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Mr. J.G. Pryde.
Mr. D.B. McSweeney.

The editorial Committee accepts responsibility for editorial work particularly of the three discussion sessions which were recorded during the Conference.
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QUALITY MILK PRODUCTION
Mr. A. Twomey, Head, National Dairy Laboratory, Ruakura Agricultural Research Centre, Hamilton

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Dr. D.J. Hills, Research Officer, and Dr. D.J. Painter, Senior Research Officer, New Zealand Agricultural Engineering Institute, Lincoln College

FEEDING THE DAIRY COW
Mr. P.G. Floyd, Dairy Adviser, Merck Sharp & Dohme (N.Z.) Ltd.
I start with the proposition that nothing is more important to New Zealand farming than the introduction of sufficient numbers of qualified young farmers into the industry, and proceed to try and answer the question "Is this Happening"?

I turn first to the question of the availability of farms.

Undoubtedly the amount of farming land is declining, but there is difficulty in interpreting rather inconsistent statistics. We know, for instance, that between 1949 and 1964 urbanization claimed about 16,000 hectares of farm land and the estimate is that between 1964 and 1984 a further 30,000 hectares will be required for this purpose. Also of course there are expanding requirements for recreation and while a proportion of the land so required is unsuitable for agriculture, nevertheless this represents a significant factor. For example, between 1956 and 1975 over 600,000 hectares were transferred to National Parks, Scenic Reserves and Domains.

On the other side of the ledger, there are gains through the development of previously unfarmed land. But the supply of such land is rapidly declining. For example, I understand that the Department of Lands and Survey has recently commenced development of the last of its major land development resources in the Central Plateau area. No further agricultural land
can be created, we can only rely on the development and intensification of use of existing land resources.

The number of farm units on this diminishing area of land is also declining. For example, the Economic Service of the Meat & Wool Boards has estimated that the number of sheep holdings has declined from 25,000 in 1962 to 22,000 in 1975. The decline in the number of dairy holdings has been even more significant. Between 1959 and 1975 there has been a 38% reduction in the number of dairy farms from 29,000 to 18,000.

We are all aware that these decreased are due largely to the effect of property amalgamations and I will return to this matter later.

A further factor determining the availability of farms for young farmers is the rate of turnover of farms. This is quite high in some years, up to 5-6,000 holdings, which amounts to about 10% of the total holdings, but it must be kept in mind that these statistics include many small rural holdings.

There are significant annual variations in the number of farm properties which come on the market. This is illustrated in Figure 1 which sets out graphically the number of rural freehold sales in various size categories from 1965-1966 to 1975-76. These variations are caused by changes in economic conditions, such as the availability of mortgage finance, and by the level of expectations of buyers and sellers.

The central question is "how many new entrants are there to farming each year" and "what is happening to the age structure of the farming population"? The generally accepted view at present is that we need to inject about 1,500 new farmers into the industry annually in order to maintain a desirable age
distribution. The indications are that a figure of this order has been attained in the past year or two. For example, the Rural Bank itself established nearly 1,000 new farmers last year, and there is some indication that the number settled by other means would be about half that.

Table 1 demonstrates that of the total farms purchased in 1975 41.9% were by new farmers compared with 33.1% in 1972. Conversely the number of farms purchased for farm enlargement declined between these two years from 38.8% to 24.3%. The
other interesting figure is the significant increase in the number of farms bought by businessmen over this period. If these latter farms are being farmed as "hobbies" with absentee owners, then this trend may be considered undesirable. If on the other hand businessmen are placing young farmers as managers, or as shareholders, or partners, in such properties, then the trend might be considered a good one.

Table 1

TYPES OF FARM PURCHASE
(Freehold Rural Sales)

<table>
<thead>
<tr>
<th></th>
<th>1972</th>
<th>1975</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Farm Enlargement</td>
<td>1802</td>
<td>38.8</td>
</tr>
<tr>
<td>Changing Farm</td>
<td>597</td>
<td>12.9</td>
</tr>
<tr>
<td>Businessmen</td>
<td>252</td>
<td>5.4</td>
</tr>
<tr>
<td>New Farmer</td>
<td>1533</td>
<td>33.1</td>
</tr>
<tr>
<td>Other</td>
<td>454</td>
<td>9.8</td>
</tr>
<tr>
<td></td>
<td>4638</td>
<td>100</td>
</tr>
</tbody>
</table>

It is not unusual to hear it said that the average age of farmers is increasing and that this is responsible for the decline in motivation and productivity. The evidence doesn't really bear this out. Analysis of census data for 1921 indicated that the average age of working farmers was 42 years, while the 1966 census revealed a figure of 43 years. Mr. John Pryde surveying a wide sample of farmers in 1976 found that their average age was 44 years.

It seems to be generally accepted that the ability of young people to save sufficient money to finance themselves into a
farm is declining. Recently I put this question to a group of Lecturers and Advisers in the Department of Farm Management at the College and was somewhat surprised to find that there was a divergence of views. One view was that if young people are prepared to withstand the immense social pressures associated with today's consumer society, their ability to save in real terms was greater than in the past. But the general consensus was that the widening gap between the rate of increase of land values and the rate of increase of salaries and wages was such that the ability to save at a rate which would ensure farm ownership at a reasonable age was declining.

Table 2 which sets out the annual average increase in Land Values and in Wage Rates for blocks of years during the past decade, gives some measure of support to this latter viewpoint.

**Table 2**

<table>
<thead>
<tr>
<th></th>
<th>Wage Rates</th>
<th>Land Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1964-66</td>
<td>5.9</td>
<td>11.2</td>
</tr>
<tr>
<td>1967-69</td>
<td>5.7</td>
<td>2.9</td>
</tr>
<tr>
<td>1970-72</td>
<td>13.4</td>
<td>4.5</td>
</tr>
<tr>
<td>1973-75</td>
<td>15.2</td>
<td>29.3</td>
</tr>
</tbody>
</table>

Wage rates kept pace with land values during the period 1964-72 but the massive escalation of land prices since 1973 has widened the gap very considerably. It is clear that the surge in land values over this period has brought a new dimension to the problem, particularly since it has been associated with steep rises in interest rates and therefore
the cost of servicing debt. It is simply a matter that even with 50% equity, the ability to pay interest at 12% on the borrowed capital even on high performing farms is very marginal.

SUMMARY

I hope therefore that we will turn our attention to the following areas:-

* Arresting the decline in the number of farms. I believe that the whole area of property amalgamation needs re-examining.
* Exploring fully the role which the State through the Department of Lands and Survey and the Rural Bank should and can play in ensuring desirable levels of farm settlement. For example, we should keep in perspective that even if the Department of Lands and Survey was able to settle 50 farms per year on a consistent basis, this represents a very small proportion of the total amount of settlement required. Should the Department of Lands and Survey therefore be given the resources to prosecute a vigorous policy of purchase of developed and semi-developed properties for subdivision and quick settlement?
I also hope that we can thoroughly examine the role of the Rural Banking and Finance Corporation and to understand more clearly how far it can go and what are the limits imposed on it, both in terms of resources and in terms of realistic lending margins.
* Evaluating the role of other financial institutions in respect of land settlement.
* Exploring the possibilities of alternative systems of farm ownership and of equity building as a means of accelerating the opportunities open to qualified young farmers.
FARM SETTLEMENT - DISCUSSION

Following the introductory comments by Professor J.D. Stewart, five farmers or farmer groups who had recently established themselves in farming through a variety of ways were invited to answer a series of questions - questions that had been given to them sometime before the Conference.

These questions and the answers are given below.

Members of the panel and a brief description of their way of entry to farming included.

Mr. K. Hanning, South Canterbury - through partnership with urban partners.
Mr. R. Smith, Waikato - share milking.
Mr. N.M. West, Southland - through a private leasing arrangement.
Mr. P.J. Ellis, Hawkes Bay - through working on farms and farm management; is currently seeking a suitable farm and finance.
Messrs D. Finlay and S.M. Hurst, North Otago - through a company structure. Mr. Finlay is the working managing director; Mr. Hurst a farmer in his own right and partner in the company.
MR. K. HANNING

EXPERIENCE  Farm Management for a number of years,
            Farm Partnership from 1975

PARTNERSHIP Three - Self, Relative, one other

FARM PURCHASE

AREA  639 ha - 340 ha Arable
       60 ha Stony Flats
       230 ha Dark/Sunny Faces

INGOING STOCK  2,000 Ewes  65 Cows
               470 Hoggets  40 Steers

FINANCE  $225,000 and Stock and Plant

Total Vendor Mortgage for Five Years

PROGRESS MADE

<table>
<thead>
<tr>
<th>Year</th>
<th>Ewes</th>
<th>Ewe Lambs</th>
<th>Cows</th>
<th>Wheat (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>3000</td>
<td>-</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>1976</td>
<td>3100</td>
<td>600</td>
<td>50</td>
<td>85</td>
</tr>
<tr>
<td>1977</td>
<td>3200</td>
<td>1000</td>
<td>50</td>
<td>90</td>
</tr>
</tbody>
</table>

COMPLETED

* 5 km New Fences
* 200 kg/ha Super p.a.
* 15 ha into Lucerne
* Shelter Planting

* On the basis of your farming and managerial background, your
  two partners established this partnership with you and you
  purchased this property. Did you personally put any capital
  into this venture initially?

Yes, this is an equal partnership of $12,000. In addition
my parents loaned $12,000 to the partnership and a friend
lent $5,000 without security; this has since been repaid.
The initial contribution from the share holders financed the
stock and plant and the land was financed entirely on vendor
mortgage.

* What is your status in the Partnership?
I am the managing director of the partnership with a legally
bound venture which entitles me to the home. The partnership can be broken up through gross mis-management or a breakdown in health.

* The vendor mortgage amounting to 100% of purchase price is pretty unusual to say the least. Would the venture have been possible otherwise?

At the time of purchasing the property there was a complete collapse in farm sales because of the world crisis in oil. This enabled us as a partnership to purchase the property and allow the farmer to retire to the city.

There were two other ways in which we could have financed the property. One was to have obtained a first mortgage from a finance company with the vendor still being prepared to leave finance on second mortgage. Or, we could have done what others have done and increased the numbers in the partnership. This would have brought in more capital, but was not as favourable as I have a written right of purchase should the partnership wish to split up after its term of 15 years.

* What could the Government do to facilitate this type of financing arrangement?

I believe that one of Government's policies is to bring in legislation to make it more favourable for farmers leaving large sums of money on farm mortgage. I can see this happening in one of two ways.

Firstly, a tax incentive on interest received from money left on first mortgage; such an incentive to help balance the difference between first mortgage farm interest and the higher rates available through city investment. The second point would perhaps be some relief of the capital gains tax that would have to be paid on stock and plant when they are sold.
Has the farm been able to service this heavy debt, pay you a good salary as managing partner, and finance its own development?

Yes, I want to stress that this partnership was not only equal in the beginning but all the way through. I am paid a high salary but I match the input that comes in every year from each partner so that it remains an equal partnership. We have been able to service our debts; all the input money is actually being used for capital stock, capital plant or capital repayment. The first year we spent about $22,000 on capital plant and stock and we made a capital repayment of $10,000. This year so far we have spent about $20,000 on capital plant and have repaid about $5,000.

With the benefit of hindsight, would you have organised the venture differently?

No, I feel it is a very successful way for a person with my very limited finance to break into farming.

If I might add a point on farm finance particularly relating to insurance companies. I feel Government could well consider ways of helping insurance companies direct quite a considerable amount of the premiums which they get from the farming community back into farming. Figures show the amount of insurance company investment in farming has dropped from 16% to 6%. I feel that the criterion insurance companies have for lending on farms means that the only farmers who get money from them are those who have a very high equity already and most have accumulated land. Alternatively, the money is going in to high rise buildings in the middle of cities.

What interest rate is paid on the loan?

The interest rate was originally 8 1/2%; it is now 11 1/2% but I still believe that we can service that on current income.
MR. R. SMITH

EXPERIENCE
- Dairy Co. Employee 5 years
- High Income Work (Australia) 1 year
- Share Milking 1971 2 years
- Share Milking 1973 (50/50)
- Purchasing Farm 1977

FINANCE
- 1971 Cash $4,500
- 1973 Cash 14,000
- Borrowed 24,000
- 1977 Stock 86,000
- Cash 11,000
- Debt 3,900 to settle

PRODUCTION
- Share Milking 1971 65 ha

<table>
<thead>
<tr>
<th>Year</th>
<th>kg Milk Fat</th>
<th>Stock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Former best</td>
<td>19,000</td>
<td>170</td>
</tr>
<tr>
<td>1971/92</td>
<td>23,000</td>
<td>160</td>
</tr>
<tr>
<td>1972/73</td>
<td>24,000</td>
<td>160</td>
</tr>
</tbody>
</table>

Share Milking 1973 50/50 98 ha

<table>
<thead>
<tr>
<th>Year</th>
<th>kg Milk Fat</th>
<th>Stock</th>
</tr>
</thead>
<tbody>
<tr>
<td>1972/73</td>
<td>38,000</td>
<td>250</td>
</tr>
<tr>
<td>1973/74</td>
<td>43,000</td>
<td>310 +</td>
</tr>
<tr>
<td>1976/77</td>
<td>55,000 (est.)</td>
<td>350 *</td>
</tr>
</tbody>
</table>

+ Plus 100 calves
* Plus 100 calves and 40 cows leased out
INGOING FOR FARM PURCHASE 1977

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.B.F.C.</td>
<td>$65,000</td>
</tr>
<tr>
<td>Bank</td>
<td>20,000</td>
</tr>
<tr>
<td>Transferable House Loan</td>
<td>4,000</td>
</tr>
<tr>
<td>Suspensory Loan</td>
<td>5,700</td>
</tr>
<tr>
<td>Cash</td>
<td>11,000</td>
</tr>
<tr>
<td>Proceeds sale cattle</td>
<td>48,380</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>154,080</td>
</tr>
<tr>
<td>Less Debt</td>
<td>3,900</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$150,180</td>
</tr>
<tr>
<td>Plus own stock and plant</td>
<td></td>
</tr>
<tr>
<td>Plant</td>
<td>$12,000</td>
</tr>
<tr>
<td>160 Cows</td>
<td>23,680</td>
</tr>
<tr>
<td>50 Heifers</td>
<td>3,000</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$38,680</td>
</tr>
</tbody>
</table>

*You entered your first sharemilking agreement in 1971 with $4,500 cash, and took on 50/50 agreement in 1973, into which you put $14,000 cash, borrowing a further $24,000.

In 1977 you are purchasing your own farm, and will put into it $88,000 worth of stock and $11,000 cash, less a small R.B.F.C. Loan of $4,000. Is this type of progress still common in the dairy industry through sharemilking?

It is a very important step from a 29% sharemilking agreement where all stock and plant are owned by the farm owner to a 50/50 agreement where the stock is owned by the sharemilker. Out of the total cost involved, $38,000, our equity was $14,000 which necessitated a borrowing of $24,000. Over the four years of our agreement we have repaid the $24,000. In the agreement, and as an incentive to develop the property,
and so increase carrying capacity and production, we bought in selected lines of yearling dairy heifers, more in fact than were needed to provide the 25% replacement rate plus 5% incentive increase. We were then able to lease out our surplus dairy cows and heifers. So, from our original total stock numbers of 360 four years ago, with cows averaging $114 and yearlings $46, we now have a total of 490 head with cows netting $148, heifers $135 and yearlings $70.

During the same time we have seen a dramatic rise in the price of new and second hand machinery, many items like tractors doubling in price in the last three years. The average 50/50 sharemilking position in the Waikato would probably have 140 cows. Five years ago a freehold herd of this size with normal replacements and associated plant and some cash would have been quite sufficient equity to get into a reasonably economic dairy farm. I am afraid now this does not apply in the Waikato area unless there is considerable family or other financial help. Today this size is used more as a stepping stone.

Because of financial restraints most sharemilking agreements are for a minimum of three years. From here they move up to 220 or 280 cows for another three to five years to gain sufficient numbers and so be in a position to sell surplus stock for additional cash and still retain sufficient cattle to stock an economic property. Because of the size and efficiency of our 50/50 sharemilking positions our progress has been a little quicker than most on today's standards, but though large herd opportunities are very limited, I can see no reason why it cannot be repeated by those that are prepared to make the additional effort.

* You took your wife into partnership. What has been the advantage of this?

There have been several advantages to my mind. The personal one is very hard to define but at the time there were definite
taxation benefits to be had, especially long term. This however, does not apply to the same extent now as recent legislation allows a person in a position similar to ours quite substantial tax deductible savings. Estate planning was made a little bit easier and for my wife I think it has fostered a little more interest and understanding in the whole enterprise.

I must confess to a gentle nudge in this direction when I bought a new mail box. My wife promptly painted both our initials on it!

*What labour have you employed?*

In our first two years on 29% sharemilking we employed single boys but the pressure was on when we commenced 50/50 sharemilking with a larger herd. We retained our single boy and employed another mid-way through the first season. Our contract stated that two male labour units, other than myself were to be employed. This allowed us to get most of the development work done in the initial two years. In the succeeding two years we have employed one married man each season; the farm owner agreed, provided the work was done. By taking on this additional work load we have saved about $4,000 to $5,000 a year in wages with the additional benefits for my wife who has not had an extra person living in the house. This year, apart from the labour at haymaking, we have handled the farm work quite easily with two. Even the labour we did employ was not necessary - it was the result of a misfortune. We have been fortunate in having good facilities which attracted labour.

Since taking up this position we have found ourselves being used as a sort of stepping stone. We have employed four individual married men over the four years; three have left us to take up 50/50 sharemilking contracts on their own and the fourth has taken a 29% position this year. I suppose
this would appear a fairly high staff turnover but it is quite satisfying to me to see this sort of progress.

* In your new farm you will have a total debt of $90,000 for a total ingoing of approximately $190,000 including stock and plant. Is this considered a reasonable level of debt to service from this enterprise?

Our equity involved is quite high for a first farm. However, we still had to do quite a bit of juggling to obtain secondary finance on terms that gave a realistic debt service ratio. When approaching the Rural Bank we applied initially for a loan on a special settlement basis; although we didn't need anything like the 85% of going concern value, we still needed above the normal maximum to keep our borrowing reasonably tidy.

Here was a farm with all the qualifications required but with a problem that seemed to be our relatively healthy financial position. Based on a reasonably conservative budget and estimate of production, our debt ratio on every dollar earned is about 40c; I have not worked it out on a stock unit ratio. This is quite high when one is also trying to upgrade a fairly run down property. Naturally the higher we can push production past our budgeted amount, the more we shall hopefully have to put back into improvements or even better production and accordingly a lowering of the debt service ratio.

As a matter of interest, if we can only match the present five year average milk fat production, and with all other calculations being equal, our debt would be around 51c in the dollar.

* Are your present intentions to milk cows for the remainder of your working life?

The critics have always told me that the work load we are carrying at present meant that I would be burnt out at 30 years of age and lose all interest in dairy farming as such.
I am quite convinced that had I not been able to see the rate of progress approaching what which we have now achieved, I would seriously have considered another calling. It is extremely disheartening for the average dairy farmer to see the operating costs increasing at a greater rate than the payment of milk fat. These costs have to be met with what reasonably should be savings. I feel that provided the financial return is again made relative to the work load and cost structure involved, I shall continue dairy farming. My present intention is to work through until 40 years of age then decide whether to carry on or employ a sharemilker or contractor.

* Are you not liable for tax on the proceeds of sale of stock sold to raise cash put into the farm?

We have kept our book values reasonably high over this period of time. When we come to sell this stock shortly we will have to pay quite a substantial amount, however this can be spread over five years and it may be offset by expenses for development incurred in the new farm. It is a problem, but not unmanageable.

