification are twofold.

Firstly, “delays” and “transports”, the things we want to eliminate, always depend on operations and inspections. For instance, if you have to spend 10 minutes waiting for a pump to do 10 minutes’ work, there is a 10 minute delay. But if you ask yourself how the pump is turned off, and if you can think of some other way than standing around for 10 minutes (for instance by installing a time switch), then by modifying the operation you have eliminated the delay.

Secondly, the efficiency with which operations are done can frequently be improved. A dairy farmer washing down his milking plant trundles down the length of the shed with buckets of hot and cold water. This is hard work. But if he converts a small vat to a water cart with compartments for hot and cold, he can save both time and effort.

Where a step is classified as an operation or an inspection, the method study engineer puts it through this battery of questions.

**WHAT** does the operation do?

**WHY** is it necessary?

(Perhaps we could eliminate the operation.)

**WHERE** is the operation done?

**WHY** is it done there?

(Perhaps we could combine the operation with another operation or change the place of the operation so that we eliminate transportation.)

**WHEN** is the operation done?

**WHY** is it done then?

(Perhaps we could combine the operation with another to save time or change its sequence to reduce time in transportation or delay.)

**WHO** is the operation done by?

**WHY** does he do it?

(Perhaps we could change the person who does the job to save or combine the job with another.)
HOW does he do the operation?
WHY does he do it that way?
(Perhaps we could refine or simplify the job by the use of a principle of labour economy or by the use of a gadget.)

This systematic questionnaire may seem somewhat unnecessary but I can assure you that by using this questionnaire along with the flow process chart shown in Diagram VI it is unusual for a better method not to occur to the investigator.

Eventually neither the chart nor the questionnaire is necessary. What, where, when who and how together with the continual question, “Is there a better alternative?” become a habit and you are “set up” for creating new methods.

Better methods from the use of this questionnaire come about by elimination; combination; changing the person the place or the sequence; simplification; and mechanisation.

Putting the operations detailed in Diagram VI through the battery of questions, we notice that most pass (with a tick) meaning that no better alternative has come to mind. But there is a question mark against the “how” column for the operation of massaging the cow’s udder. Why is the operator only using one hand? Why can’t he massage two cows at once? When he milked in a conventional shed it was only possible to massage one cow at a time. The habit has persisted to the new herringbone shed. The results from using the new method can be predicted by using another flow process chart.

Diagram V.

FLOW PROCESS CHART
Man Type
Chart Begins: Last cups changed Recorder: McArthur
Chart Ends: Second cow washed Date: 11.5.67.

<table>
<thead>
<tr>
<th>TIME</th>
<th>DISTANCE</th>
<th>DETAILS OF METHOD</th>
<th>IMPROVED METHOD</th>
<th>CLASSIFICATION</th>
<th>WHAT</th>
<th>WHERE</th>
<th>NSHM</th>
<th>OBA</th>
<th>MOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>02</td>
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</tr>
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<td>03</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09</td>
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<td>36</td>
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<td>38</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Walk back to first cow
Pick up hose
Squirt udder of first two cows
Massage two cows udders with soap using both hands
Squirt four teats first cow to look for Mastitis
Squirt four teats second cow to look for Mastitis
Hose soap off first cow
Hose soap off second cow

81
This chart predicts that the new method will save 11 seconds over washing two cows. Repeated twice a day for a 100 cow herd for 300 days saves a 1000 hours a year.

Synthesis.

Method study pulls the existing method apart in a systematic way which often suggests new ways. However, experience and an interest in labour saving methods is a great help. There are some general ideas or principles of labour economy which should be kept in mind when trying to think up better ways.

For Work Done by Hand in One Place:
1. Both hands should be used equally and simultaneously.
2. The hands should be kept close together so that both can be controlled by the eyes without excessive movement of the head.
3. Continuous circular movements of the hands at a steady rhythmic tempo are preferable to jerky, irregular movements.
4. Hands should not be used for holding things. Holding devices will set the hand free for productive work.
5. Materials and tools should be placed in convenient positions before work starts.
6. Full loads reduce the number of trips by the hands.
7. A comfortable working position with proper working heights should be secured and maintained.

For Routine Work in and Around Buildings:
1. Work areas should be close together to reduce movement. Place tools and supplies as near as possible to the place where they are used.
2. Circular travel will eliminate back-tracking.
3. Full use should be made of the force of gravity.
4. Movement by wheeled vehicle is preferable to manhandling. Passages should be wide enough and smooth enough for tractors and trailers or trolleys.
5. One operation should start where the previous operation ended.
6. Full loads reduce the number of trips.
7. Double-handling should be avoided.
8. Materials should be kept in bulk whenever possible.
9. Definite places should be provided for all tools and equipment.
10. Equipment should be fitted to the job.

Affecting Men Using Equipment or Men Working Together as a Gang
1. Equipment should be fitted to the job.
2. The work should be planned to avoid idle time for men or machines.
3. The work should be balanced between the men or machines doing
it. The limiting factor should not be one particular man or one
particular machine.
4. Small gangs generally produce more per man than large gangs.
5. All machinery should be capable of bearing its seasonal loads
without breakdowns, but spares should be available in case
breakdowns occur.

Conclusion:

In this short time I have attempted to give you a brief introduc­
tion to method study. The New Zealand farming industry has been
fortunate. We have always had innovators who have dreamt up
sensible and practical ideas which have saved us labour. This has
resulted in great changes in output per labour unit. However, the
cost price squeeze is likely to continue. New methods are essential
if we are to hold farming's standard of living and improve it. It
usually takes a greater and greater effort to create new methods
the further you go. The law of diminishing returns sets in. Con­
sequently the more people we have on the look out for better methods
the greater the change we have of finding them. I think that method
study has a role to play in turning more of us into innovators. We
are going to need them.
Beef Production

RECENT DEVELOPMENTS IN BEEF PRODUCTION

G. C. Everitt, Principal Scientific Officer, Ruakura Agricultural Research Centre, Hamilton.

Beef plays a vital role in our national income; a role, moreover, which has perhaps the brightest future of any of the animal products exported from New Zealand. Development of the beef industry will, however, require an awareness on the part of producers and processors alike of the technological advances being achieved in other countries of the world. The main theme, in fact, of this contribution is to draw attention to some beef production methods used overseas and to try and indicate how these might be used to advantage in New Zealand. Man is reluctant to change and this is especially true of farmers, but progress must involve change and it is progress which is so urgently required in the New Zealand beef scene if we are to sustain our recognised high standard of living.

Breeding for Beef Production

For many years now three breeds of cattle have virtually dominated beef production enterprises of the large beef producing countries of the world such as the U.S.A., Argentine, Australia, Uruguay and New Zealand, each with extensive farming systems and sufficient acreage to permit running large herds of beef cows. Thus, in New Zealand, the Aberdeen Angus accounts for approximately 75 per cent, the Hereford 16 per cent and the Shorthorn 5 per cent of beef cattle; and these three breeds have become established symbols of all that is desirable in a beef animal. This supremacy is now actively challenged in many countries of the world, including New Zealand.

Until about fifteen years ago many countries with developed dairy industries concentrated almost entirely upon milk production by selecting breeds expressly for this purpose. Surplus calves were disposed of at birth ("bobbies") and any beef by-product was largely derived from cull cows. In most of these countries beef supplies came either from imports or from an indigenous beef industry based on traditional beef breeds, with beef production systems quite separate from their dairying industries.

Dr. Edwards of the United Kingdom has recently listed a few examples of these countries and these are shown in Table 1.
Table 1. Numbers of dairy and beef cows in selected countries.

<table>
<thead>
<tr>
<th>Country</th>
<th>Thousands of Dairy Cows</th>
<th>Thousands of Beef Cows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norway</td>
<td>500</td>
<td>—</td>
</tr>
<tr>
<td>Sweden</td>
<td>1000</td>
<td>—</td>
</tr>
<tr>
<td>Denmark</td>
<td>1400</td>
<td>—</td>
</tr>
<tr>
<td>England and Wales</td>
<td>2600</td>
<td>600</td>
</tr>
<tr>
<td>Canada</td>
<td>2800</td>
<td>2700</td>
</tr>
<tr>
<td>U.S.A.</td>
<td>16600</td>
<td>32600</td>
</tr>
<tr>
<td>New Zealand</td>
<td>2100</td>
<td>1400</td>
</tr>
<tr>
<td>Australia</td>
<td>3000</td>
<td>7000</td>
</tr>
</tbody>
</table>

These countries are listed in a deliberate manner representing, in descending order, both the evolution towards maximising supplies of beef from dairy herds and the pressure felt within countries to make best use of limited resources. Clearly, this is less severe at present in, for example, Australia with a vast area and large beef cattle population than in, say, Norway, with no beef herds. These trends illustrate that traditional sources and types of beef diminish in the long-term as the pressure for improved land increases and the search for greater efficiency in land use intensifies.

From an economic viewpoint beef production in New Zealand has not been as profitable to date as the production of sheep meats and the associated wool clip; and certainly much less profitable than dairying. This situation is under stringent review at present and there are strong indications that beef production can compete very strongly with sheep even using traditional methods.

One reason for the relatively poor economic returns from beef has been the high values to which traditional beef stock has risen in recent years. Figure 1 records the average prices per head paid for different categories of stock in one major breeding area of New Zealand, together with schedule export prices offered by meat processors for "finished" cattle at the same time of the year.

The profit margin between weaner beef cattle at £30/head and carcass beef at £7 per 100lb is not attractive, but cattle are deemed essential in maximising pasture utilisation. In the short term these cattle prices will fluctuate, as they have done this year, but in the longer term there is little reason to believe they will fall materially for there is a disquieting static nature of the national beef breeding cow population in recent years.
Figure 1. Average prices per head paid for different categories of beef stock at Gisborne; and the schedule export prices for “finished” cattle at the same time of the year.

Shortage of traditional beef stock at a time when stocking rates require to be increased, together with low prices for wool and heavier labour demands of sheep farming, have revived interest in the beef production potential of surplus dairy animals.

This feeling that dairy herds as suppliers of beef have an increasingly important part to play is shared by many countries in the world. World demand for beef grows faster than the demand for dairy products and income from beef animals makes a valuable contribution to profits. The view is certainly widely accepted in Europe that dairy breeds, either “pure” or crossed, provide meat of a quality that ably satisfies consumer tastes; and that a cow that produces a calf and a lactation of milk each year is bound to be more productive economically than a cow which, with good fortune, provides only a calf a year.

Thus, in Britain, the Friesian breed dominates both milk and beef economies and about three-quarters of the U.K. beef supply is now home-produced with more than 60 per cent being derived from calves bred in dairy herds. Over a period of some fifteen years Holland has harnessed over 600,000 calves a year for “white veal” production, using Friesians almost entirely, with a big proportion of exports currently directed to Italy. The pressure for beef supplies, however, is likely to render veal production increasingly uneconomic except in such specialised countries as Holland. For example, Norway, with no
beef herds (Table 1) had 750,000 dairy cows in 1950. By 1965 numbers had decreased to 520,000 — or by more than 33 per cent — and a further reduction to 450,000 is forecast for 1970. Yet, quantities of beef sold increased from 43,900 tons in 1950 to 55,200 tons (or 26 per cent) in 1965. This large increase in Norwegian beef supplies stems from a massive changeover from the use of calf crops for veal to a system in which calves are reared on to mature beef.

Thriving beef industries based on dairy cattle herds are now seen in other countries such as Eire, Sweden and Denmark, Germany and Jugoslavia. Much publicity has been directed recently to the 11 million surplus dairy calves born on New Zealand farms and slaughtered as “bobbies”. It is sufficient to comment that New Zealand possesses an untapped source of human food which is the envy of many other countries; and that the prospect for increased beef production in New Zealand is largely determined by the extent to which this pool of surplus dairy stock is mobilised.

Changes in the breed composition of the New Zealand national dairy herd, and the implementation of biologically efficient new husbandry practices will, however, take time and traditional beef breeds will prevail for the immediate future. It is recognised that there is ample scope for selection of rapid growth rate, coupled with high feed conversion efficiency and relatively late maturity within the established British breeds dominating the New Zealand beef scene. Organisations charged with the responsibility of genetic improvement of our beef stock through recording and selection programmes, relying heavily on growth rate, have been initiated. It is worth noting here that more than half the beef bulls entered in the famous Perth sales for 1966 were growth recorded.

In England and Wales selection methods for increased beef supplies are confined almost entirely to bulls of the beef breeds used in artificial breeding of dairy cows. A large proportion of British home-produced beef is derived from Friesian, Ayrshire, Guernsey and Jersey herds crossed with beef bulls, the most popular breeds being Hereford, Aberdeen Angus and Charolais. The latter breed has been fully accepted into the British, Irish and Danish farming scenes. One possibly optimistic U.K. estimate of the Charolais contribution runs at nearly 29,000 tons of extra beef valued at £9 million. In Denmark nearly one-third of Jersey dairy cows are now mated to Charolais, whilst in France the Charolais breeders have “... never had it so good”! The popularity of the Charolais reflects recognition of the three primary considerations in efficient beef production; rapid growth rate, high feed conversion efficiency and relatively late maturity.

Here in New Zealand, semen from Charolais bulls held in the U.K. was first imported in 1965 and a series of extensive trials im-
plemented at Ruakura, Massey University and Lincoln College. Some preliminary results of the Ruakura trials are given in Tables 2 and 3.

### Table 2. Summary of Ruakura Trials.

<table>
<thead>
<tr>
<th>Breed or Cross</th>
<th>No.</th>
<th>Birth Wt. (Lb.)</th>
<th>Days to Weaning</th>
<th>Wt. in May 1967</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charolais x Jersey</td>
<td>29</td>
<td>76</td>
<td>81</td>
<td>330</td>
</tr>
<tr>
<td>Hereford x Jersey</td>
<td>47</td>
<td>62</td>
<td>93</td>
<td>311</td>
</tr>
<tr>
<td>Friesian x Jersey</td>
<td>59</td>
<td>64</td>
<td>82</td>
<td>369</td>
</tr>
<tr>
<td>Friesian x Friesian</td>
<td>50</td>
<td>85</td>
<td>71</td>
<td>375</td>
</tr>
<tr>
<td>Jersey x Jersey</td>
<td>49</td>
<td>56</td>
<td>101</td>
<td>295</td>
</tr>
<tr>
<td>A. Angus x A. Angus</td>
<td>49</td>
<td>67</td>
<td>82</td>
<td>306</td>
</tr>
</tbody>
</table>

Note:

Numbers include steers and heifers except Friesians with only steers.
Weaned at 140 lb.
All calves bucket reared.

### Table 3. Summary of Ruakura Farm Trials.

<table>
<thead>
<tr>
<th>Breed or Cross</th>
<th>No.</th>
<th>Birth Wt. (Lb.)</th>
<th>Weaning Wt.</th>
<th>Transfer Wt.</th>
<th>Wt. in Feb. 1967</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charolais x Jersey</td>
<td>110</td>
<td>72</td>
<td>140</td>
<td>173</td>
<td>266</td>
</tr>
<tr>
<td>Hereford x Jersey</td>
<td>146</td>
<td>61</td>
<td>132</td>
<td>167</td>
<td>271</td>
</tr>
<tr>
<td>Friesian x Jersey</td>
<td>120</td>
<td>67</td>
<td>138</td>
<td>186</td>
<td>297</td>
</tr>
<tr>
<td>Friesian x Friesian</td>
<td>45</td>
<td>83</td>
<td>140</td>
<td>196</td>
<td>300</td>
</tr>
</tbody>
</table>

Note:

Numbers include steers and heifers on 23 dairy farms and 19 sheep farms.
Weaned on average of 74 days.
Transferred from dairy to sheep farms at an average of 106 days.
Average age in February 1967 = 184 days.

Comparisons of great interest are those between calves derived from a Jersey cow but sired by either a Charolais, Hereford or Friesian bull. At this early stage the Charolais x Jersey, although growing faster than the Hereford x Jersey on the average, will need to grow very fast from now on to achieve an equal carcass weight at, say, 20 months to the Friesian x Jersey. This interim conclusion is modified by the belief that if the known high genetic potential for growth of the Charolais is to be exploited then the typical New Zealand "dairy farmer" attitude to beef calf rearing will require radical revision.

### Management and Beef Production.

Traditionally beef cattle in New Zealand are bred on less productive hill-country areas, the cows particularly being used for control of scrub and secondary re-growth. Store cattle are transferred as weaners (5-7 months old), or as older cattle, to the better pastures of lowland farms, grazing subserviently to sheep and serving as pasture.
control implements. Beef is derived from animals ranging from, say, 20 months to 4 or more years, all animals having grown on a “stop and start” basis.

Such methods as these are now virtually extinct in Britain and the sooner New Zealand follows suit the better. The vital importance of continued rapid growth for economic beef production is illustrated in Figure 2 and cannot be over-emphasised.

![RANGE of L.W. GAIN/DAY & SEASONALITY of MARKETING](image)

Figure 2. The influence of growth rate of beef cattle on seasonality of marketing and weight of product. Carcass weight represents 55 per cent of live weight throughout the range employed.

This diagram illustrates that profitability of beef production is closely associated with the time interval between birth and slaughter. Rapid growth rate of cattle, the weight of beef produced in a given time, and seasonality of marketing are inter-related topics of great significance demanding close study by all producers.

These concepts are clearly related to the breed of sire, breed of dam and nutritional regime and jointly they underlie nearly all developments in beef production worthy of note.

Three examples of the simple, but elusive, criterion of merit — heavier cattle at a younger age — can be examined. In 1961 a revolution occurred in the British beef production industry with the introduction of an intensive cattle feeding system based on cereals — "barley beef" — largely a barley diet with protein, mineral and vitamin supplements. Early weaning of calves at 3-5 weeks of age on to concentrate feeds was a development in techniques which perhaps more than any other enabled British farmers to produce beef economically as an adjunct to milk production, and a technique which blended well with the introduction of the barley diet. The “barley beef” system swept the country — a simple, labour-saving feeding routine, ample supplies of cereals and Friesian calves capable of converting the feed efficiently to a product which, although lacking
in flavour, was very tender and very lean. Curiously, the system waned and by 1964 only about 12 per cent of cattle were being fed intensively, with further declines in 1965 and 1966. The reasons lay in reduced profits due to substantial increases in calf prices — from about £9 for a Friesian calf in 1960 to £30 in 1966 — and cereals; and also because of a less tangible interest of the meat trade in heavier carcasses than those supplied by “barley beef”.

Figure 3. Growth patterns of three systems of beef production used in the United Kingdom. The “traditional” pattern is also representative of many cattle reared for beef in New Zealand today.

Figure 3 shows that this intensive cereal feeding system produces a beast of about 460 lb. carcass weight at about 12 months of age, with a high and uniform daily live-weight increase (L.W.I.) of about 2.6 lb.

Traditional beef produced in Britain until about 1960 — and very representative of New Zealand production today — at the other extreme, produced an animal of about 675 lb. carcass weight at more than two years of age with an intermittent L.W.I. of 1.9 lb/day.

“Barley beef” in Britain has lost ground to a semi-intensive system of production of the greatest applicability to New Zealand. Using both grass and cereals the system sustains an intermediate growth rate of about 2.0 lb/day L.W.I. to produce an animal of about 560 lb carcass weight at 15-18 months old, i.e. a market weight some 20 per cent greater than the “barley beef” beast with a flavourful, yet tender and lean product. The technique aims at a high daily intake of nutrients using grass of high nutritional value with a digestibility of not less than 70 per cent. Basically, the cattle rotationally graze around paddocks, returning to a given paddock after not more than four weeks; staying in one paddock about four days (depending upon stocking rate); topping the paddocks after grazing to avoid dilution of fresh-grown pasture with indigestible “left-overs”; and regular treatment with worm drenches necessary for cattle stocked intensively. A period of housed, intensive feeding in one winter is involved, but great use is made of conserved pasture, as silage and/or hay, of the very highest quality. Undoubtedly, details of the method will alter as knowledge accumulates but, to summarise in one word, these beef producing cattle are FARMED — not just run.