* Would it have been better to have tried for your own property in 1973 when you had $14,000 cash?

We looked into this but it would only have had a property of about 70 acres with a carrying capacity of about 90 cows. I could not see any terrific headway involved in this. So when the sharemilking agreement came along I took it and I think we have been better off by doing so. Certainly it has meant another four years until farm ownership but we now have a reasonably desirable property in a good area. We have a farm that is run down but hopefully in five or six years we will have a reasonable asset. Had I bought 70 acres four years ago, I would be faced with selling it now and taking the same sort of step.
MR. N.M. WEST

Age 43. Married 4 Children.

EXPERIENCE
- Farm Worker: 15 years
- Farm Manager: 6 years
- Farmer 1973: Lease of 166 ha

FINANCE
- 1973 Ingoing of Lease: $16,000 Own savings, $12,000 Lessor Finance, $19,000 Mercantile firm
- 1977 - Debt free

PRODUCTION

<table>
<thead>
<tr>
<th>Year</th>
<th>Ewes</th>
<th>Hoggets</th>
<th>Cattle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973</td>
<td>1,200</td>
<td>600</td>
<td>72</td>
</tr>
<tr>
<td>1977</td>
<td>1,500</td>
<td>650</td>
<td>130</td>
</tr>
</tbody>
</table>

* You left school and worked on farms for 15 years as a single and married man, then had six years managing a property carrying 3,000 ewes and 100-150 cattle. Did you have any outside or additional earnings during this period?

No. I worked for about 15 years on farms. I was eight years on one and on three other farms I had two years on each. I was actually 10 years managing at Pine Bush. This is the only earnings that I had apart from some incentives and bonuses towards the end of my term as a manager.

* Four years ago you had the opportunity to take on the lease of an estate property carrying 1,200 ewes, 600 hoggets, and 72 cattle. Your ingoing requirement was $45,000; would you like to comment further on that financing.

I was lucky that the lady wishing to lease the farm was prepared to leave $12,000 on it. I put in $16,000 of my own and by the time I paid legal expenses and so on I owed $19,000 to the firm. The company was very good and stood
behind me while I did the worrying and the working! By the end of the first year I had repaid that $19,000 and had also paid back $6,000 of the lessors loan. The remaining $6,000 will be paid back later.

I was very lucky in the first year; the prices were good and everything seemed to be in my favour.

* What is your net worth now after four years leasing this property and what are your plans for the future?
I am now valued at $90,000 with my stock and assets with the mercantile firm. This includes $11,000 plant which I bought last year. I have also had to freeze money to save tax - on which I get 3% - and which I can use later to buy property, stock or improvements. I have one more year before my lease expires; I have first option to carry on the lease for a further five years or first option to buy.

* You have an option to renew the lease or buy the property next year. Are these the only two alternatives you are considering for next year?
I feel that if I decide not to carry on with this property I will have the backing of the firm to help find some other property.

* You have put a lot of emphasis on the role of the stock firm in your particular case. Clearly you have a good relationship with them and they have confidence in you as you are taking a progressive view of your situation.
I will have at least $100,000 by the time the lease is up, so with a loan from the Rural Bank and the stock firm I should be able to carry on with something.

* How is the lease value assessed?
Seven per cent on the Government valuation of the land.
What return on wool and meat have you had to enable you to repay such a large amount of debt in one year?

Apart from good returns we have had to do without a lot. We have not had a holiday and it was only last year that television arrived. On the production side I have had good returns including 150% lambing. We have a Romney flock and use a black face ram. We keep all our own replacements. One hundred and fifty per cent lambing has a big impact on overall financial performance especially when combined with minimal labour input.

MR. P.J. ELLIS

Age. 36. Married 3 Children.

EXPERIENCE
- Farm Worker 12 years
- Farm Manager 7 years
- Extensive sheep/beef/cropping experience

PRESENT FARM
- 450 ha
- 3,600 Breeding Ewes (2,500 tagged)
- 200 Breeding Cows (Fully recorded)
- 40 ha crop annually

You have had nineteen years of varied farm experience including seven years managing a substantial and progressive unit. Do you believe that there is any possibility of saving sufficient under these traditional circumstances to get your own start in farming?

The short answer to that is no. Accepting that the guide to the sum required for land settlement is $30,000, I find it impossible to suggest that this can be saved from earnings. My total gross earnings after 19 years working on farms would not total twice the present guide. I would find it very difficult to have saved $30,000 out of this.
*On the basis of your personal experience what improvements to the present policy of settling young farmers do you believe to be necessary?*

We could perhaps consider two groups of potential farmers. There are those who are prepared to leave the farming industry and work at the freezing works or some other high income business and leave the farming industry to its own devices for a time. Then there are those of us that are prepared to stick with the industry and by doing so perhaps forfeiting the chance to earn sufficient money to buy a farm of our own. Bearing this in mind I would say that the criterion for farm settlement should be based on the principle of one's ability to farm and produce and not necessarily on one's current bank balance. Such a principle could bring more people onto farms.

*What are your views on land aggregation?*

Land aggregation is bad except where such land is at risk of becoming an uneconomic unit. A small property may well remain unsold if not swallowed up by a next door neighbour.

I dislike land aggregation because firstly it creates production problems. I think this will be substantiated by work being done at Victoria University which will show production drops in land that has been aggregated. There is a drop in job opportunities also, for the person buying the farm tends to continue running both properties with his original labour. From a production point of view it is much better to settle a young farmer with a manageable but heavy debt that he must work his way out of.

The other reason I think land aggregation is bad for the industry as a whole is that it tends to increase land prices even further than they have been increasing. This is because the land purchaser usually has a large collateral with the farm or farms he already owns. Often they are prepared to
pay more than a person starting in farming can afford. Often, also, the person aggregating land does not have to rely on purchasing facilities - he already has them.

*Could you give us some views of forward balloting and assisted partnerships.*

I find it most frustrating to drive round the countryside and see lots of Department of Lands and Survey farms that seem to be well developed and farming flat out, and it worries me that this land should still be under the Department when there are so many young people keen and prepared to work on them. I acknowledge of course that these fully developed properties have got a role to play in recovering some of the money that has been spent on development.

However I would like to see what has been termed 'forward balloting' where the block for development is initially developed by those who will later settle the smaller units. Those who will make the later substantial progress are involved in the initial equity building.

As far as partnership is concerned I believe that if settling one person on one farm is good news for the farming industry of New Zealand, then the settling of two families on a larger block must be better. They would run it as a partnership. This would save having to build two wool sheds and two sets of yards - invariably in the wrong place. It would give the opportunity for two people with their required deposit of $30,000 to join hands and go for a property of reasonable size.

*Where do you see yourself going now?*

Hopefully by the end of the year I shall own a farm - if the Rural Bank is sufficiently kind to me!
How do you react to a scheme which allows you to deposit half your present salary (say $4,000) in an interest bearing account. In five years you have $20,000 for a 15% deposit on a $130,000 property?

If we could hedge the required deposit sum against inflation then such a scheme is viable. There is nothing wrong with the scheme except that few farm managers are on $8,000 a year. For example last year my car cost me exactly half my gross income. By the time I paid insurance and tax there was not a lot left to put in the Post Office. I think that this is something that people don't realise; I have heard about farm managers being paid $8,000 a year and I'm sure some are paid more than this. But the average farm manager in some parts of New Zealand is paid little more than a married shepherd - a simple question of supply and demand.
MESSRS. S.M. HURST AND D. FINLAY

COMPANY STRUCTURE
5 Partners - 2 working

PROPERTY
Purchased 1969
410 ha leasehold
Stock and Plant $78,000

FINANCE
Mortgage $60,000
Shares $64,000
(S.M.H. $10,000)
(D.F. $25,000)
Purchased 1970
Additional 150 ha $32,000
Mortgage inc. to $75,000
1973 2 Partners took
150 ha on own account
1975 Mortgage increased to $120,000
with R.B.F.C.
Development Loan $64,000

1977 VALUE
Land, Plant, Stock $604,000
Less: Mortgage 100,000

$504,000

PRODUCTION

<table>
<thead>
<tr>
<th>Year</th>
<th>Sheep</th>
<th>Lambing %</th>
<th>Cattle (Yearlings)</th>
<th>B.D. Irrigation ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1969</td>
<td>1,200</td>
<td>100</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1977</td>
<td>5,000</td>
<td>130</td>
<td>600</td>
<td>320</td>
</tr>
</tbody>
</table>
MR. FINLAY

* For what reasons did you embark in company farming as against farming on your own? You had $25,000 of your own which presumably would have given you a start?

I had earlier owned a small property and was also working as a shearer. This gave me money to develop the property which was a means of saving taxes and allowing me to accumulate capital. I was then looking round for a more permanent type of life and for a house.

We started by selling the smaller property to a neighbour only to find that the Rural Bank was, because of a number of droughts in the North Otago area, financing amalgamation of properties rather than resettlement. This was a disappointment until the pending sale of our present property was brought to my notice. After considerable discussion with accountants and those who are now my fellow directors, we went ahead with the purchase.

The main advantage to me was that instead of going into what would probably have been another uneconomic unit I was in the exciting position of being involved in major development work, including irrigation, and was associated with a group of enthusiastic and capable fellow directors. I learned an awful lot from this pool of combined knowledge.

MR. HURST

* You were operating a successful farming enterprise on your own and could have acquired more land or made other investments. What prompted you to invest in a farming company?

In the 1950's farming was prosperous and I accumulated money which was invested in the share market. After looking at my investments and attending one or two annual shareholders meetings I decided to transfer my capital to a form of invest-
ment that I could be more closely associated with.

My first step was to acquire more land but I came up against two problems. Firstly land aggregation and secondly management problems associated with the acquiring of more land. At the same time I saw potentially good young farmers being held back because of lack of money. It was then that I decided to put money into farming or associated companies. I formed six companies of which two are farming companies and the others closely associated with farming. I am quite satisfied with that judgement.

MR. FINLAY

* Could you explain how policy and management decisions are made and what main advantages do you see in the company structure?

The structure of the company is quite normal - we have our own Articles of Association and, at present, three directors. These include an accountant as Chairman of Directors, an off-farm director with experience and knowledge and the on-farm Managing Director.

All our early decisions were centred round finance and the development that was available with that finance. Regular meetings were held in the early days of the company to actually direct the policy and the progress we would aim for. But the on-farm management decisions were left to me. Of course many have told me that private ownership allows me to make all those decisions myself - and so it does. But in this situation there is often the benefit of a pat on the back from fellow directors after making good on-farm decisions.

The advice of the other two shareholders has been invaluable, particularly the advice of the accountant. If there are problems - as there invariable are - there are two outside people with stable views and opinions ready and able to give
advice.

In the early days of the Company it was quite common to have meetings as often as weekly or fortnightly intervals, but now we hold monthly meetings where accounts are passed and future developments discussed. We employ one man who takes his orders from me.

MR. HURST

* Could you explain the company procedure for establishing share value?

There is provision in the Articles of all the companies with which I am associated to allow the working partner to buy the shares at any time. It has never presented any problems at all because in the beginning you have gone in with people with whom you are compatible. The methods we use for establishing those values are simple. Each year from our accounts we value the land, we value the stock according to prevailing rates and we value the plant at that time. Our accountant then has a simple task in assessing the share value allowing for any tax liability the shares may have.

* Now that the Company is fully developed, what happens next? The property is nearly fully developed with the exception of 80 ha, so that takes care of the immediate future.

In the long term there are lots of avenues open to us; we could perhaps buy a bigger development property somewhere inside or outside this area. We could cut the property up into sharemilking units - it would make three or four units. We could sell the property as is and take our money out or we could set it up as one big dairy unit. One man I am associated with just now is in that position. His farm is fully developed with irrigation and he has just sold it to buy a considerably bigger property out of the area. I thought he may have wished to go on his own but was surprised and
happy to find he wanted to continue the company association.

MESSRS. FINLAY AND HURST

*With the benefit of hindsight do you see, at present, a place for this type of farmer establishment and do you see any pitfalls?

MR. FINLAY

Company farming is a sound way of establishing oneself in farming. There is always opportunity for a young fellow to establish himself on 25-50 ha and there are opportunities for them to accumulate capital and experience from this exercise. The advantage of company farming as the next step is that this same young farmer can go onto a fully economic unit which should at no time, because of development prospects, become marginal. Then there is the great pool of experiences of other directors— a factor I put such stress on earlier.

The advantage of a financial base to use as collateral — the security available to the company through the other shareholders — is another tremendous advantage when it comes to development loans from the Rural Bank, trading banks or stock firms.

The one big ingredient required is the compatibility of shareholders.

One of the big pitfalls may be the belief of people entering this type of shareholding or company farm that it is a short term exercise; that they should hurry through the development phase to a subdivision phase and to the opportunity to take over their part of the land at share value. The company just will not operate with partners who have this policy in mind. The 'honourable intent' must be there with the compatibility of shareholders.
Let me also point out that the value of land is getting even further away from young farmers and we should look carefully at farm ownership. Is it necessarily what it is set out to be, particularly if farm ownership and the attendant finance problems mean that farmers do not have the opportunity to live socially in a modern world?

And why should not the capital accumulated by other farmers be attracted back into the farming community? The incentive should be there to attract it back and shareholding is one of those ways. People who have had their livelihood from the land should have the opportunity to come back and benefit from capital investment in the way we have seen in this present exercise. Company farming has all the advantages that land purchase with heavy mortgages and restricted financial ability for development may not have.

MR. HURST
I find it stimulating, as I have said already, to see how your own capital is being used. I have also found it a stimulating and profitable exercise working closely with these active young developers. To start with you have to be half a jump ahead of them; later it's difficult to keep up with them. They stimulate you in your own farming enterprises.

From the point of view of investment our policy has been one of low interest rates - no interest paid initially - and my gain has been a capital one. So long as there is no capital gains tax I find this form of investment quite profitable. Interest payments to me would be taxable. From the company's viewpoint we had $65,000 on which no interest is payable, and $65,000 is a lot of money with which to generate capital and get development going.

The biggest pitfall is again the question of compatibility and the finding of young partners who are company orientated.
Many young farmers are not.

MR. FINLAY

* How much development has been from income and how much from capital?

It is a bad policy to do too much development out of income and we have relied heavily on the Rural Bank. Originally irrigation development costs were $38 an acre in 1970; the last land to be developed and completed on present irrigable area two years ago cost $80 an acre. Now I suppose costs are about $150 an acre. This has been one of the advantages of the company - to borrow the maximum and to develop and operate the company as quickly as possible.
It is now approaching 50 years since Government, through the Department of Lands & Survey, became engaged in general land development for the settlement of individual farmers. While this half century has seen a tremendous change in the style and emphasis of land development and farming, it has also seen through this work, a major contribution to the social and economic progress of New Zealand.

HISTORICAL SUMMARY

It was the pathetic story of the failure of many soldier settlers on practically undeveloped land following World War I, that led to the passing in 1929 of legislation permitting the Crown to develop agricultural land before offering it for settlement. Prior to this, the Government's role in the settlement of Crown land was mainly to provide road access, ballot the sections in their unimproved state, and leave the new settlers to their own devices. This reflected the social attitudes of the pioneers. New Zealand was a country of individualists, especially as farming and development was in the hands of the single owner-occupier and some private companies.

The commencement of Crown land development coincided with the onset of the depression of the 1930's, and its main emphasis
in the early years was to provide work for the unemployed. In 1939 came World War II, and land development was brought almost to a standstill. There were severe shortages of labour and materials, new grass was out of the question, and lack of superphosphate saw the reversion of established pastures.

Around 1943, with the need to rehabilitate returning servicemen of World War II, Government efforts in land development quickly became concentrated on the creation of new farms at an unprecedented rate. However, breaking-in of land from the rough could not possibly be completed quickly enough to satisfy every one eligible for farms, and additional farms were provided by the purchase or compulsory acquisition and subsequent subdivision of large holdings.

By 1960 ex-servicemen settlement was virtually completed with over 3,500 satisfactorily settled at that stage. Since that time the emphasis has been on the settlement of landless civilians - mainly young farmers and farm workers with the necessary experience and ability to take on their own farms, and ex-servicemen settlement has dwindled right away. In the period since 1960, 494 civilians and 80 ex-servicemen have been given the opportunity to enter a farming career on land developed by the Government.

The settlement of ex-servicemen was an instrument of deliberate social policy and the economics of the scheme were subordinate to the social aims. However, in 1964 following the transition to civilian settlement, Government decided that from then on, total costs of acquisition, development, and any seasonal losses, should be recovered from farming profits and disposal prices received from farm sales. The overall objective is now to achieve recovery of expenditure on a national basis, even though recovery of development costs for each individual block may not be possible. This policy does not mean that there is no
settlement of a block before developments costs have been recovered. Rather, farm units are settled as their development is completed and pastures have matured, but a careful watch is kept to ensure that the disposal of the final units on the block will enable the recovery of all out-standing block debts, wherever possible.

The introduction of this "break even" policy resulted in a reduction in the number of units available for settlement in order to allow for pasture consolidation and accumulation of farm profits. It also came at a time when development was moving into more difficult country. Development and settlement continued throughout the 1960's but in 1971 because of the decline in the profitability of farming and the uncertainty of the effect on New Zealand of Britain's application to join the European Economic Community, Government instructed that settlement was to cease. It was also decided that until the effect of British entry into the EEC was clearly discernible, no land development should be started on completely undeveloped blocks of Crown land and that further development of partly developed blocks should be restricted to providing optimal economic production as a station. However, farming returns and prospects later began to show signs of improvement and in October 1972 Government decided to recommence settlement on a limited scale.

During that period in the early 1970's when land development was reduced and civilian settlement halted, the Department was able to begin a programme of consolidation for the first time in over 25 years. Heavier culling of stock to improve farming standards and stock quality was possible, and it became clear that farming by the Crown could be a very profitable enterprise.

At the present time, there are about 485,000 ha of land contained in nearly 200 land development blocks being admin-
istered by the Department for the Land Settlement Board. Ultimately this land should provide in the vicinity of 1,400 individual farms for settlement.

In addition, the Department farms other land such as Molesworth Station of 182,00 ha, a few blocks being developed for the Department of Maori Affairs, and some land farmed on behalf of other Government departments, bringing the total land area to almost 744,000 ha which at 30 June 1976 carried 1.67 million sheep including 1.18 million breeding ewes, and 249,000 run cattle including 125,000 breeding cows.

FUTURE DEVELOPMENT

I have given you this brief historical summary because I think it is important to place past achievements in perspective when planning for the future. I am sure that it is no secret that Government is under considerable pressure to increase settlement. However, because of the current economic restraints there has been no option but to reduce the number of farms for selection. Last year, 15 farms -12 sheep and 3 dairy units- were offered and we are now awaiting a Government announcement of the programme for the current year.

You may be wondering to what extent a curtailment of settlement reduces expenditure. Well, as those of you who have inspected land development blocks will know, these have sufficient buildings, fencing, and water reticulation to enable efficient farming as a "station". Final settlement involves scheming the blocks into family units as either sheep or dairy farms and the construction of additional houses, woolsheds, or dairy sheds, and hay barns as well as the provision of final subdivision fencing and water supply. The average cost beyond station stage of preparing dairy units for settlement is in excess of $70,000 per farm while the preparation of sheep units is in excess of $30,000 per unit. On average the preparation
of dairy farms involves the construction of 4 houses and cow sheds for every 5 farms settled, while the settlement of sheep farms usually entails the construction of 2 houses, hay barns and woolsheds for every 3 farms to be settled.