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This concept of semi-intensive grass and barley-fed beef — GRARLEY BEEF, to coin a phrase — is being rapidly developed in the Republic of Ireland; a pastoral agricultural country with many environmental similarities to New Zealand as well as being a major competitor for beef markets. Work under way in that country records a beef carcass production/acre of over 600 lb through carefully planned control of grazing management. Mr Joblin, at Ruakura, has produced 403 lb beef carcass weight/acre by increasing the stocking rate to 1.94 beasts per acre; and this level of production can be compared with the average production of about 155 lb/acre being obtained from intensive fattening farms in the North Island.

In much the same way as for dairy cows stocking rate plays an enormous role in beef production from grass. Unfortunately, raising the stocking rate of beef steers reduces the growth rate of individual cattle, as shown in Figure 4; but the figure also shows that supplementary feeding buffers the effect. High beef output per acre and per animal are not easy to reconcile and this is one development about which we cannot yet speak with confidence.

**Figure 4.** The relationship between growth rate of beef steers and stocking rate at different levels of supplementary feeding after Conway, 1954.)
One further point in this discussion of output per acre should be mentioned for it is critical to further progress. The number of beef animals reared per acre is vital. Let us consider that, traditionally, one beef cow may suckle one calf for 210 days, a really good calf weighing 500 lb, live weight at that time. Recent work at Ruakura has shown that a cow rearing three calves can produce an equivalent total live weight of calf in but 70 days — and the cow can then return to the dairy herd, with strong indications of a better subsequent lactation than if she had been milked in the shed from the time of calving. Mr R. A. Candy, the well-known Waikato farmer, recently commented from his experience that a cow suckling three calves can produce a 3-4 fold increase in total weight of calf weaned at, say, seven months as compared with a cow suckling one calf. The question should be posed by all producers — “Can I afford to continue with such a biologically inefficient practice of one beef calf per cow per year?”

Finally, a development of great significance to beef producers has been the widespread application of boning-out, fat-trim procedures for beef. This process has clearly revealed that conformation of beef-producing cattle is not a factor of great productive importance but is closely associated with overfatness, indicating the urgent need for revision of grading standards. Introduction of yield grading in Southland is a development profoundly influencing beef production practices and is a first step towards acceptance of lean meat per acre as the really valid criterion of beef production merit in a pastoral environment. This section can finish with an Irish comment: “England is unique amongst European countries in penalising the production of lean beef and encouraging the production of surplus fat which is cut off in the name of ‘quality beef’.” It could only be said in Ireland!

Conclusions:

A few developments in beef production have been discussed briefly; many of these do not originate in New Zealand but could be applied here if the spirit wished. Many other developments have been excluded; organisations evolved for distributing and rearing calves for beef production; specialised feeding and rearing systems; new marketing methods; and a whole complex of new techniques for selecting breeding stock.

The beef industry contributes substantially to the New Zealand national economy and is also of importance in world beef supplies. This contribution could increase as technological advances are applied but their application may require radical revision of traditional concepts.
A CRITICAL LOOK AT THE PLACE OF BEEF CATTLE ON HILL COUNTRY

J. O. Acland, Farmer, Peel Forest, South Canterbury.

There is no doubt in my mind that the Hill Country is grossly understocked with cattle. By Hill Country I am referring in this talk to the wet belt of hill country running along the edge of the plains and going back to the main divide.

Of course there is no point in running cattle unless they are profitable but we think, and I hope I can prove to you, that cattle can be very profitable on hill country. In fact I think that the main reason for not running more cattle is due to our attitude — we just haven't been thinking big enough.

The majority of hill country places do run a few cows but only 50 head or so. We thought we were well stocked up when we were carrying one cattle beast to ten sheep but we are now carrying a ratio of 1:6 and it seems that the more cattle we run the more sheep we can run and we also get a greater profit from the sheep. Perhaps to illustrate this point we could have a look at the stock increases on Mt. Peel.

<table>
<thead>
<tr>
<th>Slides:</th>
<th>1960</th>
<th>1967</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.a. Cattle</td>
<td>...</td>
<td>...</td>
<td>830</td>
</tr>
<tr>
<td>b. Sheep</td>
<td>...</td>
<td>...</td>
<td>7200</td>
</tr>
<tr>
<td>c. Wool</td>
<td>...</td>
<td>...</td>
<td>8.2 lbs</td>
</tr>
<tr>
<td>Lambing</td>
<td>...</td>
<td>...</td>
<td>98%</td>
</tr>
</tbody>
</table>

Improved pasture and topdressing etc. have also played a part but we are quite sure that we could not have achieved these results without cattle, and this perhaps proves that cattle can grow wool.

It is almost impossible to compare sheep with cattle and to say which is giving the best return — especially when cows are running on a 500 acre block of snowgrass, silver and fescue tussock, browntop and clover. I think cattle are complementary to sheep — not in competition with them — and by running both, better feed utilization is obtained.

To develop hill country we have found that cattle in large mobs, say, 200 in a mob, do the best job, and while keeping the country in good order for the sheep they were also making money.

At this time of year we have the cows in large mobs of 2-300 on our toughest hill blocks and we have no trouble with the cows climbing out. They can be found grazing to nearly 4000ft. even though these hill blocks run down to 1000 feet.

As the winter progresses we bring them to easier topdressed hill country where they are still doing a job of work by improving the country.

If you have only 40-50 breeding cows on a large hill block they couldn’t possibly cope with the job of development — or even of keeping developed country in good order. Even on a small hill property
where, say 1500 ewes and replacements are being carried, I feel the number of cattle should be at least 200 head and there aren’t many places doing this.

Another great advantage of running more cattle in hill country areas is that you get better labour utilization as the busy times for sheep and cattle do not clash. We find that our busiest months for sheep are September, October, December, January and April while cattle fit in between in August, November, March and May. This means in theory that in July you can either do some fencing or go for a holiday.

The other thing is that it doesn’t seem to take much more labour for 100 cows than it does for 50 cows. We still have the same labour force for 1460 cattle as we had for 850. I think that this factor of labour utilization is a very important part of cattle profitability.

Naturally good handling facilities are a necessity for general efficiency. It is pretty hard on time and tempers if you have to chase a calf around a large pen at marking time. Good yards cost a lot of money for 50 head of cattle but are a cheap investment for 200 head and with good yards it is no trouble to vaccinate, pregnancy test, drench, dip and fertility test bulls. And all these things must be done if cattle are to be made profitable.

People are often critical of cattle and say they are unprofitable but many times it is not the fault of the cattle but of the farmer who has not given his cattle a chance.

A calf from every cow is the goal to aim for.

Our calving percentage has been around 90 per cent over the last ten years or so and this is fairly general on many cattle properties.

One of the important things affecting the calving percentage can be the bull, and we find that when we are running one bull to 40 cows it is essential to change the bull every three weeks, swopping them from mob to mob, because bulls can be infertile or can become infertile during the year.

Actually we got caught this year when bulls which had been swopped got back into their original mobs. As a result we have 34 empty cows which is entirely due to our own poor herdsmanship.

Bulls can be tested for fertility but it is difficult because you have to bring the bulls in again after they have been running with the cows for a few days, and the bull must then sire a cow and the semen be withdrawn and examined under a microscope. However, after this year’s experience it will pay us to test all new bulls coming into the herd.

The cows must not only have the ability to produce a calf each year but must also produce a calf that has a good weaning weight.

It has been proved that some cows produce low weight-gain calves each year so it’s obviously best to get rid of these cows. This can be done quite easily at weaning time and you don’t need scales to do it. We culled 10 per cent of our 1st calving heifers this year by bringing in a mob of 50 cows and calves, and after keeping them separated for four to five hours we then put the poorest calves back with the cows and they went straight up to the correct cow to drink.
To follow this up we must use performance tested bulls as they will also have quite an effect on the variation in the weight gain of the calves. There is good work being done on Performance Testing and the day is not too far distant when we will be able to go to any stud breeder and ask to see his weight-gain records and thus get a good guide as to the best beast to buy. Records of weight gain will not do away with the master’s eye, but we must remember that we get paid for the amount of beef we grow and the most profitable beast is one that can stack on the most meat in the shortest time.

The age at which cows should be sold is a debatable point. The generally accepted age for culling cows is between 10 and 12 years. This may be all right for the very toughest of our hill country but we don’t sell a high producing cow until she has reached the age of 15 years. If cows can be carried for an extra three years then three extra calves are gained and the cows are still worth as much at 15 years as they were at 12. Actually we had one old cow, 18 years old, who had produced 16 calves and she died giving birth to twins.

On some of the better hill country that has been developed, the land may be good enough to have 14-month-old heifers in calf so that they calve as two-year-olds. All overseas research work on this subject points to heifers producing more calves in a lifetime if they calve as two-year-olds. We have put all our fourteen-month-old heifers to the bull this year and we expect at least an 80 per cent calving. At the present time they are running out on the hill and will stay out there until July when we will bring them in and give them silage till they calve. For the extra amount of feed that they will get they will still be cheap calves.

Perhaps in this same area of foothill country the calves could all be taken through to eighteen months and fattened. Mt. Peel is in this area and we carry all our calves through to this age. But we feel that to make the most profit from steers they must be off the place before the second winter because from this time on the cost per lb of beef produced goes up and food conversion is not as good.

Over the last few years we have managed to get the steers to kill out around 540 lbs at 18 months and have been returning about £40 per head, but to do this they must be fed on improved pastures and some winter feed.

Our cull heifers are also sold in the autumn at about 20 months. Like our own heifers they are put in calf at 14 months and have averaged about £38.

Because we are not selling calves we are gaining the £2 a head that would normally go towards commission, yard fees and cartage to the new owner. The other advantage is that the calves don’t suffer a knock back through being shifted from one place to another.

Our return per cattle beast wintered is £17 per head, but by having our replacement heifers in calf we should be able to bring this up to £19 on today’s prices.

I think this is the way to work out on hill country whether cattle are profitable or not — not by comparing them to a certain number of sheep.

95
It seems that I have spent most of this talk proving that cattle can make a profit on hill country, but I think it was necessary to do this for unless they can pay their way, then cattle are not worth having.

Accepting then that cattle are an economical proposition I think there is a much greater scope for them on our hill country because —

1. You get better labour utilization when running both sheep and cattle.
2. You get better feed utilization.
3. The hill will be developed more quickly and grass introduced at a faster rate by using cattle, and
4. By no means the least important is the fact that you don’t have all your eggs in one basket.

Therefore a property will return a greater net profit if it is running both sheep and cattle but the ratio of one to the other depends on the individual hill country farms.

Of one thing I am certain though — the present number of cattle carried on our South Island hill country is far too low.
Like many farmers I have for some years run a few cattle for fattening. These have been average quality beef calves bought during April - May — wintered on swedes and sold fat the following autumn. Few, if any, have been wintered twice.

Many people have told me that because these beasts replace sheep they are not profitable. I have been conscious of the fact that both Ruakura and Winchmore Research Stations have stated that one of these beasts replaces seven ewe equivalents.

In a paper given at the 1961 Lincoln Farmers' Conference, a very detailed comparison was made between cattle and sheep on this basis. The result is pretty obvious.

I have never believed that this conversion rate was right. Nor have I believed that statement or hypothesis that sheep and cattle will produce the same amount of meat per acre but cattle unfortunately don't produce any wool. I'm sure that a lot of farmers who fatten cattle disagree with these two points also.

We are all interested in the profitability of farming, but in recent years I have been alarmed at the continuing increase in our costs. We are all concerned at increasing production and most of us are doing this but it's in our our interests to increase production economically.

Four years ago I decided to look at beef production more critically. I wanted to know how much beef I could produce per acre and how this compared with lamb and wool and cash crops. As far as I was able to find out there had been no real trial work of this nature done. Let me state here that my farm — 420 acres at Lismore, 17 miles west of Ashburton — has 260 acres border dyked for irrigation. The pasture referred to is irrigated — in other words there is a guaranteed supply of good quality feed throughout the spring, summer and autumn. However, there are large areas which are similar to this — much of our foothill country, large areas in Southland, Westland and parts of Nelson, much of the North Island including all that devoted to dairying.

The first year I looked at the problem I found quite by accident that I had grazed about 30 chiller beasts plus a few rams and killers at roughly 3/4 beasts per acre. The calves had been wintered on swedes — without shelter — with hay fed only on the cold wet days. They had no run off. The irrigation of the grass had been spasmodic and there was long dry feed suggesting that a lot of feed had been wasted.

I estimated that 4-acre of swedes would quite easily feed a calf for three months.

All of these beasts were sold between the 9th and the 20th of April and averaged 520 lbs carcass weight.
How much beef per acre is this?

1 3/4 on grass less 1/4 for swedes
1 3/4 per acre at 520 lbs = 650 lbs
Less 1 1/4 calves bought at 200 lbs = 250 lbs

---

400 lbs beef per acre

This was a rough estimation only:
The calves were purchased at £11 per
head at 1 1/4 per acre £14 15 0
realised £36 + i.e. at £7 per 100 lbs at 1 1/4 £45 0 0

£30 5 0 per acre

I felt that this was worth trying again and the cattle could this
time get at least as good a treatment as the ewes.

I deliberately stocked them at 1 3/4 per acre on grass during this
next season, and they stayed there from the end of the first week in
September until they were sold in the autumn. When these calves
were bought they were drenched with selenium and a worm drench
and were sprayed for lice. I didn’t determine the area of swedes re­
quired by the calves as they were grazed with the ewes, except
that they were left on the swedes without a run off and without hay
except on the cold wet days. The ewes while on swedes had 1 1/2 bales
lucerne hay per 100 daily. The calves didn’t appear to need hay
although they crowded the fence to watch the sheep have theirs.

They were without shelter.

During the summer I had hoped to keep the grass well irrigated
but this didn’t happen and there were weeks when the area was quite
dry, and hence pasture production was low. However, in comparison
to 6 1/2 ewes with lambs per acre next door the paddock appeared almost
out of control.

The beasts were on the farm for 13 1/2 months this time — a tem­
porary stoppage at the works had held up delivery and they averaged
565 lbs carcass weight.

Although I had not determined the area of swedes I felt that
1-acre per calf was pretty generous and cut it back to 1/6th acre for
this year’s calculation.

It reads 1 1/3 beast per acre at 565 lbs = 753 lbs
Less 1 1/3 calves at 200 lbs 270

483 lbs per acre

The cash position —
Purchase £17 at 1 1/3 £23 0 0
Sale 565 lbs at £7.15.0 £43.15.0 at 1 1/3 £58 0 0

£35 0 0 per acre

These calculations were fairly rough but they weren’t far away
from what was actually happening.

I felt that I had a long way to go as the pasture control was not
good and there was a lot of waste. Irrigation had been spasmodic
also to reduce grass growth.
This next season I had hoped to determine the winter feed requirements but failed. The turnip crop for the ewes came to nothing due to drought and the small area of swedes for the cattle had to go to the ewes. I bought feed for the calves but didn't get much idea as to requirements except to suspect that even 1/6th of an acre of average swedes was generous.

This next year I had hoped for 1½ beasts per acre but could only manage 45 beasts on 25 acres of irrigated grass plus three acres of dry land. I needed another beast really to make it — however, I put 300 hoggets in with them for a month during the spring when growth was getting away. I felt that this was 1½ beasts as far as I was concerned anyway and there was still a lot of waste.

Irrigation was again spasmodic mostly because the race had been badly constructed and the job was very slow. The race was overgrown with feed also.

The first 15 beasts were sold in late March and averaged 623 lbs, the others in April averaging 585 lbs and the tail end in late May averaging 523 lbs. The overall average was 585 lbs. There had been one death. The result allowing 1/6th acre of swedes at 1½ on grass roughly 1½ per acre at 585 lb 875 lbs

1. (less 1½ calves at 200 lbs)  300  =  575 lbs/ac

2. (less 1½ calves at 250 lbs)  375  =  500 lbs/ac

The 15 calves which killed at 623 could easily have been 250 lb carcass weight. They were bigger than the rest and cost £23 against £17 for the balance. They were still not top quality calves but better than average.

Cash Position.

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Price (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1½ per acre at 585 lb at £8</td>
<td>1</td>
<td>70 0 0</td>
</tr>
<tr>
<td>Less calf at £20 at 1½</td>
<td></td>
<td>30 0 0</td>
</tr>
<tr>
<td>Less feed purchased £48 say £1 per beast at 1½ £38.10.0 per acre</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

£40 0 0

I was quite sure in my own mind that the average weight of the calves, i.e. carcass weight at purchase was not 250 lbs each but assuming that they were 250 lbs the figure of 500 lbs beef per acre was a most satisfactory result. I couldn't achieve as good a net return by growing either sheep, wheat, barley or linseed at the yields I had experienced. On top of this the grazing management by set stocking in this manner wasn't at all good and the amount of waste was high.

The current crop of calves when bought were put on to the same paddock with their predecessors and remained there for a month. They had a fortnight on turnips with the ewes before going on to swedes on the 6th of June. There were 64 calves and two dairy beasts on 12 acres. The crop was almost a failure and it was hard to find many bulbs as big as a breakfast cup — the rest was only tops. Because of this I fed three bales per day of Timothy and white clover straw baled after the header. The cattle remained on this area without a run off until September 9th. Had the crop been only an average one, six acres would have been ample. The calves hadn't done as well.
as in previous winters. I lost one with a liver infection and probably complicated with brassica poisoning.

Back on to A.S.P. or that's what it had been after the ewes had pretty well cleared it off. In fact I wasn't prepared to put them on at two per acre until it got away a bit. However, I set stocked 20 acres with 30 beasts and another 20 acres with 35 beasts.

They remained at this until mid-November when I increased the mob at 1½ to two per acre and put some ewes with lambs in with the other mob. I had left this move too late. The feed was well away and even at this rate they could not control it. The irrigation race was already overgrown and a lot of feed was again going to be wasted.

I decided then that to get good control with cattle one would have to strip graze with an electric fence at rates up to 2½ yearling to 15 months old beasts at this early stage to have good utilisation of the feed grown. The labour input wouldn't be great and one would more than make this up in increased production per acre.

During late January the cattle didn't look particularly well. They were all scouring badly, including those at the lighter rate. I know what I should have done now — but it's easy to be wise after the fact. I suspected they were full of worms — at two per acre this was 14 ewes per acre (according to Ruakura — from 9th September to 30th January).

I decided to call off the trial on these areas. I put them on to fresh feed still at two per acre however, where they remained until the first batch were sold. I drenched a sample of them with selenium and a worm drench but this didn't stop the scour. I fed lucerne hay for a while and the scour ceased.

I topped the other two paddocks during February and although the grass was short enough where they had grazed it was like mowing hay where it was wasted.

The cattle hadn't done as well as in the previous year and the inferior line of calves was showing up now they were due to be sold. The first 24 were sold on 12th April

| 20 sold 500 | 500 |
| 24 unsold est. at 500. |

There are other factors which have contributed to these lighter weights this season.

As mentioned earlier the check received during late January was later to be added to by a general feed shortage brought about by 40 acres of 150 acres assigned to cattle being devastated by grass grub.

In summary —

| 1½ beast/ac at 500 lb | 875 lb |
| less 1½ calves at 200 lb | 350 |

525 lb beef/ac

To give the comparison I wanted to make with sheep I prepared the gross margins for beef and sheep production:
GROSS MARGINS

SHEEP (/EWE)

Gross Revenue:

<table>
<thead>
<tr>
<th></th>
<th>£</th>
<th>s</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lamb 1.1 at 46/-</td>
<td>2</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Wool 10.1 lb at 38d</td>
<td>1</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Cull ewe .164 at 30/-</td>
<td>4</td>
<td>11</td>
<td></td>
</tr>
</tbody>
</table>

Direct Costs:

<table>
<thead>
<tr>
<th>Cost Type</th>
<th>£</th>
<th>s</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement</td>
<td>16</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Shearing at £7.10.0</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crutching</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaccination</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Dip and Drench</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Docking</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Footrot</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ram Cost (Net)</td>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Direct Costs: £4 7 6

G M = £3.5.0

G M / Acre at 6 ½ E/ac = £21.2.0/ac

CATTLE (/BEAST)

Gross Revenue:

<table>
<thead>
<tr>
<th></th>
<th>£</th>
<th>s</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>560 lb/Beast at £7.10.0/100 lb</td>
<td>42</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Direct Costs:

<table>
<thead>
<tr>
<th>Cost Type</th>
<th>£</th>
<th>s</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drench</td>
<td>4</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Dip</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lick</td>
<td>2</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Vet. Costs</td>
<td>5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Cartage (On)</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cartage (Off)</td>
<td>15</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Deaths 1½% on 100</td>
<td>10</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Replacement</td>
<td>22</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Direct Costs: £42 0 0

G M = £17.16.6

G M / Acre

(a) at 1½ Beasts/ac = £26.15.0

(b) at 1¾ Beasts/ac = £31.4.0

The next comparison I wanted to make was on a scale that would suit a policy for running cattle on a given area compared with what that area would produce in lamb and wool — e.g.

100 acres—20 acres to swedes to new grass.

80 acres available grass at 1½ beasts per acre. 120 head, and this allowed six beasts per acre on swedes.

(A) Cattle at 1½ beasts/ac

20 acres to swedes to N.G. 80 acres available grass

80 acres at 1½ beasts/ac = 120 beasts

Sales:

115 at 560 lb at £7.10.0/100 lb = £4,830

3 carry-over at £35 105

£4,935

Purchases:

120 at £23

Deaths 1½% = 2 head 2,760

Gross Return (Net of calf cost) £2,175
(B) Cattle at 1\(\frac{1}{2}\) beasts/ac
80 ac at 1\(\frac{1}{2}\)/ac = 140 beasts

Sales:
132 at £42/head 5,544
6 at £35/head 210

Purchases:
140 at £23
Deaths 1\(\frac{1}{2}\)% = 2 beasts 3,220

Gross Return (Net of calf cost) £2,534

(C) Sheep at 6\(\frac{1}{2}\) EE/ac (good price)
80 ac at 6\(\frac{1}{2}\) EE/ac = 520 sheep
440 ewes at 1 EE = 440
110 Hoggets at 2/3 EE 74
7 Rams at 1 EE 7

Sales:
100% lambs 10 lb wool (Hgts 9 lb)
Lambs 330 at 50/- £825
110 (retained)
Ewes 50 1 yr at 60/- 150
33 to works 30/- 50

GROSS RETURN £1,981

Conclusion:

The manner in which I have carried out this trial is far removed from the way it would be done by a research station — nevertheless it has been sufficient to show me whether or not beef production has a place in irrigation farming and this is precisely what I set out to do.

During recent years the development of our export trade for beef in cuts and for processing purposes has been most encouraging. In this I feel there are great possibilities not only in selling to North America but in developing a manufacturing beef trade with Japan.

Recently we have heard a lot about our so-called dairy beef. Much of our export is from the dairy herds but the vast potential for beef production by rearing our bobby calves is frequently discussed. This remains only as a potential until we make room for it.
At the present time rearing large numbers of dairy calves would only be done at the expense of existing production of other commodities.

If I have shown that there is a place for beef production on the areas suited to it then as farms increase their productivity they may prefer to show this increase as beef. I feel that running cattle offers us a means of increasing production and at the same time holding down our running costs.

To conclude I would simply say this — cattle on average have the ability to gain weight at about 2 lbs per day or to increase carcass weight by 1 lb per day.

Provided our grazing management is reasonably efficient to eliminate even some of the terrific waste in pasture production then 600 lbs of beef per acre is there for the taking.
A NEW LOOK AT DRENCHING

Introduction

Until fairly recently most discussions, at farmers' conferences, on the control of worms in livestock have centred principally on the comparative efficacy of anthelmintics rather than on the assessment of both their effectiveness and their economics. Most of the drugs then available had an overall efficacy of considerably less than 100 per cent and in some the action was irregular. However, with the advent of the newer anthelmintics, which have a wider spectrum of activity and greater efficiency, especially against immature worms, the concern of both the research worker and the farmer has shifted to the more efficient employment of these drugs. This paper describes some of the results of recent trials designed with this objective in view. These studies, conducted at the Wallaceville Animal Research Centre, underline the increased need for a greater understanding of the many aspects of parasitism, since on this depends not only the efficient employment of drug treatments but also a greater integration of these with other control measures based on pasture and grazing management. This concept is by no means new, but recently it has been given greater emphasis and increased practicability by the vastly improved standards of control offered by the new drugs.

Because of the virtual absence of research, in this country, on any aspect of internal parasitism in cattle, the subject of this address is necessarily restricted to sheep. Although studies on internal parasites of dairy calves have been initiated at Wallaceville, it would be premature to comment on these at present.

Over the years a variety of routine flock treatments have been advocated. The suggested treatments cover the entire first year of life of the sheep, i.e. pre-weaning treatment of lambs, treatment at weaning and various post-weaning drenching regimens extending over summer, autumn and winter. The pre-lambing treatment of ewes has also been suggested. However, while it is recognised that any treatment would normally benefit the animal, some consideration must be given to the possible economic return to the farmer. Undoubtedly each of the treatments mentioned would be of considerable benefit in certain exceptional seasons, but nevertheless, they must be shown to offer a reasonable assurance of a direct economic gain, or a significant long-term improvement in the health of the flock, before they can be confidently recommended as routine strategic measures.
The higher efficacy of the newer drugs makes them extremely useful research tools in the study of the damage done by naturally acquired worm infestations. As some of these drugs are highly effective against both the adult and larval forms of all the common species occurring in sheep, it has now become feasible to attempt to suppress almost completely worm infestation in sheep on pasture. By using this advantage, our first approach towards a new appraisal of current drenching procedures has been to evaluate the cumulative effect of an untreated infestation in young sheep during their first year of life. Our initial trials demonstrated that very considerable depression of liveweight gain and wool growth can result from infestation in the young animal, and our studies have now been extended to ascertain the degree to which such retardation of growth persists and affects production in the second and subsequent years. This latter important aspect has previously been overlooked in consideration of the potential economic rewards to be derived from a soundly based programme for the control of parasites in the young animal. Recently our attention has also been directed to the immediate effects of infestation on the breeding ewe and to the importance of the untreated ewe as a source of infection for lambs.

Effect of Trichostrongyle Worm Infestation on Liveweight Gain and Wool Growth of Young Sheep.

All trials discussed in this paper were conducted in the Wallaceville area; sheep were of the Romney breed, the lambs being August-September born. Stocking rates were approximately six ewes and eight to nine lambs per acre.

Three initial trials using thiabendazole were conducted for three successive years from 1961-64. In the first two trials half of the flock was subjected to a programme of fortnightly drenching with thiabendazole and the response measured in terms of liveweight gain and wool production by comparison with that of untreated control animals grazing the same pasture. Experimental drenching at such short intervals can be termed "suppression" drenching and, while it has no immediate practical application, the results provide a base line of comparison which makes possible an evaluation of the effects of infestation during the first year of life. In the third trial, additional groups were incorporated to facilitate a comparison of drenching at more practical intervals and to appraise what should be an acceptable strategic drenching programme. In each of the trials the initial drenches were given in October when the lambs were between six and eight weeks old.

Mean Liveweight Gain

The mean liveweight gains for the groups drenched fortnightly and the untreated control groups in the three successive years are shown in Fig. 1.
Table 1 shows mean cumulative monthly liveweight responses from weaning. (The responses in the additional groups included in the 1963-64 trial will be discussed separately.)

Table 1: Cumulative liveweight gain responses (lb) of animals drenched fortnightly from October. (Responses shown as at the beginning of each month.)

<table>
<thead>
<tr>
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<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1961-62</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>10</td>
<td>16</td>
<td>20</td>
<td>24</td>
<td>27</td>
</tr>
<tr>
<td>1962-63</td>
<td>2</td>
<td>4</td>
<td>7</td>
<td>8</td>
<td>11</td>
<td>15</td>
<td>19</td>
<td>26</td>
<td>31</td>
</tr>
<tr>
<td>1963-64</td>
<td>2</td>
<td>4</td>
<td>7</td>
<td>11</td>
<td>12</td>
<td>15</td>
<td>18</td>
<td>21</td>
<td>27</td>
</tr>
</tbody>
</table>

In the drenched groups the mean weight responses at the termination of the trials in August 1962, 1963 and 1964 were 27lb, 31lb, and 27lb respectively.

Wool Production

Immediately prior to the end of each trial in August the animals were shorn. The wool growth response to drenching is shown in Table 2. It will be seen that the wool response closely follows that for liveweight gain.

Table 2: Mean Liveweight gain and greasy wool weight responses of drenched animals.

<table>
<thead>
<tr>
<th></th>
<th>Increase in mean liveweight over controls (lb)</th>
<th>Difference %</th>
<th>Increase in greasy fleece weight over controls (lb)</th>
<th>Difference %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1961-62</td>
<td>27</td>
<td>43</td>
<td>1.7</td>
<td>30</td>
</tr>
<tr>
<td>1962-63</td>
<td>31</td>
<td>48</td>
<td>2.6</td>
<td>46</td>
</tr>
<tr>
<td>1963-64</td>
<td>27</td>
<td>37</td>
<td>1.9</td>
<td>28</td>
</tr>
</tbody>
</table>

An analysis of fleece wools from the 1963-64 trial showed a considerable difference in the quality of the wool from the treated and control groups—that from the untreated group was of markedly inferior quality.
Pattern and levels of infestation in untreated animals

Fig. 2 shows the mean faecal egg counts of the untreated control animals in the three trials.

The egg counts of the treated groups are not shown: observations in the first two trials showed that, for animals subjected to the intensive drenching programme with thiabendazole, only a very low proportion of positive egg counts was recorded and on no occasion did the mean count exceed 100 eggs per gram.

With minor variations, due presumably to climatic factors, the pattern of worm infestations, as indicated by faecal egg count, was remarkably constant over the three years. The pattern is one of relatively slow build-up during spring and early summer, becoming more rapid and reaching a peak in early autumn followed by a rapid decline in late autumn or early winter. This pattern of infestation is emphasised by the egg counts recorded from untreated animals in a subsequent trial, 1964-65 (Fig. 3). It is usual for hoggets to lose the greater part of their worm burden in late autumn or early winter, due, presumably, to the development of host resistance.

Although during the autumn period, the infestations acquired by the control animals would be classed, in terms of general diagnostic experience, as moderate to heavy, these were by no means exceptionally high. Also, it must be remembered that from the commencement of the trials the pasture received only a fraction of the parasite contamination that would have been deposited by an entirely untreated flock.

General considerations of the 1961-64 trials

The consistent results of the three trials in successive years provide a basis for the evaluation of the cumulative effects of untreated trichostrongyle infestation. Thus it is pertinent to summarise some of the more important results of suppression of infestation, before
considering their practical implications. The principal features common to the three trials are:

(1) The suppression of worm infestation resulted in very marked liveweight gain and wool growth responses, and these were similar at equivalent stages.

(2) Throughout the course of the trials the rate of weight gain of the treated animals remained comparatively constant except at times of apparent food shortage. (In both the 1962-63 and 1963-64 trials an acute feed shortage occurred from mid-January to mid-March.)

(3) During the period April to July the mean liveweights of the control groups tended either to decrease (the two earlier trials) or to increase only slightly (1963-64 trial). A reduction in the rate of gain over that period with or without actual loss in liveweight is characteristic of hogget ill-thrift.

(4) The weight gains of the treated and control groups tended to diverge at a relatively constant rate during the trials. The weight gains of the control groups showed no marked response to any sudden rise or fall in the level of infestation as indicated by the egg count pattern. The live-weights of the control groups showed no response following the marked drop in egg count which occurred each year in May-June.

Losses in total liveweight production

A factor not included in the data presented above is that of mortalities due to worm infestation. In the 1962-63 and 1963-64 trials mortalities of 10 per cent and 11 per cent respectively occurred in the untreated groups and these were attributed to worm infestation. In each of the three trials other deaths from factors unrelated to the trials occurred in both the treated and untreated groups, and these deaths preclude the expression of the results in terms of total liveweight production. The responses to drenching, as shown in Fig. 1, have been minimised by the fact that the deaths, from worm infestation, of the smaller animals have enhanced the mean liveweights of the control groups. Wool production figures are similarly affected.

In a later trial conducted over 23 weeks between January and June 1966, no miscellaneous deaths occurred and there was a total liveweight production response, to suppression of infestation (thiabendazole at fortnightly intervals), of 1240lb over fifty animals. This figure takes into account a mortality of 20 per cent (in the untreated animals) and a mean liveweight response of 15lb in favour of treated animals over the untreated controls (Fig 4). The maximum mean egg count of the control animals during the period of the trial was 5,300 eggs per gram.
THERAPEUTIC CONTROL OF INFESTATIONS IN YOUNG SHEEP

This is primarily the application of preventive drenching to reduce the worm burden and consequently the rate of pasture contamination at critical periods. Gordon (1959) has defined two distinct approaches to drenching. The first, called “strategic drenching,” is regular seasonal drenching applied every year irrespective of the nature of the season. Its timing is based on a knowledge of the seasonal pattern of change in the worm burden. The second approach is known as “tactical drenching” and is preventive drenching carried out when it is recognised that conditions are favourable for worm parasites to cause trouble, e.g. following out of season rainfall, during periods of overcrowding or under conditions of malnutrition.

What can be achieved by a basic strategic drenching programme?

As the results of the 1961-62 and 1962-63 trials showed a consistent pattern of liveweight gain response to suppression of worm infestation, it was decided to include, in a further repeat of the trials
in 1963-64, three additional drenching regimens. One of these could be considered as a feasible strategic drenching programme. It was considered that this might show to what extent the annual loss in production in young sheep could be curtailed by an economically practical plan of treatment.

The five treatment groups in the 1963-64 trial were as follows:

- **Group 1**: drenched fortnightly throughout;
- **Group 2**: drenched at 28-day intervals throughout;
- **Group 3**: six drenches at 28-day intervals commencing in January;
- **Group 4**: three drenches at 28-day intervals commencing in March;
- **Group 5**: untreated controls.

The mean liveweight gains of these groups are shown in Fig. 5. The terminal responses of the groups in liveweight gain and wool production are shown in Table 3.

**Table 3**: Liveweight gain and greasy wool weight responses of the treatment groups in the 1963-64 trial.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Liveweight</th>
<th>Greasy Fleece</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean Weight (lb)</td>
<td>Increase in mean weight over-controls (lb)</td>
</tr>
<tr>
<td>Drenched fortnightly throughout</td>
<td>100</td>
<td>27</td>
</tr>
<tr>
<td>Drenched 28-day intervals throughout</td>
<td>96</td>
<td>23</td>
</tr>
<tr>
<td>Six drenches</td>
<td>93</td>
<td>20</td>
</tr>
<tr>
<td>Three drenches</td>
<td>88</td>
<td>15</td>
</tr>
<tr>
<td>Untreated controls</td>
<td>73</td>
<td>—</td>
</tr>
</tbody>
</table>
These results support the findings of the two earlier trials that by far the greater part of the losses in production occur after January and more particularly after March.

The most important feature of the results is the response to a programme of three drenches commencing in March, which achieved more than 50 per cent of the response recorded in animals in which infestation was completely suppressed during the first twelve months of life. The response of 15 lb liveweight together with more than 1 lb of wool per animal must take such a strategic drenching programme an economically attractive proposition.

**Persistence of initial responses into the second and subsequent years**

The above assessment of the worth of a strategic drenching programme refers only to the more immediate benefits. What of the effects of poor growth during the first year of life on growth and wool production in the second and perhaps subsequent years, and on the fertility of the 2-tooth ewe?

A recent trial at Wallaceville (1965-66) has shown that the major part of the loss of weight gain in the first year, resulting from untreated worm infestation, persists until the time of tupping in the second year and that the loss is not fully recovered by the end of the second year. In this trial lambs were randomised into two groups at the end of February, 1965 (i.e. six months old) and infestation in one group was thereafter suppressed by fortnightly drenching with thiabendazole. At shearing in August a 1.7 lb greasy wool response to drenching was recorded. After shearing the difference between the groups in mean liveweight was 21 lb in favour of the treated animals; at this time drenching was discontinued and the animals continued to run as one flock. In March (i.e. tupping), the liveweight difference between groups was 15.0 lb and at the second shearing in August 1966 was 8 lb (Fig. 6). At the second shearing there was a further 1.1 lb greasy wool response in favour of the originally treated animals.
The significance of these results is more apparent when they are correlated with the studies of Professor Coop and his colleagues (Coop, 1962, 1964; Coop and Hayman, 1962; Coop and Clark, 1966). The results of their studies, here at Lincoln College, have emphasised the increased productive potential of the well-grown 2-tooth ewe. They have clearly demonstrated the effect of liveweight at tupping on such factors as barrenness, twinning percentage, ewe and lamb mortality and wool production. Thus, the value of increased production resulting from well-grown flock replacements must be added to the credit column in any evaluation of the economics of parasite control of sheep in their first year.

**Modifications to a basic strategic drenching programme**

Further research may demonstrate the need or desirability for additions to, or alterations in, timing of the basic strategic drenching programme as outlined above. Modifications may be dictated by local conditions or indicated by a fuller appreciation of losses caused by what have previously been considered as relatively harmless worm burdens. For instance, promising results have been obtained from a recent preliminary trial involving the winter drenching of hoggets.

Previously we have considered that the lack of weight gain response to the spontaneous elimination of the greater part of the worm burden of hoggets in May-June has been because of the inability of the debilitated animals to respond to the greatly lowered worm burden, under conditions of winter feed and climate. However, our recent results suggest that the small worm burden usually remaining at that time of year may be capable of maintaining the debilitated condition. Inhibited larval stages may comprise an appreciable part of the worm burden at this time, but this has yet to be investigated. In a 1966 trial, previously untreated hoggets were randomised into
two groups in late June, when their faecal egg counts had fallen to the usual low level, and from this time one of the groups was subjected to fortnightly drenching with thiabendazole until the end of August. One month after the last drench the weight gain response in favour of the treated animals was approximately 13lb (Fig. 7). Over the same period the weight gain difference between two similar groups of previously treated animals, in one of which treatment was suspended, was only 1lb. The lack of response between the latter groups suggests that the response to treatment of the previously untreated animals was due to the elimination of the existing low level of infestation and that new infection was not acquired by the continuously untreated group. Further trials, especially in other parts of the country may well demonstrate substantial rewards to be obtained from winter drenching of hoggets.

The need for tactical drenches

It should be re-emphasised here that the basic strategic drenching programme, outlined above, is advocated for routine application in order to combat the parasite problem which can be confidently expected in autumn. However, in exceptional years additional treatments, i.e. tactical drenches, may be necessary at other seasons, e.g. spring and summer to control outbreaks of Nematodirus, Haemonchus or Ostertagia. At our present state of knowledge it is not yet possible to predict with any accuracy the necessity for such treatments in any particular season, and consequently, the need, may only be apparent after the development of clinical symptoms; drenching then becomes curative rather than preventive.

ADVANTAGES OF INTEGRATION OF DRENCHING PROGRAMMES WITH GRAZING AND PASTURE MANAGEMENT

As mentioned in the introduction to this paper, the efficient overall control of parasitism depends not only on the efficient employment of drug treatments but also the greater integration of these with control measures based on pasture and grazing management.

With the newer drugs, treated animals are virtually worm-free and consequently the level of pasture infection to which they are exposed immediately following treatment is a major factor governing the rate of re-infection. In view of this the importance of factors such as the level of infection remaining on rested pasture and the contribution of the ewe to pasture infection should be re-evaluated. For this reason our research effort is being increasingly directed towards elucidation of the many complexities in the dynamics of infection.

Eventually, a fuller understanding of these complexities may enable us to re-evaluate certain drenching procedures which at present do not appear to offer sufficient rewards to support their recommendation as routine measures. As an example let us consider drenching prior to weaning or at the time of weaning. A feature of the 1961-64 trials was the absence of a marked response to suppression of infestation before mid-summer. As the response to six or seven fortnightly drenches before the beginning of January was only three or four pounds, a single strategic treatment before, or at the time of weaning, could scarcely be expected to produce an economic return in a "normal" season. Notwithstanding, it should be noted
that this assessment is concerned solely with the immediate benefits as reflected in liveweight. Future studies, including observations on the reduction of pasture contamination following strategic drenching, may well demonstrate benefits not considered at present.