Obviously the question arises, are all of these improvements necessary in the initial stages of settlement, and this is exactly what Government and the Land Settlement Board has been looking at very closely. We are entirely convinced that settlers must have a full quota of consolidated pasture if they are to produce sufficient revenue to service debts and accumulate sufficient surplus to carry out additional improvements. Because of the essential nature of almost all improvements on a dairy farm we really cannot see any scope for the settlement of partially improved dairy units. However, we will be investigating the merits of settling partially improved sheep units this year. We are all aware that there are inherent risks involved with such a practice but it is believed that young farmers would welcome the challenge of carrying out development themselves. This would provide settlers with a greater freedom of choice in the final stages of development, rather than have these decisions made for them in advance.

On the surface this looks a very attractive proposition for settlers but on investigation it is a little more complicated. For a start it must be appreciated that the actual cost of improvements is not equated to value. In other words if fencing costs the department $1.30 a metre, this does not mean that its value when assessed for settlement purposes will be $1.30 - it might be only $1 per metre. Against this can be argued that a settler would make savings in labour costs and on tax. This is certainly true but in the early stages of settlement, farms would produce only limited revenue to finance further improvements. As a result settlers would also be paying little or no tax on which to effect savings.
However, while the Land Settlement Board appreciates that there will be problems in settling partially developed farms we believe there is sufficient interest to at least carry out this on a trial basis. The Board has however laid down some basic requirements. Firstly, farms must have a full quota of grass and a full range of buildings with the exception of a woolshed which may have to be shared with a conveniently situated neighbour. Farms must also have a set of sheep yards. However, settlers could be left to complete internal fencing, cattle yards and water reticulation. Again, we know there can be problems in sharing woolsheds and the selection of settlers who have the necessary drive but are likely to have the temperament to share facilities will be an interesting exercise. To give the pilot scheme every chance at least initially the Board will probably need to be more selective in vetting applicants than would normally be the case.

Another possibility which has not yet been fully explored, but with further investigation may be feasible, is a scheme to get settlers on to Crown blocks before development has reached the stage where farms can be individually identified. Young farmers would thereby have a hand in the development of a block, a part of which they could eventually own. Settlers would then be familiar with properties before they finally take control over an individual unit. Furthermore, they would derive a sense of identification with both the property and the local community which would stand them in good stead during the difficult early years of establishment.

The implementation of this scheme would entail holding ballots among suitable applicants for farms that have yet to be developed to a stage where they can be settled, with the successful ballotees being employed on the blocks.

There are obviously a number of problems to be overcome in respect of this policy. Development of the blocks would have
to be under the control and direction of the Department's farm managers and there could be conflict with settlers, particularly if they did not agree with management or development policy or the breed and class of stock to be carried. There could also be some concern at the level of wages, particularly if settlers had been earning considerably more in previous employment. For instance, a prospective dairy settler who is sharemilking would be much better off financially to continue sharemilking than working for wages on the block.

There are also administrative matters which would need to be resolved. For instance, when would the deposit be paid? When would the valuation be made on which charges would be fixed? The settler would be entitled to know what the end cost and annual charges would be, when he applies for admission to ballot. These charges would be difficult to determine two or three years before settlement. This could be a source of argument which would require very accurate timekeeping and accounting, and there are many such issues to be resolved before a scheme of this nature can be implemented, but there is no reason why we should not explore the possibilities of such a novel social experiment.

I have covered these alternative schemes so that you can gain an appreciation of the possibilities for the future. These are alternatives which must be evaluated very thoroughly because we are dealing essentially with people's lives. The wrong decisions could be very damaging to settlers for a long period, and the Land Settlement Board must therefore be convinced that new schemes have every chance of success before recommending changes, but will try to ensure that its policies move in line with the social and economic policies of the Government, and continue to contribute to the growth of the farming industry in New Zealand.
The history of occupation of New Zealand by Europeans, together with the economic, social and political significance of land and its use has created an acute awareness and a heavy involvement by successive Governments in land settlement. The role of the financial organisations such as the Rural Bank and its predecessors in the implementation of policies goes back to the passing of the Advances to Settlers Act 1894.

To illustrate to you that many of the concerns about land settlement which are being expressed today, have exercised the minds of men and women in times past, I would like to quote a paragraph from a report prepared in 1938 by the Chairman of a local Farm Adjustment Commission.

"One of the most serious aspects of production ranking next in order to the dearth of capital facilities, and arising partly out of the same, is the question of labour shortage, attributable in the main to the two factors mentioned. There is a further serious side to the problem, viz, that the youth who are now leaving farms in definite and serious proportions to take jobs on Public Works, in school playing grounds etc. ought to be the army of young men from whom our future farmers are recruited, trained, and in time, financed into holdings of their own; just as likewise the young women who formerly acted and trained as domestics on farms and who are now in offices would normally have made suitable wives for young farmers."
A further serious aspect - more so from the political than economic considerations, is the discarding of horses with consequent loss of revenue from oat crops etc. in favour of machinery which has to swell our imports, and this incipient danger can only in the long-run lead to disequilibrium in our balance of trade."

DEFINITION OF SETTLEMENT

Settlement is often considered from the narrow viewpoint of the ultimate act of establishment of a farmer on an economic unit, but I suggest that any examination of the current situation would be deficient if we did not also cover the various forms of assistance available to those on the way to ownership.

RURAL BANK LENDING POLICIES

I shall briefly comment on the various Rural Bank lending policies which have a bearing on settlement in the wider sense.

Farm Ownership Savings Accounts

To encourage saving as one form of asset accretion, Government has recently amended legislation relating to the 1974 Scheme to make it possible for savings of up to $4,000 per annum with a maximum of $50,000 to qualify for a tax rebate of 45 cents for each dollar saved.

Loans to Sharemilkers and Lessees to Purchase Stock and Plant

The Rural Bank financed over 1,000 loans to sharemilkers and lessees amounting to approximately $10 million in the last financial year to enable them to purchase stock and plant. Normal loans do not usually exceed $12,000, but there is provision to exceed this in exceptional circumstances. Five year term; interest rate 7½% reducible to 5½% for first 3
Settlement Loans for Farm Workers

Loans of up to $35,000 on first mortgage may be granted to bona fide farm workers to purchase a property which in itself may be uneconomic but which will with the outside earnings provide a reasonable standard of living. Interest 7½%; term up to 25 years.

The objective of these loans is to provide security for the family and a possible stepping-stone.

Agricultural Contractors Base Establishment Loans

To enable an agricultural contractor to establish a permanent presence in the rural community, loans of up to $35,000 on first mortgage can be granted for the purchase of a base area and if necessary the construction of housing or sheds. Interest 9%.

Standard Settlement Loans

Over 900 farmers were settled in the last financial year with standard settlement loans totalling approximately $45 million. Normally it is expected that loans of $50,000 for dairy farms and $70,000 for sheep, beef and cropping farms would suffice, but there is provision to exceed these guidelines in exceptional circumstances. Interest rate 7½%; term up to 25 years.

Special Settlement Loans

To augment the settlement of farms made available through the Department of Lands and Survey, the Government introduced the Special Settlement Loan Scheme in last year's Budget.
Preference is given to those who have demonstrated outstanding farming ability, thrift and initiative who would not otherwise have the chance of attaining farm ownership. The scheme gives no guarantee of success, but brings ownership within the reach of a proportion of those who though lacking capital, are ready to put in hard work and personal sacrifice to achieve their goal. Currently loans of up to 85% of value with guidelines of $90,000 for dairy farms and $150,000 for sheep, are being considered. However, it is recognised that the ingoing costs for sheep farms have risen sharply and the guideline can be exceeded in appropriate cases.

In the financial year ended 31st March, 1977, 29 sheep farmers and 57 dairy farmers were offered loans. In a full year, it is expected that approximately 100 farmers will be settled which will require approximately $13 million in funds.

In the first year of operation it was found that there were adequate suitable dairy farms available, but more difficulty was experienced by those with sheep farming background.

**Loans for Additional Land**

Loans are granted to build up uneconomic units where there is good land use. In some cases the additional land would enable a mature son to achieve some form of ownership. Applications which involve undue aggregation are declined and those which involve the subdivision of an economic unit are normally declined. In most instances it is expected that a loan of $35-$40,000 would suffice and a first mortgage over the area being acquired is generally sought.

I must emphasise that the Rural Bank does not promote undue aggregation or the needless subdivision of properties for speculative gain.
SETTLEMENT COSTS

From the foregoing it can be seen that the land settlement policies of the Rural Bank require funding of approximately $80 million per annum. Three years ago the figure was approximately $40 million.

AGE OF FARMERS AND FARM TURNOVER

The average age of farmers settled by the Rural Bank is 30 years at date of settlement and the average age of all mortgagors is about 43.

From the 1971 census figures, Clement (a former SAC research officer) calculated that the mean age of farmers was about 45 years. To maintain comparable age structures, he calculated that about 1,500 new farmers should enter the industry annually. Valuation Department statistics indicate that about 3,000 farm units change hands each year. While it is apparent that there is a reasonable flow of farms onto the market, there is intense competition for them.

Table 1

| INGOING COSTS ($) | Dairy | | Sheep | | |
|---|---|---|---|---|
| | January 1976 | March 1977 | % Increase | January 1976 | March 1977 | % Increase |
| Land | 102,917 | 112,080 | 9 | 114,204 | 148,850 | 30 |
| Stock & Plant | 20,983 | 26,060 | 24 | 21,939 | 46,870 | 113 |
| Total | 123,900 | 138,140 | 11 | 136,143 | 195,720 | 44 |
Table 1 demonstrates the rise in ingoing costs of farm units financed by the Rural Bank.

In view of these increases, ways and means need to be considered whereby the pressure on the upward spiral of land prices can be curbed. Price control of farm land was not welcome in the past and unlikely to be so now. A capital gains tax on farm land alone would be inequitable. As an alternative it is suggested that the Land Settlement Promotion Act be reviewed to place some further restriction on the further acquisition of productive farm land by those who already have adequate holdings.

INTENSIFICATION OF LAND USE

If you accept that improved technology will be applied more slowly on the poorer lands then it is apparent that the greatest avenue for production increases lies in the intensification of the use of our better country. However, most of our future farmers are employed on dairy, sheep, beef and large-scale cropping farms. To provide a testing ground for future horticultural producers, I suggest that some consideration be given to a scheme whereby the Lands and Survey Department hold and allocate land, held close to centres of population, on say a five year temporary tenancy.

Applicants would have to provide their own housing either rented or purchased in the towns and commute to the property.

After a period of successful operation as a lessee the farmer would have acquired some capital and the knowledge necessary to handle a substantial loan for permanent settlement through such schemes as the Special Farm Settlement Scheme.
FINANCES

It is clear that if the Rural Bank is to play a greater role in farm settlement it will require more funds either from the same source or an alternative source. As a possible method of supplementing the funds currently available from the Rural Bank's principal repayments plus the borrowing from the National Development Loans Account, I suggest that farmers could be interested in making deposits to provide for death duties. At the present time a farmer who wishes to preserve his farming asset makes investment in the urban sector where his family can, at death, more easily realise on his assets. Because of this I suggest that many millions of dollars are being taken out of the rural sector.

Farmers must work with and place deposits with the organisations which re-invest in agriculture. How often do we wish to borrow long term at a substantially lower rate than we demand for a short term investment with the Trustee Savings Bank, trading bank or stock firm.

The farming community must be encouraged to accept a responsibility and invest its surplus funds and special purpose funds with the organisations which re-invest in farming. Farmers who leave funds in on second mortgages should consider a minimum term of 10 years; if necessary with provision for sensible interest reviews rather than the 2-3 year terms more common today.

THE INDUSTRY CONSCIENCE

How often do we hear people say that "they" (meaning, I suspect somebody other than us) should do something about settlement? I would like to draw the comparison with the need for self discipline in energy conservation. Each and every one of us must develop an awareness of the national benefits of land settlement. Vendors must be encouraged
to develop an attitude of preference for the bona fide new farmer as opposed to the one who has the biggest purse.

Is it too much to expect that those who have had the benefits which farm ownership has conferred over the past years should not give preference in pricing land finance to the qualified new farmer who is moving into ownership for the first time? I am fully conscious of the many farmers who over the years, have encouraged and even provided the full finance for the settlement of employees, but does the industry accept a responsibility to ensure that the young people who have proven themselves will be given an opportunity?

SUMMARY

* The Rural Bank is assisting with the settlement of approximately 1,000 new farmers.
* All major policies of the Rural Bank are aimed at increasing production by the settlement of new farmers or by direct development loans granted to existing farmers.
* The success of Lands Department development techniques clearly indicates that backward properties should be acquired and developed for settlement of new farmers.
* The practicality of Lands Department controlling all land acquired for future public use adjacent to centres of population - areas set aside for such things as airports or new towns - be investigated with a view to granting temporary horticultural tenancies.
* The Land Settlement Promotion and Land Acquisition Act be revised with a view to reducing the demand for economic farming units from those not engaged in the industry or those who already farm an adequate area.
* The encouragement of all farmers to deposit funds with organisations which re-lend to agriculture and to consider some form of death duty deposit with the
Rural Bank, Trustee Savings Banks or other appropriate institutions to ensure that rural investment is not lost. Vendors to be encouraged to lend on 10 year terms rather than the shorter terms now prevalent.

* The industry to be encouraged to give preference to settlement of competent owner-operator landless new farmers rather than those who seek to use farm land as an investment or hedge against inflation.
I see my role today as that of standing back and looking at the whole system of farm finance to see if there are any broad areas where we should be seeking to bring about change and improvement. I think I have identified two areas where changes could be of major advantage.

AREAS OF CHANGE

The two areas where I think change is called for are our present system of mortgages, and the way in which we provide incentives through tax exemptions. Changes in these two fields, along the lines I am going to propose should:

* make it easier for young farmers to get started.
* ease the liquidity problem of farmers who sometimes complain about being worth hundreds of thousands of dollars but having no money to spend.
* encourage greater farm investment of a sort that will increase the capacity and output of the industry.
* encourage greater savings, even in times of inflation.

I shall probably make things easier for myself if I start with the least controversial suggestion, so let's look at investment incentives first.
INVESTMENT INCENTIVES

At the present moment, many of the investment incentives offered to farmers are in the form of taxation exemptions of one form or another. Either approved investment expenditures are deductible from current income for taxation purposes, or large depreciation allowances are granted in the first year or two of the new asset's life. Both these forms of incentive have the effect of reducing the level of income on which tax is to be assessed, and therefore the amount of tax which is to be paid. In effect, the cost of the investment is shared between the farmer and the government, the government's contribution being in the form of the potential tax which they have chosen not to collect in order to encourage the investment. In addition to the overall benefit to the nation which will result from greater farm production, we can think of the government getting a return on its investment in the form of increased tax receipts from the higher farm incomes which should follow from the greater volume of farm production which the investment was designed to bring about.

So far, so good. There is little cause for complaint in the general aim of these exemptions, but when we come down to their operation there are some grounds for concern, and these relate to the differential effects of tax exemptions on individuals with different incomes. The high income farmer, paying 60c tax for every dollar of income at the top end of his income, has the government effectively paying 60c for every dollar of allowable investment expenditure; the lower income farmer, on the other hand, has the government contributing perhaps 20c, or even less, towards each dollar of his investment expenditure. To the extent that the investment adds to the value of assets owned by the investor, the taxation exemptions assist farmers in the process of wealth accumulation. But the high income farmer, who will
in general already have more wealth than his lower income colleague, is given by far the greatest level of assistance. To him who hath shall be given indeed, and this is the strange consequence of basing incentives on exemptions from tax which is assessed on a progressive, or rising, scale which was designed to reduce inequalities.

While we might deplore this differential effect on social grounds, for the purposes of our discussion today, I would suggest that there are more important consequences on both the level and effectiveness of total investment.

For farm investment to be undertaken there are two necessary conditions which have to be satisfied.  
* The farmer must want to invest - he has to feel that there is something in it for him.  
* The farmer must have the financial resources which are needed to undertake the investment, whether they be borrowed, saved out of taxes through exemption schemes, or saved out of tax-paid income.

I do not think that many people would argue with the proposition that, in general, the farmers with the greatest desire to invest in the development of their properties, so as to expand their output, are the young men newly established as owner-operators on their own farms. These farmers usually have a heavy mortgage commitment and they are keen to expand output in order to reduce the burden of their debt servicing. Being at the peak of their physical strength and fitness they are willing, even eager, to undertake the extra work associated with increased production. And in many cases this will be the stage of their farming career when they are most up-to-date with the latest technology. I believe that as a group, these younger farmers have a tremendous enthusiasm for farming, and a strong desire to boost their production.
But their drive and energy is being dissipated because they do not have access to the financial resources they need to achieve the production increases of which they and their farms are capable. Being mortgaged to the hilt they are unable or unwilling to borrow further. The heavy burden of the interest payable on the mortgages means that net incomes are usually low, and tax exemptions are therefore of limited value; and the low incomes mean that there is little opportunity to provide resources for development out of retained earnings. We do have government schemes designed to offset these problems but they tend to operate on an individual basis. In any case I believe they should be retained in the interests of higher output, even if we reform the basis of industry-wide incentives. Such reform should aim to ensure, first, that the social objectives of taxation policy are not counteracted so strongly as at present, and second, that financial resources are made available to those farm operators who are most likely to make best use of them.

It is sometimes argued that the keen young farmers will expand output with the minimum of capital assistance through sheer enthusiasm and ingenuity - good old kiwi do-it-yourself - and that the financial incentives must be made bigger for the established well-to-do farmers because they probably have the least desire to expand output and add to their work load. Personally I think it is tragic that the resources for the job should become available when a man's enthusiasm is running down, and he is beginning to think that the time has come to take things a little more easily. In addition, this brings me to the matter of efficiency of investment, and I have the feeling that while the young farmer is only interested in expanding his output, the established farmer may be just as interested in easing the burden of the work associated with his present level of output. Given the same investment opportunities the two might well use their investable funds in different ways, and I am suggesting that the nation
probably gets a better return from the strictly production oriented investment of the younger lower-income farmer.

If we accept that lower-income farmers should be given at least as much assistance as those on higher incomes, the question immediately arises as to how this should be done. The simple answer is to replace a system which exempts certain approved expenditures from inclusion in taxable income, with a system which provides cash grants or tax rebates to assist in the financing of the same types of approved investment expenditures. A cash grant or rebate scheme would ensure that all farmers received the same level of assistance, say 40% of the costs, for approved investment expenditure. It would still be easier for the high income farmers to invest, of course, because it would be so much easier for them to provide their 60% of the cost. The system would be fairer than the one we operate at the moment, and would probably lead to more effective investment. If we assume that the lower income farmers invest the same amount as under the present scheme, there would be greater total investment on those farms where capital is in short supply and where it tends to be the resource which is limiting further expansion.

Whenever I have put this idea forward in the past, I have always had some members of the audience criticize it on the grounds that there would have to be a great bureaucracy to administer it and approve of all the expenditures. It is true that a government grant scheme could be administered in this way, but I fail to see why it must be. In order to qualify under our existing system of tax exemptions, investment expenditures have to be approved as being eligible, but this is usually done with the minimum of red tape, and I don't see why a scheme such as I am proposing should require any more administration than the system we have at the moment. If the new scheme were operated on the basis of tax rebates,
say $40 reduction in tax for every $100 approved investment, then approvals could be granted by the same officials, using the same procedures as at present. In any event, there are some additional advantages which could be associated with a grant or rebate incentive and these would more than justify an increase in administrative costs if this should prove necessary.

As the farm machinery, fencing materials and aerial top-dressing industries are only too well aware, farm investment fluctuates along with farm income, and there would be many advantages, both for farming and its related servicing industries and for the economy as a whole, from achieving a more stable level of investment. Using grants or rebates this could be encouraged by varying the level of direct assistance from year to year. We would range from say, 50-60% in years of low incomes when farm investment would otherwise be far below the desirable levels, to as low as 10-15%, or even zero, in years of high incomes when most farmers have both the incentive and the wherewithal to undertake investment, and farm supply industries are likely to be stretched to their limits. Under the exemption system, on the other hand, the government-provided incentive tends to have most impact just when it is least needed.