**THE EWE AS A SOURCE OF INFECTION FOR LAMBS**

Other recent trials at Wallaceville have been directed towards providing an assessment of the importance of the ewe in the epidemiology of worm infestations in lambs. Results have shown that, in this country, a characteristic spring rise occurs in the faecal egg count of ewes, similar to that observed overseas. This rise, which can be most marked, regularly occurs six to eight weeks after the commencement of lambing and lasts for several weeks before the egg counts rapidly decline to a low level (Fig. 8). Although the egg counts of ewes remain low for most of the year, the contamination deposited at the time of the spring rise would appear to present a considerable source of infection for young lambs.

![Graph showingstronghold egg counts of breeding ewes](image)

In 1964-65 a trial was undertaken to determine the feasibility of suppressing the spring rise by means of a single post-lambing anthelmintic treatment, and to ascertain the effect of the spring rise on the subsequent degree and speed of build-up of worm infestation in lambs and the effect on lamb growth. Half of the ewes in a breeding flock were given a single dose of thiabendazole at “docking” time and then placed on pasture that had been rested for six weeks. Replicate groups of these treated ewes and their lambs were set-stocked on separate paddocks as were similar untreated control groups. Results show that the spring rise was controlled by the single treatment, although the rise in the untreated ewes was much smaller than usually recorded. Nevertheless, control of the rise by the single treatment and the placing of the animals on rested pasture had a marked effect on the level of infestation acquired by the lambs. The trial was carried on for twenty weeks and at the end of this time the faecal egg counts for lambs of untreated ewes were many-fold greater than those for lambs of treated ewes (Fig. 9), and the mean liveweight gain response ranged from 3 to 8lb (average 5lb). These results indicate the probable value of ewe drenching but, before firm
recommendations can be made, further trials will have to be conducted to ascertain the relative importance of the spring rise as it affects the level of infection on rested and non-rested pastures, and to evaluate the convenience and efficacy of pre-lambing versus post-lambing treatment. In addition, the possibility of further beneficial effects of such treatment, e.g. on the health and production of the ewe, has yet to be investigated.

CONCLUSIONS

At our present state of knowledge it appears unlikely that eradication of trichostrongyle worm infestation will be achieved. While the use of drugs continues to be our principal means of control, cognizance is taken of the need for further studies to evaluate the effectiveness of various management procedures in reducing the level of pasture infection. There must eventually be a greater integration of the various control measures available to the farmer.

The present trials, although limited in extent and restricted to the same experimental area, clearly demonstrate the extent of the economic losses in meat and wool production caused by worm infestation in young sheep and the possible major role played by parasites in the hogget ill-thrift problem. The ewe is recognised as an important source of infection for lambs.

The results emphasise the degree to which worm infestation in young sheep can markedly reduce the productive potential in the second and perhaps subsequent years, and that consideration must be given to this fact when assessing the economics of parasite control in the first year of life.

References


Figure 1: Mean body weights of the treated and control groups in the three successive trials 1961-64.

Figure 2: Mean strongyloid egg counts of the control groups in the three successive trials 1961-64.

Figure 3: Mean strongyloid egg counts of an untreated flock, 1964-65.

Figure 4: Total liveweight production of treated and control groups in 1966 trial, and mean strongyloid egg count of the control group.
Figure 5: Mean body weights of the treated and control groups in the 1963-64 trial, and mean strongyloid egg counts of the control group.

Figure 6: Mean liveweights of treated and control groups, in the 1965-66 trial, and mean strongyloid egg counts.

Figure 7: Liveweight gains of treated and control groups and mean strongyloid egg counts in the 1966 autumn and winter drenching trial.

Figure 8: Mean strongyloid egg counts of breeding ewes.

Figure 9: Mean strongyloid egg counts of ewes and lambs in the 1964-65 ewe drenching trial.
SELENIUM RESPONSIVE DISEASES
E. D. Andrews, Senior Principal Scientific Officer,
Wallaceville Animal Research Centre, Wellington.

Introduction

Eight years ago this Conference featured a symposium on stock health, which included progress reports on selenium in relation to white muscle disease, infertility and ill-thrift. Among the speakers were J. W. McLean, of Lincoln, and W. J. Hartley who, at that time, was on the Wallaceville staff. Today, I feel that the limited time available can best be used in summarising present knowledge of selenium-responsive conditions, rather than by concentrating on those special aspects with which we at Wallaceville have been concerned. During the past eight years selenium has been the subject of a number of articles and talks of interest to farmers. In presenting this paper, therefore, I beg the indulgence of those members of the audience to whom much of it may be familiar.

Up until about ten years ago, agricultural interest in selenium was confined to its effects as a naturally-occurring poison in fodder plants grown in certain parts of the world, notably in the western states of North America. However, in 1957, American scientists announced the signal discovery that minute traces of selenium were effective in preventing certain experimentally produced diseases in small laboratory animals. Historically, this discovery stemmed from earlier work on experimental vitamin E deficiency conditions, and it is now clear that there are a group of nutritional diseases, some of which are responsive to vitamin E, some responsive to selenium and some to either substance. So far, not much is known about the way selenium functions in animals. However, it is now abundantly clear that selenium is an element of world-wide agricultural significance in controlling a variety of nutritional diseases in animals, and in this context, is of considerable economic importance in New Zealand. At this stage I would like to pay tribute to the many farmers on both Islands who made their flocks and herds available for experiment and to workers in a number of research institutions, notably here at Lincoln, whose experiments were of vital importance in defining selenium-responsive conditions and in determining means whereby they could be prevented.

In what follows discussion is mainly centred around selenium-responsive conditions in sheep and cattle. Mention is also made of apparently related conditions in pigs and poultry, and methods of control of selenium-responsive conditions generally, are outlined.

SELENIUM-RESPONSIVE DISEASES IN SHEEP AND CATTLE

White Muscle Disease, Infertility and Paradontal Disease

In lambs, white muscle disease ("stiff lamb" disease, muscular dystrophy) may occur on pumice soils in the centre of the North Island and more extensively on the South Island stony silt soils, particularly of the Canterbury Plains. Most outbreaks have occurred on highly improved farms, often after heavy applications of fertiliser.
and where there has been ample leguminous green feed available to ewes and their lambs.

The disease is seen as a congenital or a delayed form. In the congenital form affected lambs are either born dead, or may die within a day or so of birth. Sudden exertion may bring on severe respiratory distress and death. In the delayed form the disease appears to develop after birth. Mostly it occurs between three and six weeks after birth, but onset may sometimes become apparent in lambs only a few days old or in those of up to three weeks of age. Most cases, seemingly, are not necessarily associated with exercise, but in some cases driving has apparently precipitated a severe outbreak.

Affected lambs show a stiff stilted gait with an arched back, are reluctant to move, and lose condition. Some animals may become prostrate and die. Lambs with a heart involvement may die suddenly without preliminary signs of stiffness. Some may scour profusely. Less severely affected animals make a slow recovery.

Post-mortem observations show muscle changes presenting a uniform pale granular appearance, or yellow, grey or chalky-white areas or striations. Usually, muscle changes are equal on both sides of the body. If the heart is affected, lesions are usually found in the right ventricle but can occur in other compartments. In congenital white muscle disease skeletal muscle is only rarely involved.

White muscle disease has been seen in adult ewes, and a form may occur in hoggets wintered on turnips or swedes. Also, calves have been found to be affected on a few properties in the North Island.

White muscle disease in lambs is completely controlled by selenium. Vitamin E appears to be only partially effective. White muscle disease in hoggets on turnips or swedes has been shown to be preventable by vitamin E but it is not yet known whether selenium is also effective.

In some areas experiencing white muscle disease in lambs, there is, in some seasons, an associated infertility in ewes. On most affected farms the ewes appear to be in moderate to good condition at mating, and apparently conceive. Research has shown that the barrenness is caused by death of the embryo at about one month after conception.

Experiments have shown that the barren ewe problem does not respond to vitamin E. Results of a typical experiment showing the effects of selenium on lambing percentages and incidence of congenital white muscle disease are shown in Table 1.

Table 1: Effect of Selenium on Fertility and White Muscle Disease (200 Ewes per Group)

<table>
<thead>
<tr>
<th>Group Treatment</th>
<th>Lambing (%)</th>
<th>Barren Ewes (%)</th>
<th>W.M.D. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Selenium</td>
<td>74</td>
<td>30</td>
<td>16</td>
</tr>
<tr>
<td>Selenium</td>
<td>116</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

Paradontal disease, seen mainly in 6-tooth and older sheep, can be an important cause of ill-thrift and losses. There is a broad geographical association of this disease with selenium-responsive unthriftiness, white muscle disease in lambs, or ewe infertility. It is 120
characterised by a loosening and shedding of permanent pre-molars and molars and sometimes, also, of incisors. There is an associated extensive paraodontal fibrosis and sometimes infection of the gums and tooth sockets. Recent Department of Agriculture experiments in the Te Anau area showed that selenium greatly reduced the incidence but since treatment did not prevent the disease completely it seems that other factors are also involved.

**Selenium-Responsive Unthriftiness**

Typically, selenium-responsive unthriftiness occurs on light soils (stony silt loams, sands or pumice) subject to leaching. Although the other selenium-responsive conditions already dealt with, are also generally found within those areas, selenium-responsive unthriftiness is geographically more extensive, that is, it may occur where the other conditions are not apparent.

In the North Island, definite responses to selenium appear to be largely confined to a limited area of coarse pumice soils in the Rotorua-Taupo area, to certain coastal sands in the Manawatu and to stony soils in Horowhenua, Wairarapa, and Hawke's Bay. In the South Island, good responses have been found in the Nelson and Marlborough Sounds Districts and on extensive areas of predominantly alluvial soils in Canterbury, Otago and Southland.

Lambs appear to thrive until they are 2-3 months old after which they fail to grow optimally. In severe cases deaths continue throughout summer and autumn but tend to cease by mid-winter. However, significant weight responses to selenium have frequently been found among lambs that are not obviously unthrifty. Affected animals produce up to 30 per cent less wool than do those dosed with selenium.

Post-mortem examination of severely affected sheep reveals little other than emaciation and soft brittle bones. In some cases remaining fat is yellow in colour.

Wallaceville experiments have indicated that this form of unthriftiness is not susceptible to treatment with vitamin E. In Table 2 are shown the weight gains over a 10-weeks period of survivors of groups of lambs, given either no selenium or selenium, in experiments on eight different farms.

Since, overall, the death rate among non-selenium groups (27 per cent) was much greater than that of the selenium-dosed group (eight per cent) the response to selenium shown, underestimates the beneficial effects of treatment.

### Table 2: Weight Responses of Lambs to Selenium

(21-36 Lambs per Group)

<table>
<thead>
<tr>
<th>Group</th>
<th>Farm No.</th>
<th>Average Weight Gain (lb.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selenium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Selenium</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
</tbody>
</table>

On affected pumice soils of the North Island good weight responses to selenium have also been found in beef and dairy cows.
HEPATOSIS Diaetetica in Pigs

This condition has been found in a number of piggeries throughout both Islands. There appears to be some association with areas where selenium-responsive diseases occur in sheep. Commonly, the disease occurs from May to October on diets consisting of whey or skim milk, supplemented with barley meal and, usually though not invariably, cod liver oil.

Mostly, outbreaks have occurred in piglets 6-14 weeks of age, just before weaning or shortly after transference to fattening pens. Losses have varied, ranging up to 50 per cent, and in some instances continuing over several months. Some outbreaks have been complicated by salmonellosis.

Usually, animals are found dead. Affected pigs seen alive are lethargic, show laboured breathing and become prostrate. In one case affected pigs showed stiffness, trembling and paralysis. Post-mortem findings show large amounts of straw-coloured fluid in body cavities. The liver is enlarged, friable and mottled. Often, multiple minute white streaks are seen in the heart muscle.

Although no controlled trials have yet been carried out in this country, experience indicates that losses are controlled by giving selenium and by discontinuing cod liver oil where this is being fed.

EXUDATIVE DIATHESIS—WHITE MUSCLE DISEASE IN POULTRY

An exudative diathesis—white muscle disease complex in chicks has been recognised in this country since 1951. The disease has occurred mainly in the South Island and has been associated with inclusion in the mash of South Island grains which have since been found to be low in selenium as compared with Australian grains (used mainly in the North Island). The condition has occurred with or without the inclusion of cod liver oil in the diet.

Most outbreaks occur in chickens three to five weeks old although a congenital form of white muscle disease may be found in chickens within three to four days of hatching, with lesions confined to the gizzard. Affected chickens lose weight and show leg weakness. Badly affected ones become prostrate and die. A red or greenish-blue discoloration is evident with subcutaneous swelling, particularly under the wings and down the right thighs. Post-mortem examination shows accumulation of tissue fluids, pale muscles and, sometimes, pale areas in gizzard muscle.

White muscle disease has also been recognised in pullets. The condition is associated with weight loss and poor egg production. Breast muscle is obviously pale and contains many white striations.

Experiment has shown that selenium will immediately control the disease conditions in birds, and many, clinically affected, recover rapidly.

CONTROL OF SELENIUM-RESPONSIVE CONDITIONS

It must be emphasised that selenium is poisonous in more than very small amounts, and for that reason can be used only under veterinary direction.
Doses for sheep are usually given orally and contain from 1-5 mg selenium according to the age of the animal or the nature or seriousness of the condition. To control infertility and congenital white muscle disease, ewes are dosed twice, about a month before tupping and a month before lambing. Outbreaks of delayed white muscle disease should be treated as soon as they are recognised. Selenium-responsive unthriftness in lambs can be prevented by dosing at tailing, again at weaning, and if necessary, at intervals of three months thereafter.

For convenience, cattle doses are usually given subcutaneously, the amounts varying from 10 mg selenium for calves up to 30 mg for adults. Intervals are at three months or as indicated by circumstances. Since risk of overdosing is greater when selenium is given subcutaneously great care must be exercised in ensuring that recommended dose rates are not exceeded.

For the control of selenium-responsive conditions in pigs and poultry selenium-containing supplements are now available, such that, when incorporated into the ration, 0.1 p.p.m. of added selenium is provided.

**SOME RECENT AND CURRENT RESEARCH**

At several New Zealand research institutions teams of scientists are engaged in basic research into the chemistry and biochemistry of selenium in soils, plants and animals. It is from investigations of this kind, designed to provide a background of theory, that progress in improved methods of diagnosis, and solutions to long-term problems of control, will ultimately stem.

Other scientists are engaged in work that may have more immediate practical application. Some of this kind of work is outlined below.

It has been found that, with some exceptions among deeper rooting plants, species, including weeds, usually found in a pasture sward, do not differ greatly in naturally-acquired selenium content. So far, no plants have been found that could accumulate selenium in amounts that might be harmful to stock.

As might be expected it has been found that soils and pastures from selenium-responsive areas contain less selenium than do those from areas that are not selenium-responsive. From field experiments with animals, and from a survey of the selenium content of pastures from 48 farms showing a selenium response and from 53 farms not showing a selenium response, Wallaceville findings suggest that in pastures, an average selenium content of 0.02 p.p.m., or less, is generally indicative of selenium deficiency. An average figure of more than 0.03 p.p.m. is generally indicative of adequate amounts of the element, so that borderline values are somewhere within the range of those two levels.

Similarly, figures are available for tissues, organs and fluids of selenium deficient and non-deficient animals. However, criteria of deficiency based on chemical analyses are not yet considered sufficiently firmly established to warrant their use, other than in special circumstances, as a routine diagnostic aid.

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It is of some interest that kidney and liver accumulate greater amounts of selenium than do other tissues and organs. Findings of this nature have been made use of in establishing that the dosing of deficient animals at recommended rates cannot constitute a hazard to the consumer of products from treated animals.

Much work has been carried out on methods of treatment. Present indications are that selenium in an insoluble form or contained in an oily base appears to offer no advantages in persistence over salts of selenium given as simple solutions in water.

Topdressing of selenium has been under investigation for some years. Research has included the examination of insoluble forms, and studies of the possible use of selenium absorbed into porous glassy materials, and of salts of the element applied in the form of a pill. However, interim results suggest that a simple preparation of soluble sodium selenite mixed with superphosphate may be practicable if amounts equivalent to as low as $\frac{1}{4}$ oz selenium per acre per year are found to suffice. However, because selenium in excess can be dangerous, trials on a farm scale over several years will be necessary before top-dressing can be considered for use in practice.

CONCLUSION

Areas of selenium deficiency are widespread throughout New Zealand and effective control of selenium-responsive diseases is of considerable economic importance. Reasonably satisfactory methods of prevention or cure are now available for all the selenium deficiency conditions investigated. Current research is aimed at a better understanding of the chemistry and biochemistry in soils, plants and animals, and at improved methods of diagnosis and control of selenium-responsive diseases.
COPPER DEFICIENCY DISEASE IN ANIMALS

G. G. Thomson and B. M. Lawson, Veterinary Science Department, Lincoln College.

Copper is an element, which along with other minerals, plays an essential part in the chemistry of cells in animals and plants. It is also required by bacteria. Not all of the processes involving copper are known. In animals it is used in a process known as tissue oxidation. Without copper, animals produce a wide range of clinical abnormalities, some of which I will deal with later. Without copper the nitrogen fixing organisms in the soil such as the Azobacter group and the Rhizobium species on legume roots fail to work and poor plant growth follows. Animals without sufficient copper fail to make normal proteins. This can actually be seen in sheep because the wool grows abnormally and a blue coloured fibre lacking crimp is produced. Pigment production is also upset and black sheep turn grey and black cattle turn a rusty brown colour. Lack of copper can also cause bones to break more easily. Lambs and calves lacking copper have a reduced ability to fight off infections and so are prone to illness and they grow more slowly.

How are these deficiency conditions produced? First there may be a reduced supply of copper in the food. This is referred to as a primary deficiency and can be brought about in several ways. Sometimes there is a simple lack of it in the soils of certain areas. For example, plants growing on well weathered silt loams are likely to have less copper available to them than plants growing in soils of more recent origin. It is possible for the increased productivity of pastures to cause a greater “take off” of essential minerals and so exhaust the supply in the soil. Sometimes an antagonism between nutrients occurs whereby one substance can displace another substance in the plant. For example, potassium is known to displace magnesium and sulphate can reduce the level of selenium. Copper may be influenced in this way, but it is not clear if this does happen. Other factors which can vary the supply of copper include the type and age of the plant. Legumes and flat weeds are generally higher in copper than are the ryegrasses.

A second situation can develop inside the animal if there is an interference with either the absorption or the utilisation of the copper. This condition is called an Induced copper deficiency. It frequently happens when the pasture level of molybdenum and/or sulphate rises beyond certain levels. For this reason you should be careful to find out how much copper is present in your pasture before applying molybdenum. If you apply molybdenum when the copper is moderately low you could easily induce a copper deficiency in your stock.

I now want to report on two recent incidents of stock ill health in which a lack of copper was involved. In one case the disease occurred in sheep and in the other pigs were affected.

The trouble in sheep occurred at Ashley Dene on the 30-acre experimental farmlet. This is on a soil type of the Eyre silt loam...
series and it has been claimed that the type of trouble about to be reported could occur even more easily on the older Lismore loam series. The farmlet is sown in lucerne and carried five ewes to the acre with all the feed being produced on it.

We think the trouble first started at lambing in 1966 when many lambs were born dead or were very weak and soon died. The percentage of lambs surviving to sale in 1965 was 112 per cent and in 1966 107 per cent. Wool production for 1965/66 averaged 13 lb. and in 1966-67 averaged 11.6 lb. per head. Of course it is not possible to be sure that these reductions were due to a lack of copper, but at least they seem to suggest that all was not well on the farmlet.

In December, 1966, when the weaned lambs were three to four months old more noticeable changes became apparent. On moving the lambs many tended to lag. They appeared to be stiff or to be lame. This suggested that white muscle disease might be the cause, but no improvement followed drenching with selenium. At this stage we were asked to inspect the lambs. To us the signs were consistent with "Sway back" or Enzootic Ataxia. Two lambs were killed for post-mortem studies and specimens were submitted to the Diagnostic Section at Wallaceville. The results are summarised in Table I and are compared with normal findings.

TABLE I

<table>
<thead>
<tr>
<th>COPPER AND S.G.O.T. LEVELS ASSOCIATED WITH ENZOOTIC ATAXIA (SWAYBACK)</th>
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</thead>
<tbody>
<tr>
<td><strong>PASTURE</strong></td>
</tr>
<tr>
<td>Cu.ppm, Mo.ppm</td>
</tr>
<tr>
<td>AFFECTED</td>
</tr>
<tr>
<td>2-3</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>NORMAL</td>
</tr>
<tr>
<td>5-10</td>
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Histology of C.N.S. of affected animals showed symmetrical demyelination along with chromatolysis of the neurones.

The figures showed that White muscle was not the cause because the serum glutamic-oxaloacetic transaminase levels were normal. They did, however, show a low level of copper in the pasture, the blood and livers of the lambs and the ewes. This strongly supported the histological picture of symmetrical demyelination of the spinal cord indicating that the condition was in fact Enzootic Ataxia.

To arrest any further degeneration the lambs were injected subcutaneously with 150 mg Copper glycinate. They eventually fattened and were sold. It must be pointed out, however, that copper injected at this time does not cure the condition. To prevent a recurrence
this year the ewes will be injected with copper glycinate and the pastures will be topdressed with copper in the Spring.

The second incident involving a lack of copper occurred in young pigs and it was concurrent with a lack of iron, Vitamin B12 and Selenium. Last October our advice was sought by a pig producer who said that at least 50 per cent of his gilts and ten per cent of his older large White cross sows were producing litters which all died within a few days. The pregnant sows were fed on boiled garbage to which was added a mixture of vitamins and amino acids. The newly born piglets nearly all suckled at first, but later refused to do so. They then tended to lie away from the sow making odd squeaking noises while gasping for air. Very quickly they became listless and soon died. Those surviving for 14 days or more often trembled badly or became ataxic. They also turned a yellow white colour; a few scoured. If handled at this time for iron injections they soon died. In one litter of nine such piglets dosed one evening seven were dead the next morning. This disease prevailed in spite of a very high standard of housing and management. Each sow had a separate pen in a large air-conditioned well insulated building.

The first specimens taken from these piglets were examined at Wallaceville and were found negative for pathogenic organisms and viruses. Tissue studies revealed no significant changes. Further studies were then made on many affected piglets and the results are summarised in Table II which compares them with normal pigs.

**TABLE 2**

**BLOOD AND LIVER EXAMINATION OF PIGLETS**

<table>
<thead>
<tr>
<th>BLOOD</th>
<th>LIVER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hb gms %</td>
<td>P.C.V. %</td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td><strong>Affected</strong></td>
<td></td>
</tr>
<tr>
<td>5.8</td>
<td>20</td>
</tr>
<tr>
<td>7.0</td>
<td>30</td>
</tr>
<tr>
<td><strong>Normal</strong></td>
<td></td>
</tr>
<tr>
<td>12.0</td>
<td>40</td>
</tr>
<tr>
<td>15.0</td>
<td>47</td>
</tr>
</tbody>
</table>

These figures showed gross deficiencies in the number of red blood corpuscles and in the haemoglobin level. It was found that the piglets had a severe anaemia resulting from a marked reduction of copper, iron and Vitamin B12. It is not easy to say why these piglets should have such very low values. It is well known that only moderate amounts of these minerals are passed on to the piglets in utero and that only small amounts reach them via the sow's
milk. Even the addition of mineral supplements to the sows during pregnancy made relatively little lasting difference to the situation.

At first we suspected a lack of selenium and we gave the sows three doses of 15 mg of selenium during the pregnancy period. This appeared to prevent the birth of stillborn litters and it also helped many more young pigs to live. Several trials were undertaken to help understand the problem and to see how growth rates could be improved. The piglets were numbered at birth and weekly weighings made. From all these studies it appeared that the best solution was to dose by mouth all the newly-born piglets with a mineral mixture containing iron, copper and selenium. This was repeated twice at weekly intervals. This gave a good survival rate and reasonable growth rates. It kept the piglets growing until they were able to eat a commercial meal containing the needed minerals. This is best shown by the following graph.

Growth rate of pigs from swill fed dry sows farrowed inside, then meal fed

<table>
<thead>
<tr>
<th>Weeks</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight lbs</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

- Se to piglets at birth
- Se, Cu, Fe to piglets weekly
- Cu, Fe to dry sows
- All dry sows given Selenium.

These two case histories have been presented to remind stockowners that trace element diseases can still occur and that they may arise among animals fed on pasture as well as those on so-called artificial diets.

I wish to acknowledge the invaluable assistance given to us by the staff of the Diagnostic Station at Wallaceville.
IODINE DEFICIENCY AND ITS EFFECTS

C. H. G. Irvine, Senior Lecturer in Veterinary Science, Lincoln College.

Iodine is an element—like copper and cobalt and selenium. Although its importance in animal nutrition has been recognised longer than copper, cobalt or selenium, there has been some doubt about whether it is an essential trace element, but it now seems certain that it is essential. Iodine is used in the body for only one purpose, in manufacture of thyroxine, and another similar substance—by the thyroid gland—the thyroid gland extracts iodine from the blood passing through it, normally taking out about 30 per cent—in the gland, the cells are arranged in spherical masses, the cells forming the walls of the sphere, while the interior of the sphere provides storage capacity for the thyroxine formed—where it is stored as a complex substance—when thyroxine level in the body falls below the amount which maintains maximum efficiency, the brain releases a substance which stimulates the thyroid cells to work harder, and also breaks down the stored complex into thyroxine which then travels out into the blood stream to restore the level to normal.

All this functions very well as long as the thyroid gland receives blood with sufficient iodine in it so that it can maintain an adequate rate of thyroxine manufacture, and this requires also that the cells themselves are efficient in their manufacturing processes. When thyroxine production is inadequate, because of deficiencies in either of these mechanisms, the level is not restored to normal when the brain sends out its chemical messenger, so it continues to send out this messenger in increasing amounts—each cell works harder, and enlarges in the process, and additional thyroid cells are formed, thus increasing the efficiency of iodine extraction from the blood and the production of thyroxine. The increase in size of the gland which results is called goitre. In many cases, this enlarged gland is able to manufacture sufficient thyroxine for the body's needs, and a new balance is struck where the thyroxine level in blood is kept at very near the proper level, but only because the thyroid has increased in size—however, this gland is working under stress, has little reserve, and thus is not as well able to cope with any increase in demand. It often happens, however, that such demands do not occur, and thus the animal with a goitre is able to perform its functions reasonably efficiently—also, once this enlargement of the thyroid gland has occurred as a result of production of more cells, it will remain for many months, even if the initial cause is corrected—thus the presence of a goitre does not indicate any inefficiency in the functions of the animal, although it does indicate that in the not-too-distant past, thyroid function had been stimulated by one of the causes mentioned.

Sometimes, in spite of increase in size, the thyroid gland is unable to maintain a normal blood level of thyroxine. The animal
then becomes affected in many ways, because thyroxine is necessary for the normal functioning of nearly every cell in the body. Let's look at the way thyroxine works, and then we will better be able to appreciate what happens when it is deficient. Thyroxine works in two main ways—it increases growth rate in growing tissues, and it increases the rate at which chemical processes are carried out in most cells. The effects of a lack of thyroxine on growth have been very clearly demonstrated by the removal or inactivation of the thyroid gland in calves at 10 weeks of age. These animals grew to less than half their normal size. The same thing has been observed in foals and lambs. In the animal in which growth has ceased, some tissues are still actively dividing and producing new cells. These are mainly in the skin and reproductive system. Deficiency in thyroxine leads to decreased function in these systems. Effects of lack of thyroxine on chemical processes in the adult shows up in a decrease in milk yield, wool growth and work output and a general sluggishness of the animal.

Finally, goitre can occur when abnormal substances which can stimulate the thyroid gland enter the system. Under these circumstances, the thyroid is overstimulated, even though it has been maintaining a normal output of thyroxine. In this case, the thyroid enlarges, there is excessive output of thyroxine and blood levels become very high. This occurs commonly in man, but much less commonly in animals.

Therefore, goitre can be associated with low, normal or high level of thyroxine in the blood, and the symptoms vary accordingly.

However, most goitre will arise when the manufacture of thyroxine from iodine is reduced. As we have seen, this can arise when the amount of iodine taken up by the gland is inadequate, or when the conversion of iodine into thyroxine is depressed. The amount taken up by the gland depends on the amount in the diet, the fraction of this which enters the bloodstream, and the fraction of this which is taken up by the gland. Let us deal with these in order.

The amount of iodine in the diet will be low when animals are grazing on pasture or crops deficient in iodine, or fed concentrates deficient in iodine. A small amount of iodine is taken up by the grazing animal from contamination of the pasture with soil, which is usually 5-20 times richer in iodine than pasture itself, and some iodine may be derived from water. Surface run-off, rain, glacial and snow-fed rivers are usually poor sources of iodine, while water obtained from deep wells may be a good source. While there is, with many elements, a relationship between soil and crop concentration, this does not occur with iodine. In fact, soils which are richest in iodine are often those in which it is most firmly bound and is thus unavailable to plants. The high concentrations found in soils may well occur because very little has been taken out by plant life over the years. Increasing the acidity of the soil will result in more iodine being released to plants. Increasing the alkalinity will bind iodine more firmly.
Heavy Cropping and Leaching Depletes Iodine.

Pastures containing less than 300 micrograms per kg dry weight are regarded as iodine deficient, while 300-600 is marginal. Iodine concentration is inversely related to growth rate, being highest when growth is slowest. Most important factor in determining iodine in pasture is the species, and even the strain within a species, e.g., perennial ryegrass has about 1500 micrograms per kg, Italian 800, short-rotation 250, cocksfoot 100 and Yorkshire fog 70. (New Zealand data, from Butler.) Iodine content of pastures and crops can be increased by application of iodine in various forms, and in land near the sea in which the prevailing wind blows onto the land, pasture iodine is high.

No matter in what form the iodine is taken in by the animal, it is very efficiently digested and absorbed into the bloodstream. I pointed out earlier that the thyroid gland takes about 30 per cent of the iodine out of the blood passing through it. However, the gland is unable to distinguish between iodine, which exists in solution in the blood as iodide, and another pasture ingredient, thiocyanate. If the concentration of thiocyanate in the blood is high, it will be absorbed instead of iodine, with a consequent reduction in iodine uptake. Thiocyanate is widely distributed in pasture and crops in New Zealand. For example, Tony Care, working at Lincoln, found that linseed contains thiocyanate which will produce goitre in sheep, while clovers, especially white clover, and lucerne will do this. As the relative uptake of these two substances depends on the relative concentration in the bloodstream and thus in the diet, even small amounts of thiocyanates will have an effect on iodine uptake. The reverse applies also, fortunately, so that the goitre-producing action of thiocyanate is readily overcome by increasing the amount of iodine in the diet.

We have already seen that thyroxine manufacture can be reduced, and goitre can thus be produced, when the ability of the thyroid cells to convert iodine into thyroxine becomes reduced. This very commonly happens in our animals because their diet frequently contains substances known chemically as thiouracils. Brassica species are the commonest source of thiouracils encountered in New Zealand, and many outbreaks of goitre from feeding chou-moellier, turnips, swedes have been reported. The seeds of these plants are a richer source of thiouracils than any other portion, but they are also contained in the foliage and roots. Some plants, such as the cabbage family contain both thiocyanate and thiouracil, for example, thousand-headed kale. This is of more than academic interest, because the thiouracil type of goitre-producing substance acts not by reducing the iodine uptake of the thyroid but by preventing it using its iodine. Consequently, iodine is of little or no value in prevention or treatment of this type of goitre. Unfortunately, little data is available on the concentration of thiouracils in these plants, or on the factors which affect this.

Before concluding, I would like to emphasise that the thyroxine requirement of an animal is at its maximum in the last six weeks or so before it is born. For this reason, the most obvious losses occur in these animals which may die before birth and be aborted,
may be born dead, or in such a weak condition that they don't survive. The main symptoms in these lambs are goitres, hairlessness. While reproductive disturbances have been found in the female, they are usually more noticeable in the male, the most prominent symptom being a decline in libido (sexual enthusiasm). There are many reports of the successful treatment of a falling off in sexual powers in rams, bulls, stallions and men.

While iodine deficiency has never been as important a problem as selenium or cobalt deficiency, we in New Zealand are in an iodine deficient area, and we feed our animals extensively on goitre-producing plants. Each lamb or bale of hay sent off our farms reduces the available iodine.
HIGH STOCKING RATES CAN BE ACHIEVED IN THE SOUTH ISLAND

R. W. Clark, Farmer, Rotomanu, West Coast.

INTRODUCTION

We are often told that the level of dairy production obtainable in the North Island cannot be obtained in the South Island. We read of over a cow to the acre and 500 lb of butterfat per acre and wonder if the same kind of performance is possible here in the South Island.

I believe that North Island levels of production are possible in the South Island, particularly where we have the rainfall. I say this as a North Islander who was educated here at the College where I did a V.F.M. I also have had a great deal of my practical farm education in the South. We have not yet been able to achieve North Island levels of performance at Rotomanu on the West Coast but I am confident that we will.

Before giving you some of my ideas on heavy stocking I had better tell you about the farm. Rotomanu is 30 miles south of Greymouth. The farm is 282 acres bounded on two sides by the Crooked river. Most of the farm is on very recent river silt overlying gravel. The remaining 60 acres is a schist sand, very friable on the ridges but it becomes a flax swamp in the depressions.

We are blest with a 110 inch rainfall on 188 days. Half of this falls during the night. It’s mainly warm nor’-west rain which can herald bloat conditions at any time.

Sometimes we have cold wet southerly and easterly weather, mainly in September, November and April and May. It comes in over the alps and when the wind drops, in winter, we are liable to get heavy frosts. We get 50 to 60 frosts of up to 16 degrees because we are well inland.

When I say “we", I mean my wife, myself and my father who came out of retirement to help me from time to time with this project when we started in 1963. I married 2½ years ago and I can but describe my wife’s sterling qualities by pointing out that while I am talking here, she is at home milking 120 cows, feeding 13 sows and 70 fattening pigs, all on her own.

When we took the farm over it had been doing about 22,000 lb of butterfat with a sharemilker and 150 ewes. In 1963/64 we produced 27,000 lb with 86 cows. Then we went to 29,000 lb to 35,000 lb to an estimated 34,000 for this season with 132 cows. I have been asked to tell you of the changes we have made to get this increase in production.

We have followed North Island methods. We have put on more cows, increased the soil fertility with manuring, broken in more land, and made various important changes to management. We have had problems with labour, dealing with pigs, bloat, and poaching, and we have a long way to go yet before we get to one cow per acre. That is at least four years away.

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FACTORS IN INCREASED PRODUCTION

(a) More Cows

The first factor has been to put on more cows to eat all the grass that was growing. Our experience on the coast confirms all those experiments you have read about which show that increasing stocking rate increases production per acre.

To get more stock, we have had to rear them—40 to 50 calves a year. In the first year we reared them on the bucket. Then we changed over to the calfeteria, feeding whole milk twice a day for four weeks. After a gradual change to half skim-half whole milk, we wean our calves at about eight weeks. The calves graze fresh grass but in the early years we did not have enough paddocks and on stormy nights we have lost calves in the river. Worms are a problem but up until this season thibenzole has kept the calves healthy. However, this year we reared 180 steer and heifer calves. We lost 30 mainly because of lungworms. Thibenzole is ineffective against them. They died during a stormy three weeks in early December—we have very little natural shelter.

Through rearing our own stock we have lifted cow numbers from 86 to 132 cows in four years.

(b) Ousted Sheep

The second factor in helping increase production has been getting rid of the sheep in the second season. They clashed with the cows. Lambing clashed with calving and shearing clashed with hay-making. At times we became very short of milking feed.

With rivers and bush bounding the farm ragwort is a problem and that is why we had sheep. But the sheep would only control the ragwort at the expense of the milking cows.

With bare ground thousands of ragwort seeds germinated. Now, with higher fertility, the denser pastures tend to keep the ragwort out with the aid of hormone treatment.

Another advantage of getting rid of the sheep was that it saved having to renew the sheep yards and reduced the cost of the fences put up during development.

(c) Soil Fertility

The third factor in production has been increased fertility. Before we took over the farm very little fertiliser had been put on, especially in recent years.

We applied topdressing in accordance with the needs of each paddock. In the first month of taking over, 60 tons of lime and 80 tons of super were put on 130 acres. Next autumn we put on 12 tons of super and a further 24 tons the following spring.

At this stage, I think we have put on enough super but more lime is needed when the budget will allow it.

(d) More Acreage

Next, we have increased the acreage of the farm by bringing in 45 acres of rough grazing. 25 acres were sown directly from
grass. To make sure of the soil fertility we put on two tons of lime and 12 cwt of super per acre initially.

The seed mixture was fairly simple and straightforward. 15 lb of perennial to keep the cows out of the mud, 10 lb of H1 ryegrass for winter growth and two to three lb of white clover. We have got good summer growing conditions and low fertility. Consequently I cannot see the logic in sowing expensive fancy seeds mixtures which will not persist.

We broke in another 20 acres of ground through a crop of swedes in 1965. This was manuka country. The land was light, the winter hard, the crop poor and the cows got acidosis. I lost eight. Ten acres of new grass alongside sown without a crop gave me more feed at a lower cost and no trouble, so now we sow direct to new grass.

To date we have got 165 acres in reasonable grass and 115 acres or 40 per cent left in rough grass, stumps, gorse and blackberry.

At the moment another 30 acres of this is under development. The dragline has put in the open drains needed. Some of this is stumped and waiting to be sowed down. Two tons of lime and two cwt of super phosphate will be used at sow down on this block. The State Advances Corporation have given me a development loan to complete this project.

(c) Grazing and Herd Management

Next, we have made several changes to the grazing and herd management which have been quite important.

Later Calving: The cows now calve a month later—from August 8th to September 8th. We can now winter more stock and we do not have to save autumn feed for the spring. Cows double the feed they need when they calve so there is no point in calving them until the grass is there for them. Underfeeding after calving leaves a lasting depression on the cows' production. We do not have to calve early to dodge summer droughts as we do not usually get them.

24-Hour Grazing: We have also changed the grazing management. We have done away with the day and night paddock system. The cows now have a 24-hour rotation. But with two sections of the farm almost a mile from the cow shed we will probably revert to the day system. I think this is satisfactory so long as you balance up the shift of fertility with extra topdressing on the day paddocks.

Split Herd Wintering: Up until last winter we wintered on hay, or hay and silage and swedes. However, with only 900 bales of hay conserved for last winter prospects were grim. Along came Mr John Hughes, consulting officer of the New Zealand Dairy Board. He talked me into split-herd wintering. I took his advice and the cows came through very well.

We ran a trial with 14 cows. These were a cross section of the herd and were run on 11 acres of grass with no other feed for two months during the winter. The older cows became too fat,
while the two and three-year-olds lost weight. As a result of this experiment, I am convinced we can winter cows on grass only and just use hay as an insurance.

We usually get a false spring in August on the Coast. With a little hay if needed this false spring will flush the cows for calving. By giving the freshly calved cows all they need and by tightening up on the dries following behind we should be able to get through the winter and spring satisfactorily. In a difficult spring we may have to feed hay or hay and meal or meal alone to see us through. This may be worth the extra cost to convert the abundance of summer feed we can grow into milk.

Haymaking is a problem on the Coast. We can't close paddocks for it until about Christmas and then it is a battle to get it made. Last season I burnt 400 bales and in the last two years I have ended up making silage in March.

Change to Friesians: As we are now turning over to Friesians and producing Friesian steer calves, the stock will be able to eat more of the summer feed in relation to the load of winter stocking carried through the winter. The sale of the steer calves will be a source of finance to buy hay or meal if needed.

The main reason we have turned to the Friesian is that they do better under our severe conditions. Of the 30 calves we lost this year—29 were Jerseys. With the very high standard of the Friesian A.B. bulls I think we should be able to produce butterfat just as efficiently as with the Jersey even though the Friesian is a heavier animal and eats more. You may think I am biased but I do not think you would say this if you looked at the herd on a rough day with the Friesians out grazing while the Jerseys are huddled up in the far corner.

PROBLEMS IN DEVELOPMENT

Having told you about the factors in development, more cows, less sheep, more fertility and management of the pasture feed and the herd, I will now tell something of the problems of farm development, North Island style, on the West Coast.