From what I have said, you will gather that I approve fairly strongly of the Livestock Incentive Scheme which was introduced last year. One can quarrel with the minimum level of stock increase required to qualify for the scheme, and the consequent bureaucratic involvement. Or you may argue with the fact that the tax exemption option can be slightly more profitable for the high income farmer than the grant option. But the principle of grant incentive has been established, and I hope we will see more of this type of scheme.
INFLATION PROOFED FINANCIAL ASSETS AND LIABILITIES

My second proposal involves something much more radical than the extension of a policy tool already adopted by Government. I believe that the consequences of its adoption would also be much more radical both for the farming industry and for the whole economy. There would be both gains and losses for the farming industry, and since you have nearly all gained under the present system I think your natural reaction will be to focus on the losses a change of system would bring. I hope though, that you will consider the proposal as a whole, including both the benefits and costs which could accrue to you as a farmer, before you make your final decision.

What I am proposing is that most financial assets and liabilities in the economy should be inflation-proofed. This is going rather further than the Committee of Inquiry into Inflation Accounting which reported to the Minister of Finance last September, but I think that their proposals would gain for us only some of the advantages which could be gathered from a fully integrated and comprehensive system of inflation accounting. I regard the Committee's proposals as only the first step towards protecting ourselves from the ravages of inflation; what I want to talk about is something rather further down the road.

The first effect on farming of inflation proofing, or indexing, financial assets and liabilities would be in relation to mortgages. You all know that under our present system of mortgages the borrower or mortgagor, borrows a certain sum of money and at the end of some period pays back the same number of dollars, regardless of the changes which may have occurred in the purchasing power of money between the borrowing and the time of repayment. I shall deal with the matter of interest rates in a moment, but disregarding them for the meantime, you will realise that during periods of inflation our present system of non-indexed mortgages
results in the transfer of wealth from the lender to the borrower.

Consider an example of a farmer borrowing half the purchase price of a $100,000 farm in 1970, on a flat mortgage.

Table 1

EFFECT OF INFLATION ON REAL ASSET VALUES

<table>
<thead>
<tr>
<th></th>
<th>1970</th>
<th>1975</th>
<th>1975</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property Value</td>
<td>$100,000</td>
<td>$200,000</td>
<td>$100,000</td>
</tr>
<tr>
<td>Mortgage</td>
<td>50,000</td>
<td>50,000</td>
<td>25,000</td>
</tr>
<tr>
<td>Farmer's Equity</td>
<td>50,000</td>
<td>150,000</td>
<td>75,000</td>
</tr>
</tbody>
</table>

If we assume that prices doubled between 1970 and 1975 we find that in the second year the farmer is still owing $50,000, the amount he borrowed in the first place, but this debt now represents only 25% of the purchase price of the farm, rather than the 50% it represented in the beginning. The farmer's equity has trebled to $150,000 over a period when prices have only doubled. In these circumstances we tend to say that the farmer has made a capital gain of $100,000. This, however, is a rather misleading way of expressing what has happened, because a large part of the farmer's apparent gain simply represents a change in prices which maintains the purchasing power of the farmer's equity. If we convert the equity of both the mortgagee and the farmer, as measured in 1975, back to what it would be worth in 1970 prices we get a better idea of what has happened. The mortgagee, or lender, is seen to have an asset which would purchase $25,000 worth of goods in 1970 prices. In other words the value of his equity has been halved, because in that year his equity would have bought him $50,000 worth of goods. Conversely, the farmer's equity has grown from $50,000 in 1970 to $75,000 in 1975 at 1970 prices.
prices, a real capital gain of $25,000 in 1970 prices, or $50,000 in 1975 prices. In other words, because the mortgage was not indexed in any way, there has been a transfer of purchasing power, or wealth, from the lender to the borrower. When the mortgage agreement was drawn up it was not suggested that the lender should only be paid back half of his capital, or that the lender should pay the farmer to come and borrow his capital, but in effect this is what has happened. Some of the unintended losses of capital in our society are the result of theft; many more are the result of mortgages which take no account of inflation.

Preliminary estimates suggest that for one major farming group, current taxable income has represented an average 3% return on the current value of the assets employed over the last decade, but the non-taxable capital gains averaged 9% per annum. Farmers with investable funds have therefore been encouraged to invest in the acquisition of more land, rather than to employ those funds in increasing the productive capacity of their existing holdings, because land ownership has been more profitable than the business of farming. The leverage which can be obtained from the use of borrowed funds has meant that some farmers have made very substantial capital gains indeed. I fear that some of the farmers who have been seeking to maximise their capital gains in this way are the counterparts of those who in the 1950's and 1960's led the way in the innovation and adoption of the new techniques which led to such impressive increases in production. I suspect that the attention of some of our better farmers has been diverted away from farming for current output, to farming for capital gains. In saying that, I do not want to suggest that I blame them in any way; they have been acting in the best way that they could find to achieve their economic goals under the existing system. What I am suggesting is that the system should be changed.
If farm mortgages were indexed, so that the value of a farmer's liabilities increased in line with either general inflation or land values, the capital gains to be made from the purchase of land with borrowed finance would be greatly reduced. In the example I gave earlier, if the mortgage had been indexed, and risen to $100,000 by 1975, both the lender and the farmer would have kept their capital intact, but there would have been no "real" capital given. Under these circumstances a farmer's accumulation of capital would be more closely related to his ability to save out of income, thus increasing the attractiveness of current income compared with capital gains, which I feel is just the type of change we need to encourage at the moment.

So far I have ignored interest rates. We hear many complaints these days about the high level of interest rates at the moment, but I presume you are all aware that at any rate of interest below the rate of inflation, the real return to the lender is negative, and he is, in effect, paying to have someone borrow his money. If the rate of inflation is 15%, then the rate of interest needs to be at least 15% if, at the end of a year, the principal sum lent plus interest is to have as much purchasing power as the original sum lent. The rise in interest rates over recent years is directly attributable to the increase in the rate of inflation. Lenders want to be sure that the returns they get will at least come close to preserving the value of their capital, and if they cannot get that assurance they are likely to spend the money, thus causing a shortage of investment finance and thereby forcing up the price - that is, the interest rate. The fact that interest rates have fallen behind the rate of inflation is attributable to a number of factors, particularly the expectation that the rate of inflation will be reduced. With the Government talking of inflation rates below 10% by the end of 1977, somebody lending money at 12% now can comfort himself with the thought that he may be losing money this year, but he should be getting a positive return next year. In this
regard I must say I thought it a rather ominous sign when I heard at the beginning of this week that the biggest finance company in the country is offering three-year debentures at 13%.

Because the current high rates of interest reflect the desire on the part of lenders to preserve the value of their capital, it is obvious that interest rates could be very much lower when the capital was being protected in a different way. I should think that an appropriate return on an indexed mortgage would be about 2-2½%. Imagine what this would do to the cash flow on heavily mortgaged farms, where debt servicing is one of the major costs. Since the heavily mortgaged farms, are often those of the keen young farmers I was talking about earlier, higher net incomes after debt servicing should encourage a faster rate of growth of output, by providing more resources to be ploughed back into the farm at the beginning of a farmer's career.

Some of the people to whom I have spoken about the idea of indexed mortgages have expressed the fear that you would never get it paid off, because it would just be getting bigger each year, but this is not so. If you pay nothing off the mortgage it should stay a constant proportion of the purchase value of the farm - it certainly does not grow faster than the value of the farm so that eventually it swallows your equity. If you pay anything off the mortgage, then it must decline as a proportion of the value of the total asset, and I have worked through an example of a 25 year table mortgage, assuming an inflation rate of 10%, just to assure myself that the debt is eventually extinguished in the normal way. Assuming a continuing high rate of inflation, then eventually the cost of servicing the indexed mortgage rises above the cost in dollars of servicing a non-indexed mortgage with a higher rate of interest. But it is a crucial advantage of the indexed mortgage that it gives the borrower a higher net cash income
Table 2
REPAYMENT OF INDEXED MORTGAGE UNDER SIMPLE TABLE SYSTEM
(Constant 10% inflation rate assumed)

<table>
<thead>
<tr>
<th>Year</th>
<th>Opening Balance</th>
<th>Interest @ 2%</th>
<th>Repayment @ 4% of Real Value of Sum Lent</th>
<th>Inflation Factor @ 10%</th>
<th>Indexed Value of Loan at End of Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>1</td>
<td>50,000</td>
<td>1,000</td>
<td>2,200</td>
<td>5,000</td>
<td>55,000</td>
</tr>
<tr>
<td>2</td>
<td>52,800</td>
<td>1,056</td>
<td>2,420</td>
<td>5,280</td>
<td>60,500</td>
</tr>
<tr>
<td>3</td>
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<td>1,113</td>
<td>2,662</td>
<td>5,566</td>
<td>66,550</td>
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<tr>
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<td>58,564</td>
<td>1,171</td>
<td>2,928</td>
<td>5,856</td>
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<td>5</td>
<td>61,492</td>
<td>1,230</td>
<td>3,221</td>
<td>6,149</td>
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<tr>
<td>6</td>
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<td>3,543</td>
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<tr>
<td>7</td>
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<td>1,346</td>
<td>3,897</td>
<td>6,732</td>
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<tr>
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<td>4,287</td>
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<td>5,706</td>
<td>7,781</td>
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<tr>
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<td>6,277</td>
<td>7,989</td>
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<td>6,905</td>
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<td>7,595</td>
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</tr>
<tr>
<td>15</td>
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<tr>
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<td>716</td>
<td>19,699</td>
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<tr>
<td>25</td>
<td>19,696</td>
<td>394</td>
<td>21,669</td>
<td>1,970</td>
<td>541,735</td>
</tr>
</tbody>
</table>

In interpreting this table it is important to remember that the $21,669 repaid in the last year has the same purchasing power as the $2,200 paid in the first year. If all prices were rising at a steady 10% the burden of repayment would stay the same throughout the 25 years whilst the burden of interest payments would be reduced over time.
in the earlier years. If the rate of inflation were to slow down, then the cost of servicing an indexed mortgage would remain low, and this is another crucial advantage. Since the War, borrowers have gained from our existing system because there has been a general tendency for inflation to accelerate, and interest rates have lagged behind this acceleration. People who now have mortgages at 10% would be paying very dearly for the privilege if the rate of inflation fell back to 3 or 4%. An indexed mortgage deals relatively fairly with both the borrower and the lender regardless of the rate of inflation.

From the point of view of the working farmer, then, the indexed mortgage takes away the capital gain to be obtained from using borrowed funds to purchase an appreciating asset, and gives in return a higher cash income just when it is likely to be needed most.

There are, however, other advantages to be obtained from such an indexing system. If lending institutions have the value of their loans to farmers, or any other sectors of the community, protected by indexing, then they can afford to protect money deposited with them in a similar manner. At the moment, young men saving for a farm are often disheartened by seeing the price of land rise faster than they can accumulate a deposit. If their savings were indexed, however, the rate at which the down-payment for a farm could be accumulated would be solely related to an individual's willingness to save, and would be no longer governed by the chance circumstance of whether he happened to be saving during a period of stable, or rapidly increasing, farm prices.

Some farmers have told me that they need their capital gains because in effect this constitutes their superannuation fund. I accept that there is some validity in this argument under our present system. They get such a poor deal from their life assurance policies, and this is inevitable when the
assurance companies lend out so much of their money (not altogether by choice) in non-indexed loans of one sort of another. Farmers as a group spend a lot of money on life assurance, and as savers and lenders in this way they lose through our present system, just as they gain as borrowers. Indexing of loans would mean that savings accumulated through life assurance for superannuation purposes would be protected from losses through inflation, and the funds available from this source at the time of retirement would more closely reflect the farmer's willingness to save during his working life.

One final point. In any system of indexation of financial assets the choice of index is of vital importance, especially if there are likely to be any relatively large price changes. Because of the make-up of the New Zealand economy I do not think that farm mortgages could be linked to the Consumers' Price Index. It would be more realistic to have an officially prepared farm land price index, or even better, regional indices. Young farmers with funds deposited with, say, a revamped Rural Bank, would have their funds indexed by the average of all the Bank's mortgages outstanding. In some ways the farm sector would be differentiated from the urban sector with regard to mortgages, which is why I would like to see the Rural Bank accepting deposits from aspiring farmers in order to ensure that these savings would stay in step with the prices of the land they are designed to buy.

SUMMARY

To sum up, I have suggested that investment incentives based on tax exemptions should be replaced by incentives which involve grants or tax rebates. I have also tried to make the case for the inflation-proofing or indexing of financial assets and liabilities in the economy, and I have drawn out the major implications for the farming industry. I have suggested that
grant incentives and inflation-proofed mortgages would have the effect of making more finance available where it will have most effect in increasing agricultural output.
One of the basic tenets of the National Government is a fundamental belief in the private ownership of land within a property owning democracy. The opportunity to own a property, whether this be house or farm, is the right of all New Zealanders. Our land settlement policies have been framed accordingly - our aim is to establish young farmers on to farms and a two-pronged or "dual" system of land development has evolved. The Department of Lands and Survey ballot system has been coupled within the provision of special settlement loans by the Rural Banking and Finance Corporation.

This year, for the first time since 1966, the number of farms settled with government assistance has passed 1,000; in fact, for the year ended 31 March 1977, a record 1,035 farms were settled using funds from the Rural Bank. The Government is also committed to a policy of increasing the settlement programme of the Department of Lands and Survey. Current economic restraints have meant a reduction in the number of farms offered for selection compared with previous years; however, the Government is conscious of the keen demand for farms under this scheme.
AGGREGATION OF FARMLAND

Historical background

For all New Zealanders to have the opportunity to own property it is necessary to have restrictions that prevent undue aggregation. Such restrictions are not new - they date back more than a hundred years. In the earliest years of planned settlement, attempts were made to put into practice the colonising theories of Edward Gibbon Wakefield. This involved charging "a sufficient price" for land. Governor Grey initiated a policy of providing cheap land for settlement and, in time, the concentration on pastoral farming brought about the problem of undue aggregation of farm land. In the 1880s the Liberal Government adopted a policy of closer settlement designed to aid the establishment of small farmers. Since then, land settlement policy has been based on the principle of "one man - one farm".

Land legislation has been directed towards closer settlement of farmland and the prevention of undue aggregation. In 1882 John Ballance, later to become Minister of Lands and Prime Minister, produced a pamphlet called "A National Land Policy". In this he advocated limiting the undue aggregation of land by private monopolists. In an effort to break up the big holdings "King Dick" Seddon introduced a land tax.

But the earliest attempt at really controlling land aggregation was contained in the Land for Settlement Act 1892. This act allowed the Government to buy back large estates for subdivision and closer settlement. This act provided for the appointment of a Land Purchase Board which was to inspect and report upon private freehold land which had been offered to the Government for sale. Land which the Board found suitable for subdivision
and closer settlement, could be purchased by the Crown and offered for selection under the lease-in-perpetuity tenure, with the area being limited to 129 ha. However this did not prove workable, and before it was operated the Government passed legislation permitting the purchase of the 34,500 ha Cheviot estate in the South Island. This was subdivided and eagerly taken up, its settlement was a conspicuous success and showed that the Government was acting on the right lines.

The Land for Settlement Act was improved in 1894. New provisions enabled estates of land to be taken compulsorily if the owners refused to sell, with adequate compensation to be awarded by a Compensation Court. In later years the purchase price was determined as the unimproved value of the land, as given in the Government Roll Valuation. This Act was consolidated in 1900 and 1908 with principal amendments providing for the offering of subdivided land on optional tenures. Generally speaking this legislation was most effective in providing for closer settlement. By 1924 some 625 estates, containing 801,300 ha had been acquired and subdivided to provide 8,620 individual holdings. The first attempt to control land aggregation by restricting the purchase of private land was the Land Laws Amendment Act passed in 1907. This Act imposed restrictions on the subsequent resale of land which was acquired from the Crown after 20 November 1907. It controlled the acquisition of such land to ensure that the purchasers total land holding did not exceed 5,000 ac. (2,023 ha). Subsequent land acts contained similar provisions.

However it was not until 1952 that the Land Settlement Promotion and Land Acquisition Act attempted a more equitable method of controlling land aggregation. This Act tackled the problem from an economic viewpoint, not an area basis. The Act considers undue aggregation to occur where a purchaser already owns sufficient farm land "To support ... his wife and such of
his children as are dependant on him in a reasonable manner and in a reasonable standard of comfort..." However, since 1952 there have been nine Acts amending the provisions of the principal Act and this has not helped the situation.

Present Situation

In 1975 Labour introduced the Land Settlement Promotion and Land Acquisition Amendment Bill 1975. Part II of that Bill related to the undue aggregation of farmland. Specifically, there were four amendments relating to the control of sales and leases of farmland to prevent undue aggregation. The first amendment was to repeal the present legislative provision permitting a ten man company to acquire farmland with the court's consent. The second was to provide that a 25 percent or more interest in a farm owning company, will be treated as individual ownership of land. The third to provide that the control of shares be monitored through the company share register. We decided instead to review the legislation with a view to introducing a consolidation Bill. To this end I have sought the opinion of the farming sector - just as my colleague Duncan MacIntyre did when he was Minister of Lands. In an address he gave to the Provincial Conference of Waikato Federated Farmers in May 1971 he referred to the problem:-

"Today, with the many amalgamations, with company farming now legal and the move to larger units, the legislation makes unnecessary work and expense and does not seem to achieve anything. I have spoken of this review to groups of farmers so that I may learn their views."

That was six years ago - I will need to have more success than he did. In response to my request, further submissions on the removal of the ten man company loophole and other matters have been received and these are now being evaluated. Unfortunately, these submissions do not always make the task easier; in fact, they sometimes make it considerably more
difficult. There is, at the moment, concern about the control of land being acquired for forestry purposes. This is, I acknowledge, a contentious issue that has been causing interested parties concern for some time. The Land Settlement Promotion and Land Acquisition Act 1952 does not impose direct control over the aggregation of land for forestry purposes. This is, I believe, an issue of land use rather than the aggregation of farm land. It may well be that this Act is not the appropriate place for controls of this type. However, this is not the most appropriate place to go into these details. What is needed, and what I appeal for once again, is a firm view representative of the farming sector. Consolidation will greatly affect the farming sector - the farming sector must face the challenge of helping to determine what it wants.
My task is to summarize the present situation on labour and social relations in our rural areas. Few topics are so difficult to assess but none are more important.

Of the factors of production none is so important as the human one. In 1921 the Census of Population records that the number of persons engaged in agriculture totalled 127,000. Today, fifty seven years later when farm output is over three times as great as in 1921 the on-farm labour force is still the same. Capital investment in the form of new machinery and equipment, combined with new techniques, better animals and pastures, agricultural chemicals, weedicides, fertilisers, and animal remedies, have enabled this higher output to be achieved. Farm staff have also made their contribution to this increased productivity. But while the on-farm labour force has been static the group of workers who live away from the farm, including the contractors of various kinds, have increased significantly.

LABOUR RELATIONS ON FARMS

The statistics show that farms have continued to attract annually a large number of new entrants. Retention of these
people after their training period has been a major problem. Mobility of highly trained farm workers has been one of the major problems rather than urbanisation of farm workers.

Although statutory regulations governing wage rates and conditions for farm staff have only recently been renegotiated after a lapse of many years, the new provisions may only confirm changes that have long prevailed. Indeed if a farmer had not updated wages and conditions it is doubtful, especially in a situation of over-full employment, whether he would have attracted and retained his staff.

IS THERE A SHORTAGE OF FARM STAFF?

There is inadequate data to answer this question. It has long been the case that there is a wide gap between the need for additional labour on our farms and the demand for such labour. Many farmers emphasise from time to time that they will engage well trained staff but they demur at the prospect of engaging an untrained applicant.

Over the last decade or so some significant developments have occurred in the field of training for agriculture. The farm cadet scheme has been established and expanded while many of the existing institutions have expanded their facilities. The Agricultural Training Council (A.T.C.) has been established to co-ordinate the various services and ensure that the facilities are adequate to meet the needs of the industry. It has appointed field staff to various regions and the whole subject of labour relations on our farms is being discussed much more openly in various forums. The A.T.C. has already had an impact but despite the important progress that has been made in farm training and labour relations, much remains to be done. Few of our farming leaders would claim that there is justification for any pause in the efforts being made to
improve the skills of the farm labour force and the promotion of a high standard of staff relations on our farms. Our farmers have achieved international repute for their efficiency but few would claim to have received special tuition in personnel management.

Modern agriculture is becoming increasingly complex and it demands highly trained personnel. To retain these people will require financial rewards and conditions of service at least equal to those available in other sectors. Many of our farmers already offer such regards and conditions of service for high quality staff. They recognise that as the Inland Revenue Department shares a large part of the additional costs, the net cost is not nearly as great as it would appear.

In 1964, Federated Farmers negotiated a Farm Workers Superannuation Scheme with the National Provident Fund. The response has not been great - a mere 2,000 having joined since that time. Little progress appears to have been made in the establishment of a house ownership scheme for farm workers. On the other hand the Government has introduced a savings scheme for those who aspire to farm ownership. Its value to young would-be farmers will depend on the success Government achieves in its battle with internal inflation in general and land values in particular.

SOCIAL RELATIONS IN RURAL AREAS

In recent years there has been a veritable flood of discussions and ideas on this topic. These debates have been precipitated by the realisation by the rural community that the country areas are suffering as a consequence of the accelerated rate of farm amalgamations, the declining political influence of the rural vote, government economic policies and the effects of farming's adverse terms of trade.
An excellent survey was conducted by the staff of the Department of Sociology, University of Canterbury, in conjunction with the Women's Division of Federated Farmers. In the introduction to the report the authors commented:

"Indeed, we found a relatively high level of satisfaction with life generally, which indicates a happier rural population than we had expected to find".

However the comment was then made that:

"The vast majority found satisfaction in aspects of life that are common to urban and rural life, such as family, friendship, hobbies, sports and gardening, so we are not entirely convinced that rural women are more satisfied with their lot than are urban women, although that is certainly suggested by much of the information we have collected".

The report emphasised the high level of participation of rural women who undertake voluntary community work. This is an important part of their social life and is, I believe, an outstanding characteristic of social life in our rural areas.

Notwithstanding the findings of this valuable survey there are indications that there are areas of concern regarding social relations in rural areas. They refer in part to attitudes towards urban dwellers and also employer-employee relations and relative status of employers and employees.

Today the New Zealand economy is passing through a difficult period despite the substantially increased export earnings of the farm sector. These earnings would have been very much greater if farming had not been suffering from a stagnation in its output over almost a decade.

Many have sought to identify the reasons for the static output. Although it is undoubtedly linked with climate and inadequate residual income for reinvestment, there are other factors.
One of these is, in my view, farmer attitudes to expansion. These attitudes have various origins. Some lie in the treatment meted out to farmers by governments, others lie in the failure of farming to maintain its relative income position in the community during a period of unprecedented internal inflation.

Some of the reasons for particular attitudes to expansion may be found in the factors that motivate farmers. In this regard it is of interest to note that initial analysis of the responses to the '1977 Lincoln College Farmer Intentions and Attitudes Survey' discloses that many farmers place great emphasis on farming as 'a job that offers a sense of fulfilment or satisfaction'. Those farmers who rated this aim highly, regarded the aim of farming 'as a source of income,' for example, of lesser importance.

One must ask "To what extent are changing social values in our rural areas affecting attitudes to output expansion?" Also, if policy makers are seeking an expansion of farm output - and in New Zealand's current situation this would appear imperative - it would seem that greater recognition will have to be given to the major factors motivating farmers.

There are other matters that have an influence on levels of output from our farms. They include the attitude of women in rural areas. The traditional work ethic is now being replaced by other value judgements. Leisure and recreation now assume greater importance in farming families just as they do in urban communities.

In recent years considerable attention has been given to the social factors that influence the attitudes of the families of farm staff towards life in rural areas. Can we identify the key elements that ensure contented families identifying themselves closely with the future of the farming industry? Also, what of the attitude of urban dwellers to the farming
sector on which their prosperity rests? Are there policy areas where adjustments could be made that would ensure that farming gets much more active and sympathetic support from the urban sector? Changes are occurring in rural as well as urban society in New Zealand and further changes must be anticipated. Rural dwellers are not afraid of change as farming is a process of continual adaptation. What is essential is that in the process of change the rural sector is given the resources to adapt successfully and emerge even stronger from the experience.

Let me conclude with a shopping list of items that have arisen as a result of my having to prepare this brief talk.

* I consider that the aims and activities of the Agricultural Training Council should be reviewed and researched before its activities are expanded further.

* I would like to see those servicing industries whose profits derive from the farming industry - the insurance companies, transport companies, banks, stock and station agents - make a greater contribution to the social, recreational and cultural life in rural areas.

* I am concerned about the low participation rate of our Maori people in rural organisations and in the leadership of these organisations. Research is needed to identify the causes of this state of affairs.

* I believe more resources must be directed into the crucial area of rural leadership training. Here I am convinced the new Rural Development and Extension Centre at Lincoln College has a vital role to play.

* Rural people are not 'cultural philistines'. They are interested in cultural activities. How can more of these be made available to them?

* There is an urgent need for research into farm labour in New Zealand, particularly ways and means by which
the farming industry can exert a greater corrective influence over factors causing the high mobility of skilled farm workers.

* We urgently need a New Zealand equivalent of America's Lady Bird Johnson to launch an operation for 'The beautification of our rural areas'.

* I believe that if the rural community in its efforts to retain and expand amenities in rural areas is to gain more support, the legislation relating to the rights of urban people to erect dwellings in rural areas must be reviewed.

* There is a need for a national survey of those who work on our farms to identify the particular health risks to which they are exposed.

Finally, if I were asked to sum up the situation in a few words, I would assert that there is much in the area of rural labour and social relations that can be regarded as satisfactory. But there are also some areas where improvements could be effected.
LABOUR AND SOCIAL RELATIONS IN RURAL AREAS - DISCUSSION

Following the introductory comments by Mr. J.G. Pryde, five selected people with experience in the area of labour and social relations were invited to answer a series of questions—questions that had been given to them some time before the Conference.

These questions and the answers given are printed below.

Members of the panel represented a wide cross section of opinion and included (in order of speaking)

Mrs. G.L. Kingsbury, Mid Canterbury - a farmer's wife.
Mrs. H. Ellis, Hawkes Bay - a farm manager's wife.
Mr. D. Hedderwick, North Canterbury - president, New Zealand Farm Worker's Association.
Mr. G.B. McLeod, Lincoln - recently retired Lincoln College staff member and closely associated with College entrants and farm cadets.
Mr. D. Lloyd, Wellington - author of the 1974 report for the Agricultural Production Council
It has been said that until the farmer's wife is taken into partnership the lot of the farm worker's wife will be a feeling of isolation. Any comments?

I do not think that taking a wife into partnership would have any marked effect on the isolation that many farm worker's wives feel. But I think that it may be a step in the right direction. Until such time as farmer's wives have an actual working partnership or have a set wage I feel that there is little that can be done to make farm worker's wives feel that they are needed. Because there are so few employment opportunities for women within the rural community, the farmer's wives become more and more involved on the farm. This has been adequately shown in the recorded increase in women working on farms and a decrease in the number of men. But these opportunities are not always open to the farm worker's wives; therefore it is over to the farmers and their wives when having discussions on management, to try and find some opportunity or opening for the farm worker's wife. I think that the farm worker's wife must be sufficiently motivated herself to want to be a member of the farm staff and the rural community. Too many farm worker's wives come to the rural communities and expect the opportunities to be there for them. I feel that they have to go out and look for the opportunities. One farm worker's wife in our district advertised for work. The result was quite a number of offers of work ranging from housework to outside work. I also think it is most important that women coming into the rural community learn to drive. I was astounded that one woman in ten in the rural community cannot drive.

* What is your assessment of the present labour relations on our farms?
I would consider that the present farm labour relations are good in about 80% of the cases. However there are other people who cannot keep men. I consider that these farmers
should take a very close look at their farming pattern, change their method of farming if possible or employ casual labour. These few cause a great number of employees to leave the industry and I don't think the industry can stand this continual loss. Farmers are not very good at managing labour generally, and I consider these employers who cannot retain labour should be identified and encouraged to participate in labour relations workshops and if these people continue to be the cause of skilled men leaving the farms, I think they should be actively discouraged from being able to employ men. During an economic downturn, some farmers dispense with labour or treat it as an expendable commodity. This has a very detrimental effect on labour relations and I think that in these conditions it is over to the Government to help farmers to retain labour during these times. I don't think the problem is so much with recruiting farm labour as it is with trying to keep the skilled and semi-skilled men from leaving, and there are many causes.

First I think that because of the rural education facilities, many men leave farming when their children reach secondary school level. By this stage they have usually been on farms for some considerable time and are in the skilled and semi-skilled class. Another factor is job satisfaction and the status of many farm workers. Medical services in some country areas are also very bad and as farmers and farm workers work particularly hard they have more than their share of ailments such as backs and hips. The social amenities are also bad in some areas - this applies particularly to single men. It has been suggested that we employ more girls especially where there are a lot of single men in the district. I think that this is one point that could be looked at.

* In what ways can the farmer's wife contribute towards a happy and contented farm staff? A farmer's wife must be prepared to accept a dual relationship
if she is to contribute to a happy and contented farm staff. She must be happy and contented herself; she must have a happy family life and be contented with her lot in the rural area. I consider that the farmer's wife - the wife of the farmer who is actually employing labour - must have an active working knowledge of the farm and if possible have a proficiency in some of the farming skills so that she can appreciate the work that is required and also know the standard that is required on the farm. Farmer's wives are renowned for the material comforts that they give to everyone who comes in. I think this is very well accepted - this being one way a farmer's wife can help. On the other hand there are many wives who interfere with employees and this causes a lot of dis-satisfaction. A farmer's wife must learn not to interfere with the employee's wife and family - she must be a friend and give advice when asked.

MRS. H. ELLIS

* If you were asked to summarise briefly the advantages and disadvantages of being a farm worker's wife in a rural area, what would your list contain?

I think that a farm worker's wife has a unique opportunity to join in her husband's work. Unless you are in some self-employed business it is not very often that you have the same opportunity of joining in this work. Some women find that it is much more comfortable for them and their family living away from the social pressures of town; it is also a very healthy environment in which to bring up children if you can afford to provide them with the educational and cultural advantages of town as well as the advantages of the country. The biggest disadvantage is that we have to live in houses that don't belong to us. I don't think that any farm owner or his wife could even begin to understand what this means to the farm worker's wives, who because of their husband's
occupation, have to live in houses that don't belong to them. If your husband loses his job - maybe through reasons not of his own making - you lose your home as well. The free house is not a 'perk', it is a liability. The farm owners should be paying or helping to pay into some sort of fund for farm workers to buy their own houses on retirement rather than offering free houses as a 'perk'.

The economic gap between the wives and families of farm owners and farm workers is a pretty wide one unless the farm owners happen to be going through a very bad economic period. This economic gap in turn creates a social barrier - it can't help but create a social barrier. An example is, perhaps, being asked in for a drink in a farm worker's house. You would be offered beer or sherry, no range of spirits as you would probably get in most farmer's houses. Having to use a car every time you go out and not being able to afford to do all you would like to do is another great disadvantage. We simply can't afford to run cars everywhere we would like to. Lack of job opportunities has already been mentioned and it is of course a serious problem because many farm worker's wives would like to work not only for the money but also for their own edification - especially as we don't live in our own houses.

Lack of educational facilities has again been mentioned and this is of course difficult for everybody.

Isolation is also difficult for farm owner's wives as well as for farm worker's wives. I think mental stagnation or isolation is one of the biggest problems to meet. I didn't realise, until I went back to work, how much my mind had slowed down.

* What positive steps would you put forward to overcome these disadvantages?

The area of greatest concern is housing. The average farm
worker is not paid enough to save a significant amount for a house on retirement. For exactly the same reasons we can't save enough to buy a farm. Probably we would have to put up no more for a farm than we would for a house so it is the same problem. Various points have been put forward to solve the problem of buying a farm but the problem would be overcome to a great extent if the Government could be persuaded to remove the residential clause on low interest rate housing loans so that farm workers could purchase houses at the same low rates of interest as are available to town workers; they could then let them until such time as they are needed themselves. It does not matter whether it is in North Cape or Bluff, it is the fact that you own a house.

* Compare briefly your lot as a rural wife and mother with your situation if your husband was an employee of a firm in an urban area such as Christchurch, Wellington or Auckland.

If my husband was an employee in an urban area we would own our own house - there would be no doubt about that. By this I mean we would have our house and be paying off a mortgage. Our car expenses would be greatly reduced. I would find it easier to return to my profession as a secondary school teacher and the children would have better opportunities to join a swimming club, Guides, cultural groups and all the opportunities available to children in the town. They would have no bus trips to school and better sporting opportunities after school. The availability of baby sitters would make it possible for my husband and I to follow common interests in the evenings. In the country, apart from the very odd evenings, we find it is almost impossible for the husband and wife to go out together. I think that it is most important that husbands and wives are able to do things together - things like drama clubs or even the occasional evening at the hotel. Apart from the fact that in some cases, depending on the attitude of the farm owner, the husband and wife can work together on the farm the social opportunities of doing things
together in the country are practically nil.

* Should we disregard 'perks' and have them converted into equivalent cash so that it would inflate the nominal income of the farm worker? Let me discuss this from the housing viewpoint. Houses are not a 'perk'. The free house may not in all cases be considered by the farm owner to be a 'perk', but a lot of farm owners would justify paying lowish wages saying "Well, they get a free house". I dispute this by saying that the free house is not a 'perk' - it is a liability to us, and we would much rather live in our own home even if we had to pay heavy mortgage repayments to do so.

MR. DAVID HEDDERWICK

* What are the main areas of concern of your Association in the farm employment area? At the moment our basic concern is one for the Association itself. It is for farm workers to have a voice and I think that it is important that they should have one. This voice must be recognised, and I hope that Parliament will consider legislation to do this within the next few weeks. At the moment, in whatever area we have dealt with, we have come up with the same question. "Are you recognised by Government?" "Have you legal standing?" and the answer always had to be an equivocal one. We are told we are recognised but we have nothing on paper and no legislation.

* In 1964 Federated Farmers negotiated a superannuation scheme. What is your Association's assessment of the value of a pension scheme. Why have so few enrolled in the National Provident Scheme and what improvements would you suggest? The question of superannuation obviously is a very important item in stabilising the work force and giving them the sense of security. In retirement you would have a substantial sum
available for housing and for setting up a new home away from the farm. You won't just be another cog on the pension line. To illustrate this; when the Labour Government brought in their compulsory superannuation our Association put up their own alternative scheme which was in many ways much preferable to it. After a lot of hard bargaining we got a scheme which was very much better and I think it has been fairly favourably received, in that people who have actually joined it haven't got out. When the National Government enabled people to leave superannuation schemes there were a large number who left other schemes. In ours though, only three or four left, and they were those who were leaving the country or leaving farming. Farm workers hope for some large sum to re-establish themselves away from their farm cottage, but as in all schemes it takes two people to agree. You have to have the agreement and intention of the farmer and of the farm worker. One of the reasons I think that some of the farmers are slow to take such an opportunity up is mobility; the fact that the farm worker will not be seeing out the rest of his time until retirement on that particular farm. These schemes are strictly mobile and I take it that the National Provident Superannuation Scheme would have been mobile as well, meaning that you take it with you from farm to farm. Now on each farm you go to, you are left to re-negotiate - to go to your employer and seek his agreement to participate. Quite a number of farmers have come in to ask my advice and I hope a lot more will. When the question of mobility is settled and the farmer settles down happily with a man he gets on well with, I think a great many more farmers will be willing to invest in a scheme of this nature.

* Do you think, in the light of the National Government Superannuation Scheme, that farm workers are now interested in contributing to their own superannuation scheme?

I think that the fact that they are not showing any signs or desire to leave is certainly an indication of this.
You must remember though that there are perquisites that come up in the relationship of farmer and farm employee. The great weakness of 'perks' is that if you have an accident, accident compensation does not consider them when they pay 80% of your income, and I don't think that the National Government proposes to include them in it's pension assessment.

The pension would be considerably less than that of an urban worker who is on a salary and receiving all his income in the form of salary. The farm worker will find himself very much below the level of everyone else in the same situation on retirement.

* Termination of employment is always a delicate area. Does your Association have any suggested guidelines that would make such events smoother and more acceptable?

We have terms of employment set by Order in Council. Until these were done we were subject, as farm workers, to summary dismissal and one could be asked to leave one's job and house at a moment's notice. The purpose of such terms of employment, as we set them out, is not to police the majority of farmers because the relationship is usually good. It is to form a base from which the bad employers are prevented from discouraging people from leaving the industry precipitately. The farm worker knows that when he goes to a job he will get a certain consideration on termination. At the moment we have negotiated at least a week's notice and a further week for use of the house and facilities. I would like to see this term extended but there are problems; for example, when a man is leaving, the house is required for another to move into immediately. I would like to see recognition for long service built into our scheme. Quite a number of farm workers are stable and work on a farm for a great number of years. A great many farmers give recognition and we are grateful for it but every farm worker should know that he will get consideration for long service.
* What are some of the other major issues that your Association is putting forward in the interest both of the young married farm employee and of the unmarried farm employee?

Housing is something that everyone feels very strongly about. We as an organisation, together with Federated Farmers' and their new rural development committee have put forward a number of recommendations to Government. We have been told that there will be changes in the Housing Corporation regulations on residential requirements for people living in farm houses, possibly in the coming budget. However as yet no-one is in a position to tell us exactly what these are.

I feel that it is unlikely to be satisfactory and eventually we will have a whole battery of schemes. A great many farm workers are horrified by the thought of becoming landlords, especially with a house situated miles away from town. We have suggested an index system to the Government for a housing savings scheme for people who are disinclined to become landlords.

* Should we disregard 'perks' and have them converted into equivalent cash so that it would inflate the nominal income of the farm worker?

A lot of farm workers value the right to 'perks' very highly. My opinion is that the liabilities, overall, outweigh the advantages. The problems of assessing a true wage when you have an accident and need accident compensation or when you retire and want to assess superannuation are very great. I imagine that in the future the Inland Revenue Department will probably assume a certain level of 'perks'; anything over and above this would be negotiated on the side, as is done at the moment. The majority of our members would prefer the situation as it is at the moment; probably the majority of our management committee would feel the other way having looked at it more closely.
The clergy has a contributory syndication of assets through property of some kind. Has the Farm Workers' Association given consideration to the possibility of a contributory syndication of property with negotiable shares?

No, but it is a very interesting idea. The sole move that we have made towards housing finance is that our superannuation scheme fund will, when it is large enough, be made available to members for mortgage finance.

MR. G.B. MCLEOD

What changes have taken place in farm employee training over say the past 10 years. How would you assess the effects of these changes?

There has not been much change in the last decade. I have attended meetings of farm cadet committees for 30 years and feel that after this time we are doing no more for them than we were 30 years ago. This is not great progress, but there are signs of improvement. Farm cadet committees and their field officers are giving the cadets a greater sense of 'belonging' - a sense of belonging to an organisation that is concerned with their welfare. As far as farm workers in general are concerned I do not believe we have done very much.