(a) Labour

The first problem has been labour. With the aid of my father things went smoothly in the first season. I then employed a single man but between our baching and my courting, I am still wondering how we managed to make 29,000 lb fat in that season. I then carefully budgeted for 40,000 lb fat and having two houses, employed a married man at a generous wage. We neither achieved the 40,000 lb last year nor could I see us doing it this year, so I had to dismiss him. However, with the aid of the State Advances loan we converted the shed to a herringbone. It was an eight-bale walk through shed. Now it is a nine-a-side doubled up low line herringbone. Hilary and I have milked the 132 cows this season in 1-1/2 hours without too much difficulty. We have used the existing yard and divided it into two. It has a backing gate driven through a series of pulleys using an old washing gearbox. We have only
used half the shed and can easily build a second pit beside it for expansion.

Also to help with the labour problems we have adopted rather unconventional milking hours in the autumn. We have milked every 15 hours—5 a.m., 9 p.m. and 1 p.m.—without any apparent loss in production. This has given us a longer working day and a chance to visit friends without having to rush off home at night as well as a sleep-in every second Sunday.

(b) Bloat

We have also had a bloat problem. Spraying oil on pastures is not the answer on a semi-developed farm with large paddocks. It is not the answer when you have a 110 inch rainfall to wash the oil off the grass. However, we have found flank painting 100 per cent effective and very easy to apply in our herringbone cow shed.

(c) Pigs

Our third problem is the problem of cream supply and this means keeping pigs. I started with six sows and a boar which had the run of the farm. The sows farrowed in the rushes. This may be all right in a 40 inch rainfall but not on the Coast. The sows were supposed to farrow in June and July of that year but I did not see a pig until September. I managed to buy five sows and we farrowed them in the old cow shed. There was an open Canterbury type farrowing house which we managed to renovate and enclose over two seasons. Last season I renovated an implement shed for farrowing sows.

In the first year we had 11 sows and sold 130 baconers and porkers. Now we have twice the sows and nearly twice the sales. We will sell 280 baconers and porkers this year.

Bloat and pigs are really all part of the labour problem and to reduce it on the pig side of the business I am planning to go out of sows into fattening weaners by converting the farrowing houses to fattening quarters. This will give us the space to put through 400 baconers a year. With a little extra expense the housing could be expanded to fatten 600. We will buy-in weaners when the cows calve and sell the last when the cows dry off. This will mean I will not have to look after the sows during the winter which will give me more time to get on with development.

There is quite a lot of feeling over on the Coast on the question of pigs versus tanker. I made 9d a lb butterfat last year with an inefficient system. Whole milk could not compete with this. There is a 50-mile haul for the milk to the South Westland factory in addition to the tanker stand on the farm, a tanker road, and the rosy future of the pig industry. Going over to tanker would also leave two pig houses as monuments to the New Zealand pig industry.

(d) Poaching

The final problem has been one of poaching with the large number of cows, especially at gateways. However, this is a relatively easy problem. I am planning to have offset gateways at each end of the
paddock opening onto the race. The cows will be put in the near end and brought out the far end.

While on poaching I should mention that we use a spinner drainer to drain off surface water on the grass paddocks. For new paddocks we have put in “V” drains down the hollows. The farm is not flat. It is furrowed by old river courses with a good fall so “V” draining is no problem.

The Future

Well, those are the methods we have used in the past four years and the problems we have had. I now want to take a brief look at the future.

We are going into this winter with 180 cows and in-calf heifers plus 120 heifer calves. This is equivalent to 220 cows to winter on 165 acres plus run-off country. We have 1500 bales of hay and 50 tons of silage.

We are aiming at 280 cows in four seasons’ time. This will be one cow to the acre plus replacements. Of course by this time all the rough grazing will have been brought in.

The system I have in mind for running one cow to the acre is this:
1. Split head wintering.
2. Late calving when the grass comes away.
3. Rear all calves or cows at three per cow with cows returning to the herd at weaning.
4. Rear steer calves for sale in the autumn.
5. Buy some hay and meal if necessary.
6. The herd will be rotationally grazed during the milking season.
7. Two milkers in the spring with three for the rest of the season. Using the existing shed. Beyond this point the second pit for the herringbone will have to be put in.

However, I must not be too dogmatic. The dairy farming world is a fast changing one. Who knows what lies ahead? Maybe the Inland Revenue Department will decide this for us.
FACING UP TO THE FINANCIAL PROBLEMS OF DAIRY FARM DEVELOPMENT

D. J. Botting, Adviser, Ellesmere Farm Advisory Club.

In a paper such as this it is easy to over-simplify and I will try to avoid conveying the impression that all financial problems are easily solved. But I do hope to show you that given a satisfactory personal factor, most can be solved or perhaps better still avoided.

My remarks will be chiefly concerned with problems arising from development. But first let us have a look at the causes of any financial problem on dairy farms.

These usually arise out of one of the following:

(a) An underdeveloped farm, i.e., the level of income is insufficient to meet all commitments including living expenses.

(b) An uneconomic farm, i.e., too small.

(c) Personal drawings excessively high.

(d) Poor management.

Leaving (a) for the present, most of the others can be overcome if there is a strong enough desire on the part of the owner. The uneconomic farm is probably the most difficult, and here a very strong personal factor is needed. The State Advances Corporation have assisted some of these farmers to buy more land. In the advent of failure to get assistance from this source, an approach can be made to the Marginal Lands Board. Another solution is to intensify into such enterprises as pigs, or meat chicken production, and some commercial interests will assist worthy men with finance for this type of production.

Excessive personal drawings provides an easy answer, but it's not always as simple to put into practice. It's often better to develop the farm to a level that will support high personal expenditure rather than try and reduce it.

To those with little or no capital and who would like to go dairying, the only solutions I can offer are to either marry into a farm or to go shareremilking and stay single. However, it would appear that in the future we will see larger and larger dairy and pig herds with a greater demand for really skilled managers and workers. I believe our dairy industry would attract more men with ability if a ladder of promotion was established leading to highly paid managers’ positions.

Now to return to the title of this paper. Few farmers have a real appreciation of development costs and in any such programme it's important to have some sort of plan of:

(a) What's to be done.

(b) How much it will cost.

(c) Where the money is coming from.

A good reason for this is that it's a lot easier to get money for development than it is to get it to reduce an over committed stock firm, or bank overdraft.

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To give you some idea of development costs I have taken a hypothetical Canterbury dairy farm and worked out a development programme for it.

The farm is 130 acres of good heavy clay soils, milking 50 to 60 cows and running 8 to 10 sows. In addition 30-40 acres of crops are grown. Facilities consist of a six bail cowshed in good order, a small concrete pig fattening house and some old wooden farrowing houses. Dry sows are run in a 5 acre paddock of gorse, thistles, horehound, bog holes and the odd clump of half dead grass. The rest of the farm is fenced into 10 to 15 acre paddocks.

The herd normally produces 350 lb b/f per head at the factory, and the crops always yield well. Within the community the farmer is considered to be a good farmer. All the work on the farm is done by the farmer and his 19-year-old son.

In the past the income has been sufficient to maintain the farmer and his family comfortably, but the general rise in farm costs has eroded the income to a point where there is no longer a cash surplus after living and tax. An added worry is the need in future for increased wages for the son and a house if he wants to get married.

Time does not permit me to go through the development in detail but here is an outline.

First the development of the pig enterprise, most of the work to be completed in two years.

1. Increase sow numbers to 20 by the end of the first year, and to 40 the second year.
2. Provision of better farrowing facilities.
3. Increase fattening house accommodation for 200 pigs.
4. Provision of bulk grain storage, grinding and mixing facilities.
5. Other improvements would include dry sow house and paddocks, accommodation for sows and litters and most important fenced races and small yards for moving and handling stock.

The development of the dairying enterprise would be spread over 5-6 years, with a gradual cessation of cropping and an increase to 120 cows. This would require the following work:

1. Subdivision to give 25 to 30 paddocks of 4 to 5 acres.
2. Construction of a central race system.
3. Improvements to the drainage.
4. Increased topdressing rates.
5. More haybarns and some facilities for wintering stock. In this case I have chosen a sawdust pad.
6. Conversion of the cowshed to the herringbone design.
7. Extra stock. In this case they should be able to be bred on the place.
8. Better stock water supply.
9. Married man's house. (To be eventually occupied by the son who may be married by the time development is completed.)
TABLE I.

DEVELOPMENT COSTS

<table>
<thead>
<tr>
<th>Description</th>
<th>£</th>
<th>£</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fencing—350 chains at £2</td>
<td></td>
<td>700</td>
</tr>
<tr>
<td>Central race—50 chains</td>
<td></td>
<td>300 (Part only)</td>
</tr>
<tr>
<td>Drainage—open drains</td>
<td></td>
<td>120</td>
</tr>
<tr>
<td>50 chains tiles at £9 chain</td>
<td></td>
<td>450</td>
</tr>
<tr>
<td>Water Supply (tank, troughs and pipe)</td>
<td></td>
<td>500</td>
</tr>
<tr>
<td>Cowshed</td>
<td></td>
<td>1,200</td>
</tr>
<tr>
<td>Sawdust pad—400 yards at 10/-</td>
<td></td>
<td>200</td>
</tr>
<tr>
<td>Hay racks, etc.</td>
<td></td>
<td>200</td>
</tr>
<tr>
<td>House—for son</td>
<td></td>
<td>4,000</td>
</tr>
<tr>
<td>Pig housing—silos, stock, etc.</td>
<td></td>
<td>3,000</td>
</tr>
<tr>
<td>Stock—70 cows at £40</td>
<td></td>
<td>2,800</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>13,470</td>
</tr>
<tr>
<td><strong>Less Stock (reared)</strong></td>
<td></td>
<td>2,800</td>
</tr>
<tr>
<td><strong>Provided by Overdraft and Income</strong></td>
<td></td>
<td>2,200</td>
</tr>
</tbody>
</table>

**CAPITAL REQUIRED**

£ 8,470

It is more than likely that a State Advances development loan could be obtained for this amount.

A word of warning should be given here not to depend too much on the income as a source of development finance. As the enterprise enlarges more working capital will be required, especially in this case where it is intended to buy all pig feeds at harvest time. A common mistake is to under borrow, thus finishing up in a worse position than before as far as liquid cash is concerned. This has the affect of stifling future development and often leads to bad decisions being made.

It will be noticed that I have assumed this level of production can be achieved without irrigation. On drier farms irrigation would be included in such a development programme.

Table II shows the income and expenditure before and after development.
### TABLE II.
### INCOME AND EXPENDITURE

<table>
<thead>
<tr>
<th>Income:</th>
<th>Before Dev.</th>
<th>After Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.F. 17,500 lbs</td>
<td>£ 2,500</td>
<td>£ 5,200</td>
</tr>
<tr>
<td>Cattle Sales</td>
<td>£ 500</td>
<td>£ 1,050</td>
</tr>
<tr>
<td>Crops</td>
<td>£ 1,150</td>
<td>—</td>
</tr>
<tr>
<td>Pigs—90 at £8</td>
<td>£ 720</td>
<td>£ 4,400</td>
</tr>
<tr>
<td>Less Stock purchases</td>
<td>—£100</td>
<td>—£100</td>
</tr>
<tr>
<td><strong>GROSS</strong></td>
<td>£ 4,770</td>
<td>£10,550</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expenses:</th>
<th>Before Dev.</th>
<th>After Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration</td>
<td>£ 70</td>
<td>£ 140</td>
</tr>
<tr>
<td>Standing—Rates, etc.</td>
<td>£ 120</td>
<td>£ 140</td>
</tr>
<tr>
<td>Interest</td>
<td>£ 325*</td>
<td>£ 792</td>
</tr>
<tr>
<td>Wages</td>
<td>£ 600</td>
<td>£ 600</td>
</tr>
<tr>
<td>Animal Health, etc.</td>
<td>£ 75</td>
<td>£ 400</td>
</tr>
<tr>
<td>Crop Expenses</td>
<td>£ 170</td>
<td>—</td>
</tr>
<tr>
<td>Electricity and Dairy</td>
<td>£ 75</td>
<td>—</td>
</tr>
<tr>
<td>Feed—Haybaling</td>
<td>£ 200</td>
<td>£ 300</td>
</tr>
<tr>
<td>Pig feed</td>
<td>£ 50</td>
<td>£ 1,800</td>
</tr>
<tr>
<td>Freight</td>
<td>£ 160</td>
<td>£ 230</td>
</tr>
<tr>
<td>Fertiliser</td>
<td>£ 190</td>
<td>£ 410</td>
</tr>
<tr>
<td>Seeds</td>
<td>£ 120</td>
<td>£ 10</td>
</tr>
<tr>
<td>Repairs</td>
<td>£ 350</td>
<td>£ 400</td>
</tr>
<tr>
<td>Vehicle</td>
<td>£ 300</td>
<td>£ 150</td>
</tr>
<tr>
<td>Depreciation</td>
<td>£ 400</td>
<td>£ 500</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>£ 3,205</td>
<td>£ 6,045</td>
</tr>
<tr>
<td><strong>SURPLUS</strong></td>
<td>£ 1,565</td>
<td>£ 4,505</td>
</tr>
<tr>
<td><strong>£4,770</strong></td>
<td><strong>£10,550</strong></td>
<td></td>
</tr>
</tbody>
</table>

* It is assumed that there is a first mortgage of £5,000 on the property.

### TABLE III.
### INCOME APPROPRIATION

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After (Partnership)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxation</td>
<td>£ 230</td>
<td>£ 920</td>
</tr>
<tr>
<td>Capital Repayments</td>
<td>—</td>
<td>£ 170</td>
</tr>
<tr>
<td>Living</td>
<td>£ 1,350</td>
<td>£ 2,400</td>
</tr>
<tr>
<td>Cash Surplus</td>
<td>—£15</td>
<td>£ 1,015</td>
</tr>
<tr>
<td><strong>£1,565</strong></td>
<td><strong>£4,050</strong></td>
<td></td>
</tr>
</tbody>
</table>

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It should be noted that during the course of development it has been assumed that the farmer's son has married and a single man has been engaged. (Living expenses have been increased to allow £1,000 for the son.)

The benefits of development are thus:

1. Higher income.
2. The problem of housing the son after his marriage has been solved.
3. The income is now big enough to give the son an equity in the farm.
4. The farm has been built up to three labour units, allowing weekends off and the farmer to be free to engage in more outside activities.

Speed of Development

Obviously the development of this property does not necessarily have to proceed at the speed described. For instance, the piggery could be developed first and cow numbers increased over a longer period. This would allow more to be done out of income, but to do the whole job out of income would probably take 20 years. So to be of any benefit to the present owner some capital must be borrowed. The faster the development, the more economic it is, but risks are increased, and the abilities of the man are tested. Even the best planned development programme will fall down if the farmer hasn't the skill and energy to implement it. In practice the desirable rate of development depends on this factor, and also the reaction of the farmer to financial strains. Some men thrive on borrowing, while others worry and lose their sense of judgment.

The solution to this man's problem was easy but what other sources of finance are available?

Sources of Finance

The main sources of finance are as follows:

<table>
<thead>
<tr>
<th>Private sources</th>
<th>Banks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trust companies</td>
<td>Stock firms</td>
</tr>
<tr>
<td>Insurance companies</td>
<td>Dairy companies</td>
</tr>
<tr>
<td>State Advances Corporation</td>
<td>Meat and Feed companies</td>
</tr>
<tr>
<td>Marginal Lands</td>
<td>Finance companies</td>
</tr>
</tbody>
</table>

Private sources through legal firms, Trust companies and Insurance companies, normally only lend where a first security on the land is available. Their function is usually in the initial purchase of land, where they will normally lend 50 to 60% of their value of the property. However, if a farm is lightly mortgaged this source can be used to raise money for development purposes.

The State Advances Corporation is the biggest lender of funds for development purposes. Most farmers can qualify for this assistance provided they have an economic proposal. Development loans are arranged as table mortgages with interest rates of 6% on a second security and 5½% on a first security. As is well known they also finance farm purchases.
The Marginal Lands Board is another Government sponsored organisation doing an excellent job for the nation. They only lend when all other sources of finance have failed. Security is not considered important, up to 100% of assets being lent in some special cases, but the personal factor must be of the highest order. This is the only general source of finance where lending is based on the man rather than his assets. The farm must be capable of becoming an economic unit but they will finance the purchase of additional land, to make this possible. There is no maximum loan, interest rate is 5½% and interest payments can be withheld until the property is capable of meeting all charges. You don't have to be on the West Coast or in North Auckland to qualify as some people seem to think.

Banks and stock firms are mainly interested in seasonal finance. Unfortunately stock firms are not as interested in dairy farms as they are in sheep farms, especially in the South Island. However, in the past some firms have made advances to farmers for such development work as pig fattening houses. Banks will also make advances for development work where there are prospects of repayment fairly quickly.

Meat and Feed Processing Companies occasionally provide capital for pig and poultry enterprises. Their advances usually have some strings attached and are not very widely available.

Financial assistance from Dairy companies varies from district to district. Some companies are heavily committed to their own capital development and have little available for assisting farmers. Where finance is available advances for purchasing stock, or short term assistance such as an advance against final payout, is the most common form of lending.

Finance companies are in the main restricted to assistance with purchases of assets such as tractors. Repayment is usually rapid and interest rates high.

Conclusion

To avoid financial problems in dairy farm development:
1. Have a plan.
2. Make sure your plan is economically sound and the finance is available before starting.
3. Don't under-estimate capital requirements.
4. Realise your own capabilities and get some outside guidance.
5. Include estate planning and taxation minimizing arrangements where applicable.

The best method of solving problems is to avoid them.
BEEF FROM THE DAIRY HERD


My first real interest in beef from the dairy herd came in 1958 following the disastrous fall in dairy produce values. It was apparent to me then, with the market in the state it was, that increased supplies would only add up to a lower total income. I therefore recommended dairy farmers, where they could, to turn some of their cows into foster mothers, to rear for veal three or four calves each, according to their milking capacity; these calves wherever possible to be from the heavier dairy breeds.

Feeling that I should practise what I preached I then put 54 calves in all on 16 of what I classed as my marginal cows. These were all sold for veal off the mothers, about half in the February following and the balance in early April. My average return was approximately £16 per head for the calves and £54 per cow used. I purposely had not mated the cows, and sold them as culls soon after.

It must be admitted that these 70 head in all ate more grass than 16 milking cows alone—how much more I do not know. It is also true that the return for veal was not as good in the two following seasons. There was no soundly based export market at that time for it, and the price received was practically wholly dependent on local demand, as it still is.

My partner, Martin McAdam, and I then decided to try out on our Okoroire property some Friesian and Friesian Jersey X steers reared as dairy calves and weaned at 10 to 12 weeks of age. At this period we were still in the throes of developing this place and were adopting a policy of deliberate over stocking to attend to any second growth problem. As a consequence our cattle had to rough it fairly badly through the winter and early spring period. Under these conditions there is no doubt that the Friesian and Friesian Jersey X steers suffered more than the Polled Angus ones. While we were able to fatten our Polled Angus cattle largely before the third winter, we were not able to ‘finish off our Friesian and Friesian Jersey X ones until the following spring, when they were from 3 years to 3 years 3 months of age. As a matter of interest, with this lot we also ran two straight Jersey steers.

The whole line was killed in October. The straight Friesian steers averaged 762 lbs, the Friesian Jersey X ones 724 lbs and the two Jersey steers 535 lbs. The most surprising thing of all to us was the very close relationship in weight between the Friesian and the Friesian Jersey X ones.

Might I also here mention that it is our experience with the Friesian X cattle that the great majority of these will finish off earlier than the straight Friesian stock, but there is a minority with which the fine bone of the Jersey and all its dairy characteristics as opposed to beef show up very materially, and these are very unsatisfying to handle.
Whether the Jersey steers at their weight, some 200 odd lbs lighter, were as economic as the others on a feed conversion basis I do not know, but it does appear to me that we should have some soundly based information on this matter.