If you were asked to prescribe a positive measure to retain more people in the farming industry what would be top of your list?

Money - the average married couple working on a farm earn, on average, $5,000 and 'perks'. Add to the basic wage the amounts of $1,000 for rent, $500 for meat, $100 for firewood which may or may not be available, $200 for milk (allowing 5 pints a day) and $200 for telephone and electricity we arrive at a gross figure of $7,000. A man in the city would have to earn $8,000 because 'perks' are not taxed; but it is not difficult for a skilled person to earn $8,000 - or more!

Let me ask all farmers whether they are paying their employees
the amount they would have wanted for themselves at a comparable age.

Perhaps farmers tend to forget that inflation rates are lowering the cadets and farm worker's wages. Often the farm worker's son who goes out into other work can bring home more money than his father who has worked all his life on farms. His father may even have managed a farm while the owner was away for a couple of years. You can therefore see why there is discontent among the farm workers today. 'Perks' do not make up for the lack of money which the employers fail to pay and more discontent comes about when farmers are seen to take trips overseas while still withholding the raising of the average wage of a farm worker. I feel sure that if they were to raise their wages they would be able to hold their farm workers and have more harmony on their farms.

* Are human relations as important in agriculture as in industry. Can they be imparted and what changes would be needed in the present institutional framework of the rural sector to effect any improvements that may be considered necessary?

In an on-the-farm situation with a farmer who is steeped in his ways there is very little that can be done to change the human relations problem. He doesn't communicate with his employee; very often he grumbles about the bad things, forgetting to give encouragement when a good job has been done. Farmers tend to regard pre-Lincoln College students on the other hand, in a different light. They know they are studying and tend to give praise and encouragement - but they forget about the farm worker. From my experience as a field officer it seems that when a rift develops it cannot be mended easily and it is wise for the farm worker to move to some other place.

I believe that it is necessary to decentralise and get organisation into the different areas where young farm workers can meet, discuss problems and have social meetings - where they
can enjoy the company of other young workers.

The educational side should be covered by some local assignments which would go out to the homes where all involved could gather and discuss the questions - perhaps even the farmer would find it of interest. These assignments should be on a local basis and relevant to the area.

MR. DAVID LLOYD

*If you were writing your report, not in 1974 but in 1977, what in fact would you include?
The task that I was given in 1973 was to prepare a report in which I brought together all the studies and tied up the information that was available at that time on the rural social scene. The focus was particularly on the farm labour force. I did not wish to make recommendations from myself but from the rural community itself. No sooner had I finished the report than the Government of the day decided to phase out the Agricultural Production Council!

The report focused on two points. Firstly it looked at the inadequacy of available information. Up until 1970 we counted the livestock every year but we only looked at the number of farmers and farm workers every 5 years!

Focus on the trends within the rural community was the second point considered. We knew there had been some loss between 1961 and 1971 but in 1971 there were still the same number of people living in the rural community as in 1951. We saw that we were losing within the rural community many of the personal services that had been associated with rural living. In many cases they were still servicing the rural community but they had changed their location from the smaller township to a bigger town or urban centre.
We saw too that there had been changes in the size and structure of the farm family itself; particularly a reduction in the birth rate, a tendency for parents to retire to the town rather than stay on the farm and the tendency for teenagers, particularly girls, to move out. It is no longer the pattern for the girl to stay home and help on the farm. There was also a withdrawal of some services from the rural community; closure of some country schools and stores and in some districts loss of a doctor.

On the other hand there had also been an extension into the rural community of some service facilities which we sometimes tend to overlook. Over the past 20 to 25 years there have been extensions of electricity supply, telephone services, improved roading, greater reception for radio and subsequently television. In effect it was cutting both ways. As services have been improved for the town dweller it has not always been possible to duplicate these services in the country areas. I don't think we bemoan the loss of the County roadmen as we now have tarsealed roads; nor do we bemoan the loss of the blacksmith. These changes have been positive changes.

Since the preparation of that report a number of things have happened at the two levels. As far as information itself is concerned there has been ongoing research at Lincoln by the Agricultural Economic Research Unit and now the growth of the Rural Development and Extension Centre. We have also had the interest shown by the University of Canterbury's Sociology Department which, in conjunction with the Women's Division of Federated Farmers, have completed a survey of rural women. We have continuing work going on in the University of Victoria's Geography Department - we have an agricultural geography section there and a number of people looking at the relationships between forms of farm ownership and levels of production. Findings to come from this should be very
interesting. We also have a group completing a survey of rural communities on Banks Peninsula.

On the action side over the past three years there has been a lot of talk about rural problems. Last year we had a seminar sponsored by the Rural Development and Extension Centre here at Lincoln; a seminar that drew attention to the problems as they are seen today.

This action has also been taken up politically and I think we have a growing recognition on the part of some of our politicians that there is concern in the rural community about some of today's trends. I think there is growing recognition politically of the importance of the relationship between agricultural development and regional development. It is accepted that the two go hand in hand. The 1976 budget saw an increase in the boarding bursary; the first since 1972. There was also a greater emphasis in the 1976 budget on the whole question of land settlement.

The farm worker housing question has already been referred to several times. Again the National Party in its 1975 manifesto made a commitment which has not yet been implemented, but I understand that plans are afoot to implement it shortly. What I would personally like to see is the waiving of the residential clause for those in tied accommodation so that the Housing Corporation is able to lend - as long as other Corporation criteria are met - so that the farm worker is able to buy a home of his own without having to live in it initially. Possibly the rental problem could be handled by the Housing Corporation also.

As far as future action is concerned, a lot will depend on the rural community itself deciding what it really wants and saying this loud and clear. I am hopeful now that Federated Farmers, who have taken the initiative in setting up a joint working
party on rural development, will act as a catalyst group in assisting and putting cases to the Government.

One of the questions to be answered when we discuss rural social conditions, is whether we are looking for a better deal for farming in general or whether we are focusing on quite specific aspects. What tends to happen is that there is a greater focus on social conditions in years when farming is feeling an economic pinch. So it is a question of whether, when farming is a profitable industry, social problems are capable of resolution; or are the social problems themselves quite separate and have to be dealt with as such.

On the question of additional recommendations I would make were I writing the report today, I would comment particularly on the costs of running a motor vehicle. This is something that has increased quite substantially in the four years since the report was completed. I am not sure of the solution but would hope the farm worker would obtain the same concessions as those presently available to farmers.

*What are the implications for the rural community of relatively fewer rural members of Parliament in the future?*

The question at issue here is how well the farming community puts its case. It is no longer possible to assume that the Government will necessarily do what is best for the farming community or that the Government really knows what the farming community wants. There was a time when the rural community could assume this and were well represented by Members in Government who knew their real needs. Increasingly the rural community has got to ensure that the case is well made and that the rural community makes it easier for the politicians to implement the right sorts of policies and sell them to an urban community. Any politician today is going to be looking over his shoulder at the urban voter.
* How can the rural workers and wives enjoy a social life when the cost of running cars is so great?

When my report was prepared in 1973 I was thinking that one of the ways to allow the rural community to overcome some of the social problems was to ensure that people who live in the country could run a motor vehicle and escape from the isolation. I was thinking that we should focus on the slightly bigger town with its adequate educational and medical facilities even though it may be 30 km away on a sealed road. But it is quite clear now that the cost of running a motor vehicle, particularly for the farm worker, has climbed so steeply in three years that that proposal looks far less attractive.

At one stage I also concluded that there would be considerable advantage in encouraging farm workers to live in the townships. This would have saved the farmer providing a house on the farm and it would have provided a grouping of farm workers wives with better opportunities for employment. But now the whol energy cost weights against that and I think that it is a very important one for a rural community to grapple with.
Being vitally involved in rural development and rural population I have been extremely heartened by the degree in which you have all taken part in these discussions. The fact that we are becoming increasingly concerned by the social aspects of the agricultural industry is evident. It has been discussed with great seriousness and we all realise that there are problems in this area. Mr. Lloyd has suggested that these problems might only arise at times of downturns in the agricultural economy. I would disagree with that quite strongly from the work that I have done. I would say that the problems continue but they are camouflaged bearing in mind that our small rural towns service the agricultural hinterland; therefore any benefits that you derive from a good season are obviously thrown back into that area. But at the same time the social problems can be continuing so that at a time of downturn they appear to have escalated rather than just to have continued.

I want to talk for a minute about farm employees. It has been stated that a farm employee is just that, because he too, like the farmer, has an affinity with the soil. He has a love of working with animals. He has the inbuilt 'something' that you all have because you are farmers. We have a great deal of self consciousness about the naming of
these people who help us to create a viable farming and agricultural industry. The term 'worker' is unfortunately used by too many people who don't know what on earth a worker is. Unfortunately the expression 'the workers of New Zealand' is far too tarred with connotations of industrial strife for us to apply it without self consciousness to the men that live with us in the country. The farm employee is becoming the 'in' word. I think the term 'married couple' is quite appalling. I don't know how married couples feel about it but I know how I would feel about it when some marital activity becomes your 'occupation'. I would rather be a shepherd, a musterer, or a farm employee, and I would not like to be classified as a 'married couple'.

Taking some points from Mr. Lloyd's comments I would like to ask 'What are the requirements of the labour force?'

* A right to a fair wage - this is important for him and for you, because the right to a fair wage must be sufficient to attract him to your property.

* The stability of employment - the fact that a permanent worker can too easily be turned into a seasonal worker at the time of a financial downturn. And that seasonal worker will become an urban dweller shortly.

* Community status - as yet nobody has touched on the social status within the community of our farm employee's. It is a very sensitive subject. We are becoming a community where people who work with their hands are looked down on. Perhaps it is a form of snobbery towards the productive worker, and this can rebound on all sections of the farming and rural community. Perhaps it is because of the increasing tendency of our society to accord status to an educated service industry - an elite - maybe it starts in the university. We all know the 'my son's a doctor' syndrome.

* Home ownership - is a very telling and very sensitive area.
Members of the farming community can have something to contribute in this area. It is obvious from questions and comments that you too are not very satisfied with the position at the moment. From the Agricultural Production Council report, Mr. Lloyd brought a list of factors concerning labour which he believed were within the farmers control. Let me relist them and emphasise that they are all over to you farmers to control. That list contained wages, living conditions, status, conditions of employment, recognition for jobs well done (in other words technical ability) and inter-personal relationships. The factors you may be able to alter are the desire of the employee to own his own home and his concern about his future prospects. The factors over which you have no control, factors which effect both you and the members of your family as well as those who work for you and their families are schooling, health, medical care and lack of employment opportunities for wife and family.

Recently I was involved in a seminar at Massey University where the suggestion was made that if there were no facilities for farm worker's wives to find gainful employment then the amount that they could be earning should be added to their husband's wages. I found that appalling, because I believe that the whole area of small industries in rural towns to give women something to do is a creative thing, and we have found, in the studies that we have done, that in fact the wage element has less to do with it than you would imagine. If the women are given the opportunities of working at home they say "no thank you". "We will put our sewing machines in the car and we will go to the local hall and we will work together, because of the social contact". Loneliness is obviously a bigger element in our rural communities than we are prepared to admit. So social contact is equally important as wages; putting more into a farm workers wages won't help loneliness! Lack of social life and amenities is
something that we all have to face in our own way depending on the people we are and our interests. But those of us who have advantages and the privilege of having taken some education into our more isolated areas have a responsibility towards our communities to see that social and educational amenities are developed in our own community. We have a responsibility to see that we draw everybody in. This is a field where women should be making their mark in our rural societies.

Poor roading emphasises the factors and emphasises the isolation. If we add to the quality of roading the additional factor of distance and the consequent petrol costs we have yet another addition to the feeling of isolation.

I was interested in Mr. Pryde's concept of insurance companies, transport companies and others promoting some form of recreational or cultural life in rural areas. I would like to emphasise the shattering effect on a small country village when a transport company, because of costs or lack of financial viability makes the decision to move 30 km down the road to a larger base. To them it is perhaps the moving of two or three trucks and two men out of the district. To us it is the removal of that driver, his wife, three or four children from the school roll and the addition of another empty house in the village. The importance of these service facilities that we have in our small country towns cannot be over-emphasised. They service the rural hinter-land that lies round the small towns and the agricultural industry is dependant upon them. Their place in our small country towns is of the utmost importance. I cannot see how such firms can put financial commitments into recreation and cultural life; not that we wouldn't like to see it done.

I would like to see some form of rural leadership training and am particularly concerned about the need for greater
participation from rural areas in matters such as regional planning. Country people need to involve themselves more in matters such as those that will affect their areas. To date the operations of regional planning authorities and committees in rural areas is very small and the regional planning that is done is normally done in large cities far from the points on the map where the lines are changed. I know that it is often very difficult to see the implications of plans that are trying to cope with the overflow population from large city areas; overflows which are tending to turn larger country towns into dormitory towns. But there is a need in this area for rural and country participation. This could well be an area in which rural leadership and rural education could be taking place at Lincoln College through the new Rural Development and Extension Centre.

We are not philistines, we do appreciate cultural activities, but they are becoming increasingly hard to find and we go right back to the petrol price and the isolation problem. We must start thinking about our schools in a completely different light. We have within our areas a well set up and usually well provided and responsive education system. We must think of these schools as forms of community colleges. I would like to see our schools being used for courses of instruction for men and women, girls and boys outside school hours. We immediately come up against several problems in the practical sense of getting instructors; but the only reasons in life why there are problems are that problems can be solved and there are ways of getting around this. I would call on the use of our schools to try and fill the gap and the blank in our lives.

The whole concept of tied houses can only lead you at some stage in your thoughts to the concept that our farm employees must be given the chance to live in the villages. I can see that in the future our farm employees will be doing this and
that the whole pattern of employment will gradually change because of it. We will be seeing in the future, employees who work for one farmer on pre-lamb shearing and work for another on wheat harvesting. The whole scheme of employment and its conditions and terms, and the availability of employment, and the slack time when we cut down the wages and lose men is going to have to be balanced out. I don't believe that the agricultural industry of 1977 is doing anything other than responding to the ups and downs we have known in the past. Therefore we are going to have to make some form of adaptation from our traditional forms of employment.

We certainly do need the 'Lady Bird Johnsons'. I think of an area in Canterbury like Geraldine where people actually want to go and live because it's a very attractive town - scenically and in other ways. Maybe, in spite of all the present endeavours to generate and establish forms of industries in our small towns to keep people, we are looking at the wrong things. Maybe we should be making our small towns so attractive that people looking for another lifestyle will come to them.

If we want a stable population in our rural areas with all forms of people with all types of wants and desires, we must have varying types of farms. Small farms can be used as stepping stones and financial bases from which to work further whether it be towards farm ownership or a viable market garden. The restrictions of a 10 acre farm, particularly in areas like mine, is not a good one. I believe that the Government should think of some form of funding probably through local government, to help set up a scheme of industrial and rural development in country areas. Local government should be the medium for such funding as they have the best feel of local problems.
There are many myths, as we know, concerning farming - the healthy life is one of them. It has been proved medically and statistically that the healthy farmer is a myth. There is a predominance of back and lung ailments and a rather frightening increase in terminal illness among farmers. People are beginning to point the finger at such things as insecticides and weedkillers.

If we accept that these are areas of concern then the solution of these problems lies with us and the successful solution will depend on how we face up to them. The whole change in the pattern in rural life is our responsibility.
THE NEW ZEALAND MEAT INDUSTRY 1977-78

A.M. Begg

New Zealand Meat Producers' Board

If we forget for a moment or two that "77-78" part of the subject and concentrate on "The New Zealand Meat Industry" part, what are we looking at?

We are looking at a most complex industry which in comparatively recent times has grown to be this country's largest export industry. It is interesting to reflect that only twenty odd years ago, when bulk purchase arrangements for the sale of meat to Britain terminated, both wool and dairy produce were earning substantially more in overseas currency than meat.

We are looking at an industry based on New Zealand's ability to grow grass and involving farmers and those who service and advise them.

It involves also those responsible for the transporting and processing of stock, the storage and transport of meat, its shipping and distribution, its financing and marketing. A mighty conglomerate making for a very wide discussion topic.

MARKETING

No one part of the industry can be treated in isolation but
I suspect most of you are interested in market prospects. Factors which can affect our prospects include a number of imponderables such as access to markets. Climatic conditions which are even further from our control than market access can have a dramatic influence on consumption patterns in importing countries as well as on production here and overseas. Breakdowns in industrial relations can cause disruption in our processing industry at any point along the distribution chain. Can anyone confidently predict what exchange rates or the level of economic activity in consuming countries will be this time next year? So many variables exist that predicting market conditions three months in advance is fraught with difficulty, and indeed considerable risk if you happen to be putting money at stake. Making predictions and forecasts on prices 12-18 months in advance is very much a speculative pastime. However, before speaking on some wider aspects of the industry I am going to discuss some of the market possibilities for next year.

The recovery in world meat trade and prices following the slump of 1974 has been slower than expected. In broad terms the sluggishness of the situation can be attributed to some hesitancy in the rates of economic growth that have been recorded in major consuming countries. This has had a retarding influence on consumer demands for meat.

In addition there has been a continued heavy availability of meat, particularly of beef and veal and more recently of pigmeat, both in major importing and producing countries. These factors have maintained pressure on producer and wholesale prices for meat so that despite some apparent willingness to liberalise trade most importing countries have, in fact, maintained controls on imports to protect their domestic producers. Only a gradual improvement in this situation can be expected in the next 12 months. The medium and longer term outlook appears brighter, with rising prices and easier
trading conditions, as world meat supplies are expected to decline through to the early 1980's.

In looking at the market prospects of beef, lamb and mutton during 1977-78 it is necessary to remember that while all three are somewhat inter-related they are largely sold in different markets. The conditions of access to those markets and the volume of supplies on these can differ quite markedly and they may be isolated completely from world trends. Therefore I am going to devote a little time to the likely position in the main markets for each of the three meats we export.

**Beef**

So far as beef production in New Zealand is concerned supplies for export this year have dropped considerably from last years peak and present indications are that next years production will be similar to this years. On the world scene, higher rates of cattle slaughter, particularly of capital stock in the form of breeding cows and calves, must lead to a downward phase in the supply cycle. Although there have been significant reductions in cattle numbers in most major producing countries, continued heavy slaughterings have, until now, moderated expected increases in world prices. Prices will rise as demand increases and the rate of slaughter eases but the rate of rise may be tempered by the considerable export potential which still exists in the large herds in Australia and the Argentine. In addition, pork and poultry supplies will be freely available this year and will have at least a steadying effect on any price increase for beef.

For us our own level of production and the state of the North American market will be the most critical factors for 1977-78 beef prospects. The United States cattle inventory dropped in 1975-76 and heavy slaughterings have continued this year.
More cattle have been going into feed lots and total beef production is likely to be only slightly down this year. There could be a further decline next year and it is likely that the decline in cow kill and non fed cattle will be significant, bringing benefits to the manufacturing beef trade which is vital to us.

The world beef market looks set for improved prices during 1977-78. The extent of our access to the best markets, that is to Europe, North America and Japan, remains in doubt and the pressures for protection of domestic producers continue to be strong. However, in the United States, which is vital to us, pressure from producer interests is more intense than for many years past. The President and his administration have been making noises about the need to maintain the freedom of international trade which sound much sweeter to our ears than some of the noises made prior to and just after the election.

All things considered 1977-78 should see our beef export industry on the road to recovery.

Lamb

The prospects for lamb are less likely to be affected by problems of access, although the long awaited sheep meat regulation could still present a serious threat to our trade. The downward trend in world sheep numbers appears to have stabilised. The lower levels of profitability of beef production, combined with relatively stable sheepmeat prices and improved wool prices must lead to some upward movement in flocks around the world but supplies of lamb are unlikely to fluctuate greatly.