I am one who believes as the result of my experience since I first started farming sheep and cattle some 12 years ago, after over 30 years of working with dairy cattle, that if we are going to be able to greatly increase our beef exports, then the great majority of that increase will have to come from animals that are bred from dairy stock. My reasoning behind this is quite simple. As the result of the greatly increased quantity of fertiliser used on our hill country over the last decade, together with improved stock management, we are likely in the years ahead to have a reduced area of country rather than an increased one, where the beef breeding cow will be required to play the role of the developer of new country. Once country is developed to a stage that it has no second growth problem, then to my mind the traditional beef cow, which spends eight months to rear a calf to weaning stage, has become quite uneconomic. There are so many ways in which the grass consumed by this cow can be used much more efficiently.

On the other hand, on the dairy industry side we have been and are still killing off as bobby calves thousands of animals that are capable of producing, according to farming conditions, 15 to 20 times as much beef as they are providing bobby veal today. This will not be achieved, though, without sound farming practices by both the dairy and the sheep and cattle farmer. I believe that the role of the dairy farmer in this campaign for increased beef production lies in the rearing of these calves to the weaning stage of from 10 to 16 weeks of age.

Once these animals are weaned, then it is uneconomic to continue to run them on a dairy farm at the present relative values for dairy products and beef. As a dairy farmer I would not rear these calves for sale at weaning through the normal saleyard system of disposal. The risk is too great. Many farmers who did so last spring in the Waikato have had a very unhappy experience.

On the other hand, as a sheep and cattle farmer I would prefer to know each year where my young weaner cattle were coming from, and what they were going to cost me. Also as a sheep and cattle farmer I find it very hard to be able to provide satisfactory feed for these weaners before about the end of November.

As I operate my sheep and cattle properties in conjunction with my partner, Mr Martin McAdam, and my dairy farm operations in conjunction with my family, I had the dubious responsibility of trying to work out a selling and buying operation that was fair to both parties, and this I think we have achieved on the basis of relative beef and dairy product values ruling up until this year. If the very high values received for bobby calves this last reason (the highest in the history of the movement) were to continue, then it would justify some increase. The price we arrived at was 1/3 per lb live weight. On this basis, except for this last spring, on the dairy farm we have received a nett payment for the rearing of
the calves to an average of 12 weeks of £5 per head over and above the cost of feed used and bobby calf value.

I then decided to see how other individual farmers reacted to this basic idea of operations, and we (Candy and McAdam) have purchased 240 to 300 calves on this basis over the last two seasons.

I must say that there has been a great variation in weaning weights from 124 lbs to 280 lbs. The 124 lbs calf is, of course, a dead loss really to both parties. We have found that the great majority of these weedy calves are very badly invested with lice. I cannot stress too greatly the utmost importance of watching very closely for these parasites, as they have a very debilitating effect on the growth of the animals. It is equally important, too, to dose against both stomach and lung worm. If this is done and the calves are regularly moved around the paddocks when being fed, then quite good weights can be assured, judging by the results of several of our contracting dairy farmers.

On taking delivery from the dairy farmers our policy as graziers has been to spray all calves for lice. At this size they can be quite satisfactorily done in a sheep shower. At this time of the year we seem to be able to get away with only one spraying, as over the summer period lice numbers seem to go into a decline anyway.

The biggest worries of these young calves are worms, both intestinal and lung, the latter being of particular significance over the December to March period. We have used the new drenches, Bovizol and Nilvern, for the control of these worms, with very good results. It has been our programme this year to drench regularly once a month between December and March regardless of what the calves look like. We have found that once they start to slip it is often too late and losses occur.

In the 1965/66 season we lost 15 out of 300 due to severe infestation of lung worm, but this season to date we have lost only four out of 236 bucket fed calves, and we believe two of these deaths were due to salmonella.

The other important thing at this stage is that the weaners must be inspected frequently to see that the feed is adequate in quantity and quality, water is right and readily available, and that all animals are thriving. This year we will drench everything at the end of this month and spray for lice. Further sprayings may be necessary during the winter. What we hope will be a final drench will be given in early October, and from then on no significant management problems should be encountered.

The total cost of the drenching and spraying programme as just outlined is approximately 13/6 per head. We would need to have an increased dead weight for our steers of nine pounds to pay for this. We believe the benefits derived from this programme will give us improved weights of at least 50 lbs.

To the grazier the big calf is definitely the most profitable, as it is to the breeding feeder as well. Losses amongst the small weaner calves can be quite high unless very stringent precautions are taken. The great importance of having calves well done, though,
particularly with straight Friesian calves, is to make it possible to
get these away as prime G.A.Q.s. or F.A.Q.s. before the second winter
at about 21 months of age.

There is no doubt in our minds that the conversion of grass to
meat is progressively more inefficient as the animal gets older. We
have been able to get weight gains up to date with the cattle we
are farming in the Charolais, Friesian, and Hereford crosses with
the Jersey of approximately 1½ lbs per day since weaning, but from
birth to weaning the daily gain, as I will show later, has over all
“crosses” averaged a little less than 1 lb per day. We have not
as yet been able to achieve a better increase than 1.5 lbs per day
for the whole period from weaning to sale, and it is quite apparent
that in the last 12 months the animals are eating much more for
this equivalent weight gain. This I think brings the point out quite
clearly.

It is as well also for those of you who are dairy farmers to re­
member that the grazier has today to sell these animals on a schedule
of £7/10/- per 100 lbs hooks weight. This is the equivalent of 9.4d
per lb live weight, and he does not receive this as a nett return
on his whole beast, as he has already paid you at the rate of 1/3
per lb live weight for this animal at the weaning stage.

In actual fact a grazier who buys a calf of 192 lbs at 1/3 per lb
live weight and then sells that animal at 1,077 lbs live weight, which
is the equivalent of 560 lbs dead weight, actually earns for the 885 lbs
of live weight added 8.14d per lb.

I cannot stress here too much the great economic importance to
the fattener of getting his stock away prime before the second
winter, because of the reasons mentioned earlier, and quite frankly,
up until this year we have not been able to achieve this very essential
goal with beef from the dairy industry that has been bucket fed,
whereas it has been much easier to do so with conventional beef
cattle. This does not mean that these cattle have grown faster;
in fact they have not, but they have finished off much better. We
are expecting in the next few weeks, though, to do this for the
first time with cattle that have been run since weaning on our Taupo
property, and the average weights of our Friesian cross cattle and
straight Friesian ones will definitely be greater than that of our
Poll Angus ones.

With our Charolais, Friesian and Hereford Jersey X cattle
that we have running in the present experiment with Ruakura, the
weights of our Charolais X calves were 74.4 lbs at birth, our Friesian
Jersey X ones 64.9 lbs and our Hereford Jersey X 62.2 lbs. At
weaning on an average age of 15 weeks or 105 days, the Charolais
Jersey had increased to 184.3 lbs, again of 110 lbs or 1.05 lbs per
day. The Friesian Jersey had increased to 171.2 lbs, a gain of 106.8
lbs or 1.01 lbs per day. The Hereford Jersey increased to 150.7 lbs,
a gain of 88.5 lbs or .88 lbs.
Since weaning the weight gains have been as follows up until the end of last month:

<table>
<thead>
<tr>
<th>Breed</th>
<th>At Weaning</th>
<th>Weight Gain</th>
<th>Total Period</th>
<th>Gain per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charolais Jersey</td>
<td>184.3 lbs</td>
<td>414.7 lbs</td>
<td>230.4 lbs</td>
<td>1.53 lbs</td>
</tr>
<tr>
<td>Friesian Jersey</td>
<td>171.2 lbs</td>
<td>402.5 lbs</td>
<td>231.3 lbs</td>
<td>1.54 lbs</td>
</tr>
<tr>
<td>Hereford Jersey</td>
<td>150.2 lbs</td>
<td>348.5 lbs</td>
<td>198.3 lbs</td>
<td>1.32 lbs</td>
</tr>
</tbody>
</table>

However, by the look of the cattle it seems quite definite that the Charolais and Hereford X cattle will definitely finish off earlier than the Friesian X ones; therefore, if the weight gains of the Charolais X continue to be in line with the Friesian X, they will definitely have advantages in their ability to finish off more quickly.

May I now turn to another way which I think under suitable circumstances might enable us to overcome to a large extent this problem of finishing off prime Friesian and Friesian X cattle before the second winter. This I mentioned to you in opening this paper we first tried in 1958.

Because of our experience then we decided this last spring to try it out again as a means of rearing young cattle for the end purpose of beef as opposed to veal, and we have been very pleased with the results. These foster mothers were taken from our Ngaura herd and were picked out for the following faults as milkers:

1. Cows that were bad machine ones, drying off early in the autumn.
2. Those other bad machine cows from the point of view of being slow milkers or hard to keep cups on, and those requiring a lot of extra attention to ensure satisfactory let-down.
3. Cows that caused trouble because they would jump over or crawl under electric fence units with impunity.
4. One or two with foot trouble or dropped udders that developed after calving, and we thought would be economic to use this way for the season, and to be sold straight after weaning.

These were mostly given three calves each, but one or two good cows that had a complete disdain for our electric fences got four, and a few with dropped udders or foot trouble only had two.

The 23 foster mothers we had in total were given originally 67 calves. It was estimated that on average these calves would be getting approximately a gallon of milk per head per day as a minimum. We lost three of these during the first two months of rearing. One of these we believe was infected after castration, and the other two we believe were from salmonella.

The balance of 64 thrived very well indeed, and were weaned at the same time as our line of Poll Angus calves at our Taupo property. These cows had been equally as well fed as had the foster mothers at Okoroire. We weighed both lines of calves on weaning on the 8th of last month. The foster mothered calves, which would on average be three to four weeks older than the Poll Angus ones, averaged 498 lbs per head, ranging from 350 to 720lbs.
lighter ones would be about two months younger than the oldest, and also most likely fared much more poorly in the sharemilking business that goes on in this sort of operation than did the biggest ones. On the other hand, the Poll Angus ones averaged 413 lbs per head, and in their case there was much less difference between the smallest and the biggest. The most important factor to remember, is that each foster mother at weaning had raised 1,391 lbs of live weight young beef, as against the 413 lbs for the Poll Angus cows. This is an economic factor of the greatest importance.

On the 20th of February when we did a sample weighing of our bucket fed calves in comparison with the multiple suckled ones, the latter were 120 lbs per head heavier. This greatly increased weight at weaning will, we feel sure, ensure that we will be able to finish off these cattle satisfactorily before the second winter.

From this you can see that I believe multiple suckling has a great deal to recommend it, but I must emphasise that these foster mothers must be fed as well as the milking cows in any dairy herd, whether they be on sheep and cattle property or on a dairy farm. I believe that under certain circumstances this type of operation can be carried out economically on the dairy farm as well as the sheep farm. For the dairy man who is in the situation of having a carrying capacity measured in terms of cows that really needs more than one labour unit but less than two, or more than two and less than three, a number of cows used as foster mothers could well be quite economic in the nett return so achieved, as against the return from these animals if their milk was sold for butterfat and solids not fat products. Also in other cases a few of the problem cows in a herd used for this purpose could well make milking generally much simpler and pleasanter.

This type of operation can quite well be carried out on the sheep and cattle farm as long as reasonable facilities are provided for the mothering up of the calves. It, of course, involves contracting with dairy farmers for the supply of calves a few days after birth. It is important that the calves should receive adequate colostrum milk from their mothers before being fostered onto a cow that has perhaps been milking for two or three weeks. It should not be difficult to arrange this on a weight basis that will ensure an adequate reward for both parties.

May I therefore sum up by saying:—

1. That I believe every effort should be made to expand our beef exports.

2. I believe that, on market values which have ensued over the last two or three years, economically we have had a better nett return from beef than from ewes and lambs.

3. That if we are to sell more beef for the reasons I have mentioned I believe that the great majority of it must originate from dairy farms.

4. That because of the great economic importance of being able to get animals away prime before the second winter, it is most important that calves be at maximum weights at weaning.
5. That it is also important that hand reared calves have adequate preventive treatment against lice and stomach and lung worms.

6. That suitable feed, both as to quantity and quality, and adequate water are always available for stock, particularly from three to 12 months of age.

7. That the traditional beef breeds still have a great role to play in the development of new country wherever second growth is a real problem.
DAIRY SPECIALISATION VERSUS DIVERSIFICATION

G. A. G. Frengley, Lecturer in Farm Management, Lincoln College.

In 1958 the outlook for New Zealand dairy products on overseas markets was similar to the present situation—varying from satisfactory to gloomy depending on your viewpoint at this time. Messrs Hodgson, Watson and Clifford reviewed the question of diversification of North Island dairy farms at the Massey Dairy Farmers' Conference. Their purpose was to acquaint the North Island farmers with alternatives which could be used to maintain income in the face of a likely slump in butterfat prices.

Today, after a lapse of nine years, these same factors are called into question but the reasons have changed. Technological changes have occurred which have profoundly influenced dairying. Similarly, changes have occurred which affect cash cropping and stock systems, the alternatives to dairying, but their impact has been smaller.

These technological changes have made it possible to produce a greater amount of butterfat or milk with the same levels of input as used formerly. Thus, for example, output per man and per acre can be significantly higher than was attainable nine years ago with the same amount of fertiliser, grass and forage crops. In other words, the technical efficiency of the dairy industry had increased markedly and is showing no apparent sign of levelling off. Technical advances have resulted from many developments, but some of the more notable have been:

1. The change to herringbone sheds, making considerably higher levels of output per man possible.
2. Management changes. Specifically the wider acceptance of later calving dates and higher stock numbers, resulting in reduced emphasis on winter feed conservation as a means of utilising the spring flush. Later calving has made it possible to winter more cows with the same amount of feed and more cows are on hand to control spring surpluses. General improvements in herd management has also occurred.
3. The genetic improvement of herds as a result of the increased emphasis on selection of bulls of high genetic merit. This has improved the ability of herds to convert grass into milk.

Many of the alternatives to dairying have also been affected by considerable technological advances. New strains of cash crops and management techniques have been developed and slow but steady advances in sheep and beef cattle breeding have occurred.

Thus technical advances have occurred on both sides of the ledger. However, it may be quite valid to suggest that the technical advances of dairy farming over the last nine years are more than equal to the advances made in the alternative enterprises.

Although technical efficiency is important, it is not sufficient to be used on its own to determine the comparative advantages of
one form of agricultural enterprise over another. The relative levels of prices and costs are of extreme importance.

In the dairying industry, costs have increased but this has been offset to a considerable extent by the improved technical efficiency on the farms where these advances have been applied. Prices for dairy products are comparable with their levels nine years ago. By contrast it would be hard to concede that the technical advances made in mixed cropping have offset the increases in costs except under large scale operations. Except for wheat, the decline in prices has tended to place mixed cropping at more of a disadvantage than in 1958. It is doubtful whether the increases in costs in sheep farming have been offset by technological changes. Added to this has been the decline in product prices which has affected sheep farming severely.

Thus a careful evaluation of the place of these other enterprises, which could be used to diversify dairying must be made to ensure that they would lead to higher profits on any particular dairy farm.

Indeed satisfactory alternatives for diversifying dairy farming practised a few years ago, will lead to reduced levels of income if they are still continued. Where the case for diversification was very strong in 1958, the changed economic and technical position makes a re-appraisal essential if high profit levels are to be maintained. The purpose of this paper is to demonstrate simply the methods of evaluation and discuss the pros and cons of the major enterprises.

The possibilities for diversification are within crop or livestock enterprises. To compare these financially with dairying, gross margins analyses may be used. The gross margin is the gross income minus the direct costs of the enterprise.

The gross margin for a reasonably efficient dairy farmer producing butterfat and carrying a normal complement of pigs would be as follows:

<table>
<thead>
<tr>
<th>Gross Revenue</th>
<th>Direct Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Breeding Expenses</td>
</tr>
<tr>
<td>240 lb Butterfat @ 33.9d = 678/-</td>
<td>Part bull ½ x 1/100th x £60 = 4/-</td>
</tr>
<tr>
<td>Net income from pigs 8d lb fat = 160/-</td>
<td>AB + Herd testing 25/- x ½ = 12/8</td>
</tr>
<tr>
<td>Cull cow (portion)</td>
<td>20/8</td>
</tr>
<tr>
<td>1/6th x ½ x £20 = 44/6</td>
<td>General Expenses</td>
</tr>
<tr>
<td>Bobby calf (portion)</td>
<td>Power £1/cow x ½ = 13/4</td>
</tr>
<tr>
<td>½ x ½ x £2 = 8/10</td>
<td>Veterinary expenses £1 x ½ = 13/4</td>
</tr>
<tr>
<td>Bull (Portion)</td>
<td>Shed expenses £1 x ½ = 13/4</td>
</tr>
<tr>
<td>½ x 1/100th x £60 = 4/-</td>
<td>40/-</td>
</tr>
<tr>
<td>Feed Expenses</td>
<td>Feed 16/- x ½ = 8/8</td>
</tr>
<tr>
<td>Meal 10/- x ½ = 5/-</td>
<td>Hay 40/- x ½ = 20/7</td>
</tr>
<tr>
<td>Pasture renewal ½ x £4 = 10/-</td>
<td>Pasture renewal ½ x £4 = 10/-</td>
</tr>
<tr>
<td>Fertiliser 2 cwt = 23/7</td>
<td>Fertiliser 2 cwt = 23/7</td>
</tr>
<tr>
<td>Lime ½ x 45/- = 5/-</td>
<td>Lime ½ x 45/- = 5/-</td>
</tr>
<tr>
<td><strong>Gross Margin</strong> = 762/3 = £38.2/3 per acre per year.</td>
<td><strong>Gross Margin</strong> = 762/3 = £38.2/3 per acre per year.</td>
</tr>
</tbody>
</table>

(Based on ½ cow + 1/6th yearling heiferlacre. Approximate farm size 100 acres.)

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It is now possible to compare this figure with the gross margins for the alternatives.

A. Garden Peas

Gross Revenue
35 bus. at 16/-  £23

Direct Costs
Cultivation 5 hrs. @ 3/- = 15/-
Seed 4 bus. @27/9 = 111/3
Fert. 1 cwt @ 11/3 = 14/-
Spraying = 34/3
Harvesting (mowing and heading) = 6/-
Sacks 12 @ 1/2 = 14/-
Cartage 12 @ 1/6 = 18/-
Cartage 11 cwt fert. @ 9d = 1/-

Gross Margin for garden peas = £17/6/6 per acre
45 bush. Gross Margin = £24/18/6 per acre

B. Vining Peas

Payout determined on basis of tenderometer readings.

Gross Revenue
2,500 lb at reading of 95
@3.9d = £40/12/6

Direct Costs
Cultivation 3 hrs. @ 3/- = 9/-
Seed 1.5 bush. @ 25.3d = 37/7
Fert. 1 cwt @ 11/3 = 2/-
Cartage 23 @ 1/6 = 34/6
Levy 6/10 per 50 bush. = 9/6
Raking and ploughing for fire break 1/2 hr. @ 3/- = 1/-

Gross Margin = £29/10/6 per acre
3,500 lb at 100 @ 3.242d = £49/4/0

Costs as above

Gross Margin = £38/12/0 per acre

C. Wheat (Arawa)

Gross Revenue
70 bush. @ 14/4 = £50/4/4

Direct Costs
Cultivation 3 hrs. @ 2/- = 9/-
Seed 1.5 bush. @ 25.3d = 37/7
Fert. 2 bush. @ 19/6 = 38/-
Cartage 27 @ 1/2 = 31/6
Fertiliser = 9
Cult. for fire break = 1/-

Gross Margin = £44/2/11 per acre
60 bush. Gross Margin = £36/19/0 per acre

D. Barley

Gross Revenue
80 bush. @ 9/6 = £38/0/0

Direct Costs
Cultivation 4½ hrs. @ 3/- = 13/6
Seed 2 bush. @ 19/6 = 38/-
Fert. 1 cwt @ 11/9 = 11/9
Spraying, appn. & material = 11/-
Harvesting, heading = 2/-
Sacks 27 @ 1/2 = 31/6
Cartage 27 sacks @ 1/6 = 40/3

Gross Margin = £30/9/0 per acre
70 bush. Gross Margin = £26/7/0 per acre
60 bush. Gross Margin = £21/19/9 per acre

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E. Potatoes

<table>
<thead>
<tr>
<th>Gross Revenue</th>
<th>Direct Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 tons table @ £18</td>
<td>Cultivation 12 hrs. @ 3/- = 1 16 0</td>
</tr>
<tr>
<td>3 tons seed @ £20</td>
<td>Seed 1 ton @ 50/- = 50 0 0</td>
</tr>
<tr>
<td></td>
<td>Fert. 3 cwt @ 16/- = 2 8 0</td>
</tr>
<tr>
<td>$270</td>
<td>Spray = 16 0</td>
</tr>
<tr>
<td></td>
<td>Picking 182 bags = 27 6 0</td>
</tr>
<tr>
<td></td>
<td>Cartage 182 @ 9d to grader = 5 15 6</td>
</tr>
<tr>
<td></td>
<td>Cartage 140 FOB table @ 25/6 per ton = 12 15 0</td>
</tr>
<tr>
<td></td>
<td>FOR seed @ 11/6 per ton = 1 13 6</td>
</tr>
<tr>
<td></td>
<td>Cartage seed sown @ £2 = 2 0 0</td>
</tr>
<tr>
<td></td>
<td>3 cwt fert. 9d = 2 3</td>
</tr>
<tr>
<td></td>
<td>Sacks 182 @ 2/6 = 22 15 0</td>
</tr>
<tr>
<td></td>
<td>Grading 13 tons @ £3 per ton = 39 0 0</td>
</tr>
<tr>
<td></td>
<td>Levy 10 tons @ 25/- = 12 10 0</td>
</tr>
<tr>
<td></td>
<td>Certification = 1 0 0</td>
</tr>
</tbody>
</table>

F. Short Rotation Ryegrass Seed from Pasture Grass Revenue,

| Gross Margin | = £270 - £180 = 18 3 |
|             | = £385 1/9 per acre |

| Gross Revenue for 14 tons table @ £15 | = £120 |
| 7 tons seed @ £25 | = £175 |

Direct costs

| Gross Margin = £155 12 0 per acre |

G. White Clover Seed from Pasture

<table>
<thead>
<tr>
<th>Gross Revenue</th>
<th>Direct Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>160 lb @ 2/3</td>
<td>Harvesting Mowing ¾ hr. @ 3/- = 2/-</td>
</tr>
<tr>
<td></td>
<td>Baling and twine = 3/-</td>
</tr>
<tr>
<td></td>
<td>Heading = 4/-</td>
</tr>
<tr>
<td></td>
<td>Sacks = 2/3</td>
</tr>
<tr>
<td></td>
<td>Twine = 3</td>
</tr>
<tr>
<td></td>
<td>Cartage 2 bags @ 1/3 = 8/4</td>
</tr>
<tr>
<td></td>
<td>Dressing and Certification = 102/6</td>
</tr>
</tbody>
</table>

Gross Margin = £18 12 6 per acre

<table>
<thead>
<tr>
<th>Gross Margin</th>
<th>= £12 2 8 per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>160 lb @ 2/9</td>
<td>Gross Margin = £16 10 8 per acre</td>
</tr>
<tr>
<td>80 lb @ 2/3</td>
<td>Gross Margin = £5 12 10 per acre</td>
</tr>
<tr>
<td>80 lb @ 2/9</td>
<td>Gross Margin = £8 0 10 per acre</td>
</tr>
</tbody>
</table>
Stock Gross Margins

1. Ewe Flock buying 2th replacements:

(a) On basis of present prices allowing 110% lambing, 5 lambs per ewe, 10.5 lb wool per ewe. 34d net for wool, lambs at £2.

Gross Revenue = £4 0 6
Gross Margin = £2 15 0 per ewe
at 6 ewes per acre = £16 0 per acre
at 8 ewes per acre = £22 0 per acre

(b) At average prices (45/- for lambs wool at 42d—Corriedale)

Gross Margin = £3 7 5 per ewe
6 ewes per acre = £20 4 6
8 ewes per acre = £26 19 4

(c) At high prices (50/- for lambs, 52d for wool)

Gross Margin = £3 18 2 per ewe
6 ewes per acre = £23 9 0
8 ewes per acre = £31 5 4

2. 2 year Fat Lamb Ewe Flock.

(a) Low Prices

Gross Margin = £2 15 3 per ewe
6 ewes per acre = £16 1 6
8 ewes per acre = £22 2 0

(b) Average Prices

Gross Margin = £3 7 6
6 ewes per acre = £20 2 6
8 ewes per acre = £27 0 0

(c) High Prices

Gross Margin = £3 18 4
6 ewes per acre = £23 10 0
8 ewes per acre = £31 6 8

Summary:

<table>
<thead>
<tr>
<th>Enterprise</th>
<th>Yield</th>
<th>Price</th>
<th>Gross Margin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairying (BF &amp; pigs)</td>
<td>240 lb</td>
<td>33.9 and 8 pence</td>
<td>£38 2 3 per acre</td>
</tr>
<tr>
<td>Garden Peas</td>
<td>35 b.</td>
<td>15/-</td>
<td>£17 6 6</td>
</tr>
<tr>
<td></td>
<td>45 b.</td>
<td>16/-</td>
<td>£24 18 6</td>
</tr>
<tr>
<td>Vining Peas</td>
<td>2500 lb</td>
<td>3.9d</td>
<td>£29 10 6</td>
</tr>
<tr>
<td></td>
<td>3500 lb</td>
<td>3.42d</td>
<td>£38 12 0</td>
</tr>
<tr>
<td>Wheat (Arawa)</td>
<td>70 b.</td>
<td>14/4</td>
<td>£44 2 11</td>
</tr>
<tr>
<td></td>
<td>60 b.</td>
<td>14/4</td>
<td>£36 19 0</td>
</tr>
<tr>
<td>Barley</td>
<td>80 b.</td>
<td>9/6</td>
<td>£30 9 0</td>
</tr>
<tr>
<td></td>
<td>70 b.</td>
<td>9/6</td>
<td>£26 7 0</td>
</tr>
<tr>
<td></td>
<td>60 b.</td>
<td>9/6</td>
<td>£21 19 9</td>
</tr>
<tr>
<td>Potatoes</td>
<td>10 tons table</td>
<td>£18</td>
<td>£89 1 9</td>
</tr>
<tr>
<td></td>
<td>3 tons seed</td>
<td>£30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14 tons table</td>
<td>£15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 tons seed</td>
<td>£25</td>
<td></td>
</tr>
<tr>
<td>Hl Ryegrass</td>
<td>45 b.</td>
<td>17/6</td>
<td>£26 11 2</td>
</tr>
<tr>
<td></td>
<td>50 b.</td>
<td>15/-</td>
<td>£24 9 0</td>
</tr>
<tr>
<td></td>
<td>40 b.</td>
<td>15/-</td>
<td>£18 12 6</td>
</tr>
<tr>
<td>White Clover</td>
<td>160 lb</td>
<td>2/3</td>
<td>£12 2 8</td>
</tr>
<tr>
<td></td>
<td>160 lb</td>
<td>2/9</td>
<td>£16 10 8</td>
</tr>
<tr>
<td></td>
<td>80 lb</td>
<td>2/3</td>
<td>£5 12 10</td>
</tr>
<tr>
<td></td>
<td>80 lb</td>
<td>2/9</td>
<td>£8 0 10</td>
</tr>
<tr>
<td>Ewe Flock buying 2th replacements</td>
<td>6 ewes/acre</td>
<td>low prices</td>
<td>£16 0 0</td>
</tr>
<tr>
<td></td>
<td>8 ewes/acre</td>
<td>low prices</td>
<td>£22 0 0</td>
</tr>
<tr>
<td>2-year fat lamb ewe flock</td>
<td>6 ewes/acre</td>
<td>low prices</td>
<td>£16 1 6</td>
</tr>
<tr>
<td></td>
<td>8 ewes/acre</td>
<td>low prices</td>
<td>£22 2 0</td>
</tr>
</tbody>
</table>

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Gross margins could also be prepared for a limited number of specialised products. However, the majority of these products do not have stable markets and excessive levels of production could depress prices substantially as in the case of the production of fodder beet or mangolds for sale. Gross margins for other possible stock systems also fall well below the dairying figure and their suitability is dependent on other factors.

Gross margin estimates for dairy-beef production in the South Island are not available. However, North Island information would suggest a gross margin slightly lower than, or comparable to, breeding ewes. Two factors give this enterprise a different aspect from the sheep alternatives. Labour requirements are minimal except for winter feeding, but pasture damage may make wintering particularly difficult on many properties. Apart from the fact that these animals can be produced "in situ", dairy beef has few advantages which make it substantially more profitable or suitable than other possibilities. In wetter districts dairy beef deserves consideration, as cash crop possibilities are reduced and in certain areas sheep cannot be purchased at reasonable prices in the early spring. In these areas, where labour or capital restrictions result in summer grass surpluses, dairy beef diversification has a useful place.

The major observations which may be made in relation to these gross margins, show that only two competitive enterprises have a gross margin significantly higher than the gross margin for dairying. These are wheat at yields of 70 bushels and better, and potatoes at reasonable yields and prices. Given a decline in yields and prices, both become less profitable and as both require high fertility and good drainage for satisfactory yields, they are only fully competitive on the best dairying soils and cannot be grown on all farms.

Thus the desirability of incorporating alternatives to diversify dairying is more likely to be dependent on factors other than the profitability of the directly competitive enterprises.

Some factors which may be considered sound reasons to diversify dairy farming are:

1. If surplus summer feed cannot be controlled because of a lack of capital for cows or facilities to cope with a larger herd, cash cropping or fat lamb producing alternatives may be introduced satisfactorily providing their capital requirement does not impose limits. In this case they are not competitive enterprises. They will add to profits.

2. If labour limits the size of the herd and more than adequate feed is available, alternatives may be again considered, providing the seasonal labour requirement can be met for the particular enterprise.

3. If the risk of price fluctuation is high in dairying (and this is rarely the case), diversification may result in a more stable income. However, almost all the alternative enterprises are subject to greater fluctuations than dairying.

4. If diversification results in a lower level of risk or uncertainty in the overall farming programme, for instance, to offset animal health problems or unreliable feed production. Spring flooding
may result in a herd tending to dry off and a dairy farmer may be justified in running other stock, taking barley as a cash crop or selling hay.

Thus the real basis of deciding whether diversification may have a place on a farm is dependent on whether all reserves are being fully utilised or not, or whether alternatives must be incorporated to reduce risk and uncertainty.

Once it has been decided that diversification has a place on a particular farm, the management factors must be given careful study. The enterprises to be incorporated in the management of the property must integrate with the management of the herd without disturbing the smooth running of the farm. A shortage of capital, labour or contractors is likely to bring about this effect if certain alternatives are considered. If the management of the herd is upset or labour severely strained at certain periods, the management complexities resulting from this may make it quite inadvisable to incorporate the alternatives. These deleterious effects are hard to evaluate and careful planning will be essential to ensure that their likelihood has not been underestimated. For this reason it may be entirely inadvisable to contemplate diversification on many farms. Diversification demands competent management, to ensure that the dairy farm routine is not upset. Mismanagement even of a slight degree may result in the losses from dairying outweighing the gains from diversification by a considerable margin.

Diversification does have a place on some farms. It may also be advisable to realise that its place is more limited than nine years ago. Diversification mishandled will result in a substantial loss of potential profits. Outwardly it would appear that specialisation and intensification of dairy farming would be simpler and more profitable than diversification on most properties in acknowledged South Island dairying areas.
SOURCES OF PROFIT AND LOSS WITH MEAL FED PIGS

J. L. Adam, Scientific Officer, Ruakura Agricultural Research Centre, Hamilton.

The event of a lower than expected annual profit in most instances, will lead to a detailed analysis of production costs. Individual costs incurred by producing pigs vary from a small to large proportion of total costs, and include such items as veterinary expenses, electricity, insurance, labour and feedstuffs. Where pigs are produced on mainly meal diets, the cost of food is likely to be the largest single item, probably accounting for something in excess of 70% of total costs.

On the basis of food representing at least 70% of the total costs in a meal feeding pig unit, a detailed examination of food costs in relation to pig performance could yield some worthwhile financial gains.

The first part of this paper deals with an analysis of food costs. This is followed by examples in which the cost of inefficiencies in pig production is measured in cash terms.

The total cost of meal consumed in a pig unit can be divided on the basis of a breeding unit and growing/finishing unit. The breeding unit comprises—boars, gilts, sows and all piglets prior to weaning and has as its marketable product the weaner pig. The growing/finishing unit consists of pigs from weaning up to the time of sale. In this case the marketable product is either as pork or bacon. Practically this subdivision is important, as it allows a measure of efficiency to be obtained for each unit.

In the case of the pork/bacon unit meal is fed to promote growth, but by concentrating on increased efficiency we can reduce the food cost involved.

The total food cost involved in producing weaner pigs can be split into six parts. Subdivision is done on the basis that meal is consumed for a productive purpose, be it by sows during lactation to produce milk, or by piglets as creep feed to supplement the milk production of the sow. Meal fed to boars and pregnant sows also has a production function. On the other hand sows and gilts which are not in pig cost money to feed and keep. The pre-service period in this discussion is defined as a four to ten day period between weaning the sow from the litter, and the first normally occurring post-weaning heat. If this heat is missed, a sow will cost as much in food as she would had she been successfully mated. In the case of gilts, the pre-service period includes the rearing from market weight, whether pork or bacon, to the first successful mating.

The cost of meal eaten by sows makes up the majority of the food cost of producing weaners. Because of this it is possible to single out food costs incurred by both pregnant sows and those which are not in pig for further consideration later on.

To reduce the food cost of producing each weaner there are two
possible approaches, and these are either to spread or reduce the total food cost of weaner production. In order to spread the weaner overhead we have to produce more pigs per sow. This involves, among other things, producing more pigs per litter, more litters per sow a year, and keeping mortality of young piglets within reasonable limits. Suggested minimum targets are nine pigs weaned, sows weaning two litters within the year and having a piglet mortality of 17% or less. To reach these targets it could be beneficial to use cross bred stock, which will generally give better litter performance figures than pure bred stock. Equally by weaning sows from their litters at six weeks or earlier it is more likely that they will produce two litters per year.

In addition to spreading the food cost of weaner production, it is possible in some instances to reduce the food cost. One way is to reduce the cost of feeding sows which are not in pig by ensuring successful mating of both gilts and sows after weaning. It will be helpful in this respect, if we hand mate sows as opposed to running sows out as a group with a boar and thereafter living in hope that they are successfully mated. It will be useful to record the dates of service and farrowing. These dates can be used to cull sows which persistently refuse the boar, as well as providing information on the annual litter production of sows. If the dates of farrowing are not kept we have little idea of how many sows are not in pig, and such animals can be regarded as non-paying guests.

Recent research work has indicated that current feeding standards which allow 6 lb of meal per day to pregnant or in pig sows are too generous. In this respect Ruakura results agree with overseas findings. The current Ruakura recommendation is an average of 4.7 lb of meal daily, and this has given good litter performance over the past three years. Where good grazing is available it is possible to reduce the average daily meal allowance from 4.7 to 3.0 lb.

Good grazing can be loosely defined as a white clover/ryegrass mixture in which clover is predominant, and one in which the ryegrass is maintained in a short leafy condition. While we still do not know the type or amount of meal to use in combination with pasture, under-feeding of meal particularly can result in poor litter performance and the difficulty of getting sows in pig again after weaning.

Where the level of feeding is tightly controlled during pregnancy, it is probably wise to feed sows a generous meal allowance during lactation. The level used at Ruakura is 4.5 lb for the sow plus 1 lb for each pig suckled, as this level of feeding allows sows to maintain both live-weight and body condition.

In the case of the pork/bacon unit we are mainly interested in the efficiency with which pigs convert food into carcass weight. The efficiency of food conversion depends upon several factors including nutrition, disease and breeding. If reasonable attention is paid to hygiene and to the composition of rations there remains the question of breeding.

Good breeding means different things to different people; to some it is ‘eye ball’ appraisal, to others it is performance. For the commercial producer it should be performance first and conformation
second, the reason for this being that breed improvement is carried out for economic reasons. The commercial pig farmer must ensure that any boar purchased is backed by above average performance, preferably a performance tested boar rated highly against his contemporaries. The mere fact that a boar is tested gives no indication of his merit, as he could be the worst boar of all those tested.

So much for a general consideration of costs. These can now be considered in terms of cash. The examples which follow are based on a 100 sow unit in which each sow produces 10.5 pigs per year at weaning. To spread the resulting feed cost of producing these 10.5 pigs it has been assumed that the sows could equally well produce 16 pigs per year, in two litters of eight pigs. To reduce the food cost of producing these pigs on all meal, good grazing has been taken as replacing 35% of the meal. This is as outlined previously, either 4.7 lb per day or 3.0 lb of meal plus grazing. The cost of meal is taken as 3d per lb (£29 2/0 per short ton) for all meals except the creep feed which is costed at 6d lb (£50 short ton).

The meal cost of producing 10.5 pigs per sow from a 100 sow unit on all meal is £4,193 as opposed to £4,829 where sow productivity is increased up to 16 pigs per sow in a year. While producing extra pigs has increased the total weaner unit cost, at the higher sow productivity it took only 185 lb of meal per pig weaned as opposed to 256 lb where sow production was low as 10.5 pigs. By increasing the number of pigs weaned we have effectively reduced the food cost of each weaner from £4 (256 lb meal) to £3 (185 lb meal).

In addition to spreading the weaner overhead, we can also reduce this sum. Where sows produce 10.5 pigs we can reduce the meal cost by the use of proper grazing. The meal saved by such a policy could be £423 which is the difference between £4,193 and £3,770. At the higher level of sow productivity this saving could be even greater as shown at £566. These two sums are the result of introducing grass into the diet of pregnant sows in place of meal.

Earlier in the discussion I outlined the desirability of using good performance backed boars. Recently a trial was undertaken at Ruka to compare performance differences between progeny sired by a lean boar as opposed to progeny from a slightly fatter than average boar. In terms of the carcass at bacon weight there was a 7 lb advantage in lean meat to those pigs sired by the leaner boar. To the housewife it would mean quite a difference in terms of value for money.

The food conversion efficiency figures for the boar progeny groups were 3.36 lb meal per lb of live-weight gain for the leaner boar, and 3.56 for their fatter contemporaries. The difference of 0.2 lb meal per lb L.W.G. would cost an extra 7/1d per pig with meal at 3d per lb. When this is related back to a 100 sow herd producing 1050 to 1600 pigs annually, the extra costs involved would range from £415 to £632, and this excludes any loss in revenue from pigs being down graded.

So far in the discussion we have considered the weaner and pork/bacon units separately. We have found some points in the
production process when increased costs can be avoided by paying
due attention to sow productivity, rationing and generally increased
efficiency of food use. The final process is to relate food costs with
returns by calculating the returns in pence per lb of carcass
weight (CCW) required to cover the cost of food. In the case of
weaners the return is given for interest and is on the basis of
each pound live-weight. Where pork is produced on an all meal
ration, including the weaner unit, and sows produce only 10.5 pigs
per year, we need a return of 1/11d lb CCW to cover the cost of
meal. Spreading the costs of weaner production over an increased
number of pigs, in the present case 16, we would only require 1/8d
lb CCW. The same will also hold for bacon pigs except that the
actual price per lb will vary. Where we reduce our weaner food
cost by replacing 35% of the daily meal allowance in pregnancy
by grass, we also reduce the return necessary to cover food costs.

While these differences appear small on a carcass weight basis,
they do become substantial when considered for the progeny of
100 sow herd. By marketing 1600 pigs at bacon weight using grass
as a food for sows the margin between food costs and returns (at
2/6d lb CCW) could be as high as £9,700 compared with £5,000 from
1050 baconers. This amount is not solely profit but includes labour,
electricity, veterinary expenses, etc.

Summary:

1. The total meal cost was divided up firstly between the weaner
and pork/bacon units. Further division was then done on the
basis of the type of production involved.

2. On the basis of individual costs it was suggested that the feeding
of the pregnant sows and food conversion efficiency were
points where costs would have to be watched.

3. Increased annual litter production was also suggested as means
to spread food costs.

4. Using a 100 sow herd we discussed the financial advantages of
spreading food overhead by greater sow productivity, reducing
food costs by correct rationing of in-pig sows, and striving for
greater efficiency of food use by the pork and bacon pigs.