The United Kingdom continues to be the major outlet for New Zealand lamb and, although prices in other markets will have some influence, the realisations from the volume sold in
Britain will be the most important factor determining your returns next year.

Given the likely state of Britain's economy and the probable supply of competing meats the challenge is for us to equate the volume of exports to that market's ability to pay the prices we need.

It is 1977-78 that I am supposed to speak about so I will not dwell on this year's operations, except to say that diverting lamb away from Britain is proving more difficult than last year. It is my opinion that next year will see an improved demand from the diversified markets.

We now have a number of sizable markets. U.S.A., Canada, Japan, Continental Europe, Iran, Iraq and Greece are all valuable lamb markets with economies which are in many ways quite independent of each other. Each offers scope for further development and steady growth. The Middle East, with the rise in wealth from oil production is experiencing a substantial rise in consumer demand. The people of these Islamic countries are traditional sheepmeat eaters and their domestic production does not lend itself to large or rapid increases. Estimates by international organisations of the sheepmeat requirements in the Middle East are quite staggering. While these estimates may or may not become realities, demand in the area will grow and 1977-78 should see increases in sales of our lamb there. The market prospects for lamb next season must be bright.

Mutton

Mutton is our "Cinderella" meat and this year it went to the ball. It doesn't look as if next year will be the "morning after". The projected world meat supply scene is one of production shortfalls through to the early 1980's. Mutton is not subject to the trade barriers erected against beef but neither is it a universally pop
is not subject to the trade barriers erected against beef but neither is it a universally popular or sought after commodity. In recent years we have been heavily dependent on two large customers, Japan and Russia. Neither of them are known for their benevolent trading habits. Mutton prices are vulnerable but, given that we should have a total clearance of stock this year, and that overall world supplies of protein are likely to be less than demand, the outlook must be regarded as satisfactory.

MARKET PROSPECTS AND INDUSTRY PROBLEMS

No doubt the Conference would like me to be more specific about market prospects. The fact is, as I am sure you are all aware, that nobody knows what next season will bring. All we can do is explain the likely factors which will influence the market and express some opinions as to which of these factors may become the dominant ones. On balance, the market prospects for next season give grounds for more optimism that has been the case for some years.

However, the 1977-78 season will be notable for many things apart from the prices paid for stock or received for meat. The season will see a marked increase in the use of container transport, notably on the European trade. Electrical stimulation, or more correctly accelerated conditioning of both beef and lamb, should move from the experimental stages to full scale commercial use. Mechanical pelting of sheep and lambs should also be developed as a practical on chain proposition. Containerisation gives us the ability to service our customers more adequately and ensure a better product out-turn. It will also mean less meat on board ships during the peak of the season because of quicker turnarounds and reduced voyage time. This will put greater pressure on storage and will necessitate different shipping patterns from those which have become accepted in practice.
The meat industry has had some years to prepare for these changes and has built up experience during recent years. Next year will test how well we have, in fact, prepared and whether facilities planned and provided over recent years will be adequate when the pressure comes on.

Accelerated conditioning has been talked of for a number of years and as the swing towards selling in supermarkets continues in the United Kingdom and as we build up our exports to other markets, the whole question of cold shortening and tenderness assumes greater significance.

The ability to ensure a uniform degree of tenderness for our lamb at a reasonable cost, together with the protection containers give the product, will mean that we can have a top quality article presented in the market place.

Apart from some difficulties which occur with irregular deliveries only one major criticism of our lamb will remain a threat to our image. This criticism concerns fat. In my time on the Meat Producers Board this has been the most frequent criticism received. The Board has tightened the grade specification and a great improvement has taken place. It may well be that for lamb producers this will be the continuing challenge for 1977-78. I believe a great deal has already been achieved and that ram breeders are very conscious of what is required. The challenge is to obtain better muscle development with less fat at equivalent weights. I will say no more on this subject which could occupy the attention of a farmers conference by itself.

Mechanical depelting of sheep and lambs has been under development experimentally for some time and, but for industrial problems, may have been a reality for next season. It has the potential to produce a better dressing standard and significantly reduce costs. There are other prospects of
reducing costs in a labour intensive industry which is short of skilled labour. During 1977-78 they must be pursued with all possible vigour by the whole industry, in the interests of the whole industry, and in the national interests of New Zealand. If you were to ask farmers in my area of New Zealand what they considered most important for them in the 1977-78 season, almost all would reply "getting our stock killed when it is ready for slaughter." Why do we have these recurring problems when there are sufficient facilities and they seldom work to capacity? There are, of course, a variety of reasons but over and above them all is the question of industrial stoppages.

This is a farmers conference and quite apart from the losses which farmers suffer through inability to get stock killed and off the farm when it should be, they are also, in the long run, paying most of the resulting cost increases and a very considerable share of market losses. I am not an expert in industrial relations in the meat industry or anywhere else. The situation we have seen in different parts of New Zealand in different years is a national scandal. We all tend to keep clear of involvement. We do this partly from the fear that we may only harden attitudes and make settlement more difficult. People say we should avoid confrontation, by which I suppose they mean there should be further compromise. Industrial relations in the meat industry have been built on compromise. The National award has grown more complex year by year as a result of successive negotiations resulting in compromise.

Local agreements, productivity agreements, call them what you will, have all too often been made as a compromise, made in isolation from other works, made in isolation even from other departments in the same works, and too often made hastily under duress.

The whole industry, including the unions, needs to take a
fundamental look at work methods and remuneration. This should not be looked on as a defensive exercise by any sector but as a positive move to give the industry a soundly based method of rewarding those engaged in the industry in relation to the skills and physical effort they contribute. A sound base on which to build productivity agreements for the future has to be provided.

The Meat Industry in 1977-78 will still be New Zealand's largest earner of badly needed overseas exchange. It still has vast potential for further increases in volume and in value.

The 1977-78 season will present the New Zealand meat industry with new possibilities in the fields of processing and transportation. It will present us with the opportunity to deliver a better article to our customers. The industry has a great future before it in spite of some prickly problems. We must grasp the opportunities and the nettles firmly if we are to realise the full benefits of that future.

We have to compete with the meat producers of the world, often in their own territory, so we have no room for inefficiency. We have no room for factional strife. The processing companies, the meat workers, shippers and exporters should be regarded as allies, not enemies.

Next season will bring many opportunities at local, regional, and national level for us individually and collectively to work for a united and efficient industry. The New Zealand meat industry in 1977-78 should be set on the road which will bring it to expansion and prosperity through the 1980's and you should help to put it there.
LET'S LOOK AT CROPPING TREES

R. Clark

Mid Canterbury

Cropping trees come in between orchard and forest trees and have been sadly neglected of recent years. You have all used their products recently in the rubber of your motor tyres and we were taught the value of the coconut palms from our early days at school.

They are trees that give an annual crop for the use of man or beast; a crop that, once established, needs very little in the way of annual inputs.

I believe we have to look at them because we cannot continue with an agriculture like ours, which converts expensive and finite fossil fuel into edible energy so very inefficiently.

In Britain, one unit of fossil energy used on the farm will only produce two units of edible energy in the form of grain at the farm gate. Potatoes are even worse giving a return of 1.1 only, but are far ahead of broilers at one tenth of a unit of edible energy per unit of fossil energy.

Here is another set of figures from Australia. For each joule of digestible energy eaten, at least five joules of fuel are spent in making it available; 0.6 getting it to the farm gate, 2.0 from farm to retail store and 2.8 in
getting it from the retail store to the dining table.

We simply cannot afford this kind of input. In the world oil scene we are the runt of the litter. Further, once we have produced our goods for sale, transport to the other side of the earth is going to be prohibitively expensive.

We are going to have to develop very low input farming systems, producing high value for volume goods and further we are going to have to produce much more of our own requirements.

That's why I'm offering this new idea of developing already existing cropping trees. They fall into several main classes.

FOOD FOR HUMANS

Walnuts are the best example here. Half a hectare of good walnuts will produce a tonne of nuts a year. With a crack out percentage of 50 per cent, we have 900 kg of edible nut meat per hectare per year. Fifteen lambs a hectare is good going and they kill out at 200 kg of bone, gristle and meat.

There are 81,000 ha of walnuts in California and their experts tell us that we have as good a climate with cheaper land and cheaper water in Mid Canterbury. Nothing need stop us now that we have developed an efficient method of grafting them - this was the earlier barrier.

The target is first, to replace our present imports of $300,000 and then to become the only nation in the southern hemisphere exporting walnuts. This would mean that we can land this high risk crop on the world markets six months ahead of the world crop.

I heard from an Australian a few days ago. He has 24 chestnut trees which give him 4.5 tonnes of nuts in a good year and this year they were netting nearly $4.50 a kg on the
Sydney wholesale market. These trees are easily grafted to good varieties and we have identified really good trees to provide grafting wood. Any chestnuts that hit our stores are sold very smartly and once the fresh nut demand is met, there's plenty of scope for preparing stock feed.

We import a lot of hazels and yet they grow very well in the South Island and there are some excellent trees round Geraldine. The DSIR is working on them in Havelock and further north they are developing Macadamias and Pecans. In the United States the turnover of Pecans is $80 million a year.

FOOD FOR STOCK

There is a fantastic potential here. Imagine how comforting it would be to have our farms and back country clothed with high producing cropping trees dropping their beans, fruit or nuts right now, just when the grass is getting short! I emphasise high producing. Only grafted trees should be used, trees grafted to the very best strains.

The sweet oaks of America have provided tucker for wildlife and Indians since time immemorial. If any of you know where I can get seeds from them you would be my friend for life.

In Portugal, unploughable hillsides are covered with the cork oak which fattens thousands of hogs every year. Near Te Puke, there is an enthusiast for honey locust which drop long sugar rich pods and another enthusiast near Blenheim is trying out the tamarugo tree. This tree gets its moisture from a sort of reverse transpiration and is growing where there has been no rain for thirty years. Yet once established, the groves can carry over seven sheep to the hectare, feeding on the beans and leaves being dropped from the trees.

As far as I know, we have no scientist working on this type of crop. Too many of them are polishing up techniques which will be antiques in a few years.
FOOD FOR BEES

One of New Zealand’s greatest natural farming advantages is that we get our nitrogen for free from the clover plant. Yet all round the country, particularly in intensive cropping areas, the unthinking improvident farmers are bulldozing out fencelines to make bigger paddocks, bare of food and shelter for bird and bee. White clover is a major export item. How is it going to be pollinated if there is no tucker for the bees early in the season? The cost of transporting hives is so high that my neighbouring beekeeper is refusing to bring hives away from the honey rich birch forests to the bare windswept cropping areas.

At home, Ministry staff are working with me to plant an 8 ha paddock with trees good for bees in the shelter breaks and as specimens all over. In five years time it will look a picture. We’re using robinias, limes, eucalpts, kowhais and any others we can find.

TREES FOR ENERGY

Forty years ago, farmers grew their own energy in the form of oats for their horses. I run 500 ewes for energy in a roundabout sort of way. I sell their wool to pay Arabs to turn on oilwells. How much more sensible to use the land involved to harvest energy direct. Only this week the commission on future energy needs for New Zealand has suggested that trees should be used to provide the future liquid fuel requirements for the country. DSIR staff are already working on growing eucalypts, harvesting them every seven years; Lincoln College staff are investigating the possibilities of using macrocarpa.

TREES FOR OIL

Life in the Mediterranean area would not be possible without
the olive tree, providing oil for light and cooking and producing it from land too bare and arid for any other form of crop.

TREES FOR CONTINUOUS CELLULOSE PRODUCTION

In Ireland, France, Sweden and Holland, scientists are working on growing willows on wet land for continuous cellulose production, cropping every year. The willows are planted at close centres and are harvested with conventional forage harvesters.

Our scientists know about this and have been thinking about it for nearly a year. Just imagine this as a new crop for the wet lands of the West Coast.

This all sounds a lot of fun. What progress have we made?

We have formed the New Zealand Tree Crop Association and now have 600 members with ten branches covering most of the country. We have the very active help of the DSIR, who have been wonderful. Our national secretary is a DSIR agronomist who has been able to travel the length and breadth of the two islands setting up our branches.

We have identified a lot of very high producing nut trees to provide foundation stock for grafting wood. We produce a first class journal twice a year and we run regular conferences and field days. We have started trial areas for comparative testing at DSIR, Lincoln College and elsewhere.
In 1975 the institute commenced a series of trials to determine the minimum structural requirements, of a farm fence to adequately control stock; such trials were justified by the very wide divergence of opinion among farmers as to what constitutes good fencing. We are looking at post and batten spacing and the wire spacing. In the North Island, for example, fences having as many as 280 posts and 2,000 battens per kilometre are common, while in the south, fences composed of far fewer posts and battens, control virtually the same stock.

To our knowledge trials of this nature had never been attempted before. In addition, institute staff involved with their design and execution had little or no previous knowledge of stock behaviour patterns. Initially, then, there were some misgivings about their possible worth, particularly whether results obtained would make sense from an engineering point of view.

In the event, and although there are some anomalies, and only sheep have been tested so far, the performance with the sheep has been such that even should the results from cattle prove
illogical, the trials have still proved worthwhile.

The test area consisted of a 1.25 ha block fenced off on the Lincoln College mixed cropping farm. This area was further subdivided into two half hectare pens with a smaller pen between each. In use test animals held in the outer pens were obliged to penetrate the subdivision fences, which were the test fences, to gain entry of the smaller inner pen. Consequently two fencing systems were tested at the same time.

Each test fence was only 40 m long, so, as line wires were added, the wires were each fitted with a spring designed to give to the wire the reaction of a further 160 m of wire. This simulated a 200 m long fence.

Thirty Border Leicester Romney cross sheep, a breed known to have a penchant for fence penetration, were used in the trial.

Initially the sheep were all put into one of the outer pens, and this was grazed down hard so that there would be ample inventive for the sheep to attempt entry into the inner pen. For the purposes of the first series of tests this pen was fenced off with netting. A 1.5 m gap was later opened in the netting.

Initially the sheep took no notice of this gap, and so had to be mustered through it to show them where it was. It was then quite difficult to drive them from the inner pen, via the drafting yard, into the outer paddock; but once in the outer paddock they rushed to the gap. The sheep, having learnt that there was a gap in the fence, remembered where it was, as the gap was some distance from the drafting yard gate.

Having found that the sheep quickly learnt and remembered where a gap in a fence was, we then attempted to find out how
high they could jump. So line wires were added across the
gap from the bottom upwards in order that the sheep would be
obliged to jump increasing heights to gain entry to the inner
pen.

At a height of 0.50 m about half the flock were not prepared
to attempt to jump the wires, while at 0.75 m only four jumped
the fence. At 0.90 m only one animal was capable of clearing
the wire. This particular animal finally cleared one metre,
attempted 1.07 m, struck the top wire rather forcibly, and
being somewhat shaken and probably losing confidence, would not
try again.

Its actions afterwards are worth recording; these amounted to
trotting towards, then backing off from the gap rather in the
manner of a high jumper and apparently in an attempt to gauge
the height of the top wire and its own ability to clear it.
Possibly then there are individuals of this breed of sheep
capable of jumping 1.07 m.

The general conclusion reached from these trials was that while
sheep are probably capable of jumping to a height of greater
than one metre, it is very unlikely that they could clear a
fence with the top wire 1.10 m off the ground.

At the conclusion of the jumping tests the inner pen was fenced
off on both sides with netting, and immediately behind the
netting, on the inner pen side, the 2.5 mm diameter high tensile
line wires for the fence penetration tests were installed.

These wires were, in turn, stapled loosely to two line posts,
the gap between each pair in each fence of which could be easily
varied.

A gap was then opened in the netting fences so that, in order
to gain entry to the inner pen, the sheep would be obliged to
Sheep penetrating fence without inducement.

Sheep penetrating fences
Post spacing 4m (5 to chain)
Wire spacing 152mm (6 inches)
Wire tension 1557N (350lbs)
force their way between the line wires of the plain wire fences in the area between the posts. The sheep were then split into two mobs, with 15 being held in each of the outer pens.

Initially little or no incentive was required to get the sheep to penetrate the test fences when the posts were widely spaced. However as the degree of difficulty of penetration was increased, by way of alterations to wire tensions or post and wire spacing or a combination of both. Many in each mob would not try, unless hay was placed in the inner pen near each fence.

Nevertheless two or three of the sheep, and perhaps not surprisingly they were those that had jumped highest in the high jump tests, seemed to delight in trying to get into the inner pen regardless of incentive, even if it entailed considerable difficulty.

At this stage it was decided to carry out a survey of fence line wire tensions at Lincoln College's light land farm at Ashley Dene. We wanted to measure the range of wire tensions likely to be found in fences in a practical farming situation. These tensions were found to be surprisingly low, and as a result the final series of penetration tests were all carried out with the wire tensioned at only 666 Newtons (150 lbs).

Incidentally an attempt was also made during the course of the trials to measure the loads being imposed on the line wires. However this proved impractical because of the combined vertical and horizontal deflection of the wire, and because invariably more than one sheep at a time was attempting to get through the fence.

Nevertheless the final six field tests did give a very good indication of vertical member spacing; that is posts or batten spacing, combined with line wire spacings, needed to achieve
control at low wire tensions. (Table 1).

Table 1

CAN SHEEP GET THROUGH A FENCE. YES OR NO?

WIRE TENSION 666 N or 150 lbs

<table>
<thead>
<tr>
<th>Post or Batten Spacing</th>
<th>Wire Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>metres</td>
<td>101.6 mm or 4 ins</td>
</tr>
<tr>
<td>2.5</td>
<td>8' 3&quot;</td>
</tr>
<tr>
<td>2.2</td>
<td>7' 3&quot;</td>
</tr>
<tr>
<td>2.0</td>
<td>6' 6&quot;</td>
</tr>
<tr>
<td>1.68</td>
<td>5' 6&quot;</td>
</tr>
</tbody>
</table>

The greatest wire spacing gap tested was 150 mm, it being thought that anything greater would not give control of lambs, regardless of wire tensions or vertical member spacing. However this has still to be verified.

We intend to start trials again in late 1977 when lambs will be weaned against trial fences and the optimum fence requirements for cattle will be tested.
INTRODUCTION

Until the early summer of 1975 insect pests of lucerne were considered relatively unimportant and apart from surveys, the priority for work on them was low.

Since then, two pests, the blue green lucerne aphid, Acyrthosiphon kondoi (BGLA) and the sitona weevil, Sitona humeralis have appeared with the former causing a great deal of damage. The Sitona weevil, although damaging some paddocks in the Canterbury area, has not reached the importance of BGLA.

BGLA spread from the North Island, where it was first discovered, through the north of the South Island and became established on a wide scale in Canterbury late in 1976. Since then, it has spread further southwards with reports of its presence near Dunedin and Balclutha.

This paper describes some of the work carried out on both the BGLA and the sitona weevil. The emphasis however is on BGLA since the weevil has not yet become so serious a pest.
BLUE GREEN LUCERNE APHID

Biology

This aphid is a dark matt green in colour and initially colonises the apices of fast growing and succulent lucerne plants. It may in spring and autumn reach densities of over 500 per shoot. The pest overwinters in lucerne paddocks in relatively low numbers, which rise to a peak during October and November and again in April. This latter peak has only partly been manifest in Canterbury this year probably because of the lack of rain in March.

There are a number of alternative hosts, including white and red clover, peas and probably many other legumes, but the extent to which they overwinter on these is not known.

Winged forms occur and disperse over the late December-January period and again later, in March and April. The high populations of wingless forms present up to January collapse at this time, whilst a later peak occurring after the second flight period diminish as the weather deteriorates into winter (Fig. 1). The reasons for the collapse of the high December populations is by no means certain but dispersal of winged forms, the stage of growth of lucerne, the pressure of predators, the climate and other factors no doubt all play a part.

The aphid is preyed upon by a variety of insects including the spotted ladybird, lacewing larvae and the larvae of Syrphid flies. This predation however occurs too late to prevent the early build up of the pest and ceases too soon to prevent the later peak of wingless aphids. Fungus and possibly virus diseases may also reduce the number of aphids but even in the relatively wet summer of this year, there was no obvious or massive effect of disease.
FIG. 1. BLUE GREEN LUCERNE APHID SUMMARISED BEHAVIOUR PATTERNS AT 3 LOCALITIES.

Damage to Lucerne

The presence of large numbers of aphids can cause severe symptoms of damage, particularly demonstrated in the late autumn of 1976. Infested lucerne turned yellow and defoliated. Apart from the effect of feeding, the aphid injects a toxin into the lucerne plant which causes the leaves to curl and stunts the plant. This has a long term effect on the growth of the plant even in the subsequent absence of the pest. Aphid attack in the early seedling stages of lucerne may kill seedlings or, if not killed, severely stunt their growth over an extended period.

Control - Chemical

Over the past 18 months, a great deal of work has been directed at determining the rates, times of application
and types of insecticide which can be used against the pest to
the best advantage.

It is perhaps fortunate that many chemicals effectively control
the pest at rates considered too low for aphid control in
horticulture. Their costs, compared with the possible loss
of crop if it were unsprayed (Table 1) are low.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>DM/ha in kg</th>
<th>+ % over control</th>
<th>Aphids/shoot at harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paraquat alone</td>
<td>5700 aC</td>
<td>- 8%</td>
<td>560</td>
</tr>
<tr>
<td>Untreated</td>
<td>6480 aAC</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>Paraquat + insecticide*</td>
<td>7770 bAB</td>
<td>+ 20%</td>
<td>6</td>
</tr>
<tr>
<td>Insecticide* alone</td>
<td>8070 bB</td>
<td>+ 25%</td>
<td>540</td>
</tr>
</tbody>
</table>

C.V. % 8.3%
* Chlorpyrifos 0.5 kg/ha

Chemical control of the pest must be considered the first line
of defence at this stage. Other methods of eliminating the
pest or reducing damage are being worked upon.

Control - Grazing Management

Sheep grazing in winter reduced aphid numbers and delayed
their spring build-up; in spite of this, yields taken between
successive grazings in spring indicate that the residual
aphids can still cause considerable loss of production. Data
from the North Island shows that the delay in aphid build up
and the reduced numbers resulting from a winter grazing
permits lucerne plants to grow at a greater rate in spring
(Table 2).
Table 2

EFFECT OF GRAZING ON BGLA NUMBERS AND SPRING GROWTH OF LUCERNE (MANAWATU)

<table>
<thead>
<tr>
<th>Assessment Dates</th>
<th>Aphid Numbers/10 shoots</th>
<th>Stem Length (cms)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grazed (26.7.76)</td>
<td>Ungrazed</td>
</tr>
<tr>
<td>1976</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.8</td>
<td>1.0</td>
<td>21.8</td>
</tr>
<tr>
<td>30.8</td>
<td>1.0</td>
<td>35.1</td>
</tr>
<tr>
<td>15.9</td>
<td>2.9</td>
<td>60.5</td>
</tr>
<tr>
<td>28.9</td>
<td>2.4</td>
<td>63.5</td>
</tr>
<tr>
<td>4.10</td>
<td>1.4</td>
<td>46.1</td>
</tr>
<tr>
<td>11.10</td>
<td>4.5</td>
<td>40.1</td>
</tr>
<tr>
<td>18.10</td>
<td>21.5</td>
<td>180.1</td>
</tr>
<tr>
<td>25.10</td>
<td>170.5</td>
<td>267.2</td>
</tr>
</tbody>
</table>

Plots cut on 25.10.76.

Under dairy grazing management high numbers of aphids have been observed both before and after grazing; production losses under these conditions have not been assessed but the authors believe that they would be high.

In this context a lack of palatability or digestability of aphid infested lucerne should not be ignored. These aspects are being examined; observations indicate that high aphid populations will make both hay and growing lucerne considerably less palatable.

Control - Biological

Although at present the indigenous natural enemies of the aphid appear to be inadequate to effect a degree of control which would make chemical control unnecessary, predators and parasites are being imported by the DSIR to augment those
already present. The establishment and overall effects of these imports will take some time to evaluate.

Control - Resistant Varieties

Some lucerne plants show a natural resistance to BGLA. By utilizing the summers of both the Northern and Southern hemispheres, seed from resistant plants can be multiplied rapidly. The DSIR, in co-operation with the U.S.A. are well advanced with this work. Varieties from California, developed by Dr. Lehman of the University of California, are already under test. However, besides resistance to aphids, varieties must be tested for disease resistance and yield under N.Z. conditions. Thus, we may look forward to the replacement of current varieties of lucerne with varieties resistant to aphid in perhaps four or five years. Until these are sown and established, existing stands will need protection against the pest.

Control - Recommendations

For lucerne which is to be made into hay, Table 1 indicates that an efficient chemical application during the late winter or early spring will eliminate losses from BGLA until at least the first cut. There are no early flights and invasion of treated areas is unlikely to occur until flights start. Virtually all the lucerne paddocks examined in Canterbury recently have some aphids present and if even a few can be found an early spray treatment is recommended.

If the decision to spray is made after observation and counts of aphids, a level of 6 to 10 aphids per shoot indicates that spraying should not be delayed. Populations may increase very rapidly (Fig. 1) and, if a spray application is delayed, farmers may be faced with the dilemma of either spraying a well grown crop or leaving it until after cutting and carting.
If faced with the choice, and the possibility that weather may hamper spraying operations after cutting, it is advisable to spray before cutting. Hay made from infested lucerne may be unpalatable to stock; hence early spraying is advisable.

Between the first and second cuts, no hard and fast recommendations can be made. If aphids can be seen on the new shoots, it is essential to spray immediately. If aphids are present in the crop before the first cut, then the aftermath should be sprayed as soon as the first cut is removed. New shoots of lucerne, if infested, become deformed and stunted and loss of crop will occur.

In Canterbury this year, most of the third cut hay was not severely infested. But conditions may vary from year to year. Levels of aphids should not be permitted to rise. The difficulty with a decision on the third cut is that low populations may be on the decline; if they appear to be on the increase, then a spray application would be advisable, even if only as an insurance.

In the North Island, where the effects of BGLA, particularly in the autumn, were in many instances much greater than in Canterbury this year, trials have shown that up to 17% mature lucerne plants may be lost as a result of BGLA attack. It is possible that there was some interaction between aphid attack and disease, but overall the result was an increasing weed problem and a probable reduction in stand life. It therefore seems essential that aphid populations should be controlled at an early stage.

General Comments and Conclusions

After such limited experience with this pest it would be unwise to presume that its behaviour will remain constant. The peak population and flights may be advanced or retarded according
to weather and the levels of damage may be greater or lesser. This has been demonstrated by a comparison of the differences between aphid behaviour in the South Island and two areas in the North Island.

In Canterbury lucerne growth this spring and summer was good but growth in autumn was delayed by dry weather. Losses from aphid damage in spring were masked and plant recovery from damage was good. It is believed that the slow autumn growth has delayed or suppressed the expected autumn peak of aphids. In the autumn of 1976 the damage caused by populations resulting from the early immigrant aphids was dramatic; had they been on a wider scale they would no doubt have matched the experience in the southern North Island where plants were killed, severe defoliation occurred and the effects of damage were carried over into spring.

In some seasons the flight periods may be extended and may considerably overlap the build-up period of the wingless aphids; hence reinvasion of treated areas may become more important in late spring or autumn with increasing damage and the need for multiple sprays.

There are no early flights of the pest and paddocks free of the pest in winter will remain so until flights occur. In this respect if lucerne is sown early it will remain free of aphids until flights occur; but if the flight period is advanced or lucerne is sown late, young plants are at considerable risk unless protected.

Young regrowth of lucerne is particularly susceptible to damage and protection of the crop at this stage is essential.

A number of insecticides have label recommendations, accepted by the Agriculture Chemicals Board, related specifically to BGLA. These are, at the time of writing, acephate, demeton-
s-methyl, chlorpyrifos, pirimicarb and thiometon. Many other insecticides have general label recommendations for aphids. In general terms they are all effective whether they are broad spectrum or specific aphicides, whether they are systemic, contact or fumigant. This indicates, at present, that predators have played little part in the control of this pest. Label recommendations should be adhered to since any saving in cost by reducing the rate of application is small compared with the overall costs and the risks from poor control are high.

The authors believe that the blue green lucerne aphid will be important again next season; they would be delighted to be proven wrong.

SITONA WEEVIL

Biology

The adult weevil is a lively grey to black insect some 3-4 mm in length with three longitudinal white stripes behind the head. It is believed that, in Canterbury, there are at least two generations each year (Weightman, J. pers. comm.) but the adult weevils are frequently long lived and there may be some overlap between the generations; this makes it difficult to make clear cut distinctions between the generations.

Certainly there is a peak emergence of adults in January and February and paddocks have been damaged by the adults at this time.

Their feeding typically produces notches in the leaves; with heavy feeding the plants look tattered.

Larvae feeding on lucerne root nodules underground are relatively inconspicuous; they are white, curved and legless.
with brown heads. When fully grown, they are about 4 mm in length.

The fact that the insects feed as adults on the leaves of lucerne and as larvae on root nodules make them potentially an important pest although, to date, attack has been confined to only a few localities in Canterbury.

The insect is likely to have a range of host plants similar to the BGLA with perhaps, from overseas experience, a preference for some of the annual medicks such as the weed bur medick *Medicago polymorpha*.

Very little is known about the need for or methods of controlling the larvae. Biological control of the larvae by predatory beetle larvae almost certainly occurs and bird predation and disease has been observed in the adults. The levels of these and their importance have yet to be determined.

**Table 3**

| Counts of *Sitona weevil* adults after treatment of lucerne with selected insecticides. Numbers per sample of 20 sweeps with a net 40 cm in diameter (Canterbury). |
|---|---|---|---|---|
| Treatment applied 24.2.76 | Days after treatment | Total all days |
| | 1 | 6 | 13 | |
| azinphos-methyl 0.5 kg/ha | 28 | 10 | 2 | 40 bB |
| dimethoate 1.0 kg/ha | 42 | 6 | 4 | 52 bB |
| fenitrothion 0.5 kg/ha | 28 | 3 | 6 | 37 bB |
| untreated | 86 | 85 | 44 | 215 aA |

Control of the adult weevil by some common insecticides is effective even at low rates of application see Table 3. At what levels of infestation the adults cause sufficient damage to warrant chemical control is not yet known.
In 1967, a symposium on the lucerne crop was held at Lincoln College. Although the diseases of lucerne in New Zealand were reviewed, our knowledge at that time was confined to records of diseases present, and, based on overseas work, their probably effects on the growth of lucerne in this country. A concluding paper to the symposium stated that pests and diseases has a 'sporadic and ill-defined effect' and that the situation was 'not-too-serious'. It may have been as a response to this challenge, that plant pathologists in the last ten years have completed much research on lucerne diseases and made significant discoveries. In addition, the increase in area of lucerne for processing has focussed attention on the crop in conditions where disease severity and spread are enhanced and where maximum yields are required for profitability. Any factor which reduces annual yields and/or the life of stands will therefore be of importance.

Diseases can affect lucerne at all stages of its growth. This review will examine their effects on the development of seedlings, on the growth of leaves and stems, and on the life of lucerne stands. Symptoms of the various diseases are described in the papers listed at the end of this article.
SEED AND SEEDLING DISEASES

Research has shown that there are a number of fungi that can be carried on or in lucerne seed but that these do not appear to have a significant effect on seedling development. On the other hand, most farmers have come to accept that the growth of lucerne seedlings is highly variable; at six weeks after sowing the range is from very small plants to strong, well-developed seedlings. It is known, of course, that the soil is a hostile environment and that seedlings are likely to be attacked by fungal disease organisms and pests, all of which contribute to decreased growth and/or seedling death. Thus growth may be improved by the use of chemicals, sown with or on the seed, to protect seedlings. Recent research at DSIR, Lincoln, has shown that there are chemicals which can protect seedlings, and the result is a uniform vigorous stand. In a trial sown in December 1976, plots, grown from treated seed, yielded twice as much herbage as those from untreated seed. So far these results have been achieved in glasshouse and small field trials, but larger trials are planned for next season. If successful the cost of treatment will be minimal. Present chemicals being evaluated do not have any adverse effect on nodulation.

LEAF DISEASES

It is known that the cultivar Wairau is very susceptible to diseases affecting the leaves - diseases such as downy mildew, pepper spot, common leaf spot, and so on. These diseases are caused by a number of different fungi. Research has shown that, when severe, herbage yields have been reduced by 16%, and seed yields by 31%. Thus large scale field trials to investigate control methods would seem to be of value especially with Wairau lucerne for seed production.

However, cultivars with resistance to leaf diseases have been
produced overseas, and are now grown here. The cultivar Saranac is resistant to the main leaf diseases and other cultivars with similar resistance are under test.

**BACTERIAL WILT**

This disease has now been found throughout New Zealand and will be of major importance only where Wairau or other susceptible cultivars are grown under high rainfall - say over 750 mm - or irrigation and are cut regularly. It is likely that the disease has been present here for at least twenty years, and possibly much longer. Although first found in Mid-Canterbury, this should not be regarded as the centre of introduction, for it is probable that the disease could have been introduced on a number of occasions into various areas.

Spreading of this disease, once it is present in an area, takes place mainly by movement of infected hay, in which the organism can survive for years, and on harvesting machinery. Infected plants can be detected in new Wairau stands 12-18 months after sowing, and are seen as yellow, stunted plants. When the outer layer of the taproot is removed, the inner part can be seen to be yellow-brown in colour as compared with the white of healthy plants. Wilting is not a symptom of the disease. Plants with symptoms will increase in number with time, and most will eventually die. This leads to a thinning of stands, grass and weed invasion, and a drop in lucerne production. The decrease in plant numbers can be seen in Figure 1 which compares the plant population over a three year period of Mesilla which is resistant to bacterial wilt with Wairau.

Although the first discovery of bacterial wilt of lucerne in New Zealand was greeted with concern and alarm, many would now agree that it has been of considerable benefit to the
FIG. 1. PLANT DENSITIES, IN 1974, 1975 AND 1976, IN THE
LUCERNE CULTIVARS WAIRAU AND MESSILA, BOTH SOWN AT THE SAME
RATE IN NOVEMBER 1971 IN AN IRRIGATED TRIAL, AT LYNNFORD,
MID-CANTERBURY, ON WAKANUI SILT LOAM.

Lucerne industry. This is because it then became possible to
import a large range of lucerne cultivars with resistance, not
only to bacterial wilt, but also to other diseases. The new
cultivars may also have greater yield potential or greater
spring and autumn growth than our traditional cultivars. It
is important to appreciate that resistant lucerne cultivars
have been developed over 40 years in U.S.A. and that we are
now tapping their resources.

Thus bacterial wilt is now causing little concern, but our
plant breeders will always need to incorporate bacterial wilt
resistance in any new lucerne cultivar.

Control recommendations relate to the use of resistant
varieties in combination with management.

* in low rainfall areas of less than 750 mm, where
lucerne is used for hay or grazing, Wairau should still
be satisfactory.
* in areas of higher rainfall, and with lucerne being utilised for processing, the use of resistant cultivars, such as Saranac, will be required.

VERTICILLIUM WILT

This disease is present throughout New Zealand but its importance in lucerne stands has not been assessed. Although it may cause slight stunting of plants, its main effect is to cause premature yellowing of the lower leaves of mature plants, then loss of leaves, wilting, and finally drying of the whole plant. If a large number of plants become infected, the premature loss of leaves could lead to some loss in production.

This disease is caused by a fungus, which like bacterial wilt, crown rot and Phytophthora root rot, can remain in the soil in association with lucerne debris for several years. Hence to prevent rapid development of this and other diseases it is important not to sow lucerne after lucerne, but leave a gap of at least three years between lucerne crops.

Resistant cultivars have been developed. Washoe appears to have a satisfactory level of resistance but other resistant cultivars will become available.

CROWN ROT

This is caused by a complex of fungi which are able to survive either directly in the soil or on lucerne debris. They are able to infect damaged parts of the crown and root system particularly. Here they cause an extensive brown to black rotting of the tissues.

In order to assist control, damage to the crown of lucerne plants must be kept to a minimum. Avoid over-grazing and heavy trampling, particularly in winter, by stocking for
shorter periods on a rotational basis. A three year gap between lucerne stands in the same field should be maintained.

PHYTOPHTHORA ROOT ROT

This fungal disease can blacken and destroy part of the root system. As it is encouraged by wet conditions, it is more severe with lucerne on heavy soils or in low-lying situations. It is probable that this disease is much more important than is at present realised.

For partial control, drainage should be improved. The cultivar Washoe should be tried in damp areas as it is known to be resistant. Other resistant cultivars will become available in the future.

STEM NEMATODE

Damage due to stem nematode shows in spring as patches of stunted plants, with swollen shoots and small distorted leaves. Plants may appear to recover during summer. The nematode can be introduced to crops in seed debris, hence the recommendation to always use machine dressed seed; dressing removes the debris and the nematodes. Spread on farms and between farms occurs through infected hay as the organism can survive in hay for some years. For this reason, lucerne hay should never be fed out on lucerne stands.

Resistant cultivars will be the answer, and where stem nematode is severe, Washoe should be sown. Other resistant cultivars are being evaluated.

NODULATION FAILURE

Although not normally regarded as a disease, the failure of lucerne plants to nodulate following inoculation at sowing
can be very serious. In the past this would have necessitated ploughing and re-sowing. However, *Rhizobiwm* granules are now available, and these should be drilled into the surface of the stand, to a depth of 2-3 cm under moist conditions. The *Rhizobiwm* bacteria then multiply, infect the surface roots, nodules develop and the stand takes on a healthy green colour as compared with the previous yellow appearance.

**SUMMARY**

Although there are a number of diseases affecting lucerne, there are good prospects for control.

The important aspects are:

* Further research on a field scale to assess the value of seed treatment fungicides for control of seed and seedling diseases.
* The need for much more work on the development of resistant lucerne cultivars. This will certainly be the most satisfactory way of controlling the main diseases.
* There should be an expanded programme for the evaluation of many cultivars already available both in research and farm scale trials, as well as under all types of lucerne management.

**ADDITIONAL INFORMATION ON LUCERNE DISEASES**


Lucerne is an important crop in New Zealand. The latest official statistics show that in the 1973-74 season 191,000 ha were in lucerne. Approximately 30% of this area was used solely for grazing, less than 5% was used solely for the production of dehydrated leaf meal, and the rest was used for both grazing and conservation as hay or silage. Fig. 1 shows that the area of lucerne grown for conservation in New Zealand has been steadily increasing and that the expansion in area has taken place in both islands at about the same rate. The South Island is still clearly the dominant area for lucerne and Canterbury is the most important province, having maintained approximately 50% of the national area.

There are many possible reasons for this increased use of lucerne including: several dry seasons during the 1960's, increased use of lucerne for grazing, grassgrub attacks on pasture leading to a Government establishment subsidy for lucerne, an expansion in the lucerne dehydration industry for export, and the general intensification of farming forced by rising costs.

Over the last 15 or 20 years the lucerne growing industry has changed markedly in two major respects. The use of lucerne
for grazing has increased considerably and while at the start of this period restrictions to expansion were managerial and financial, disease and insect attack are now known to have severe effects in particular areas and at particular times.

With effects of diseases and pests on lucerne having to be taken seriously, some economic form of disease control is necessary. At present the most satisfactory method of disease control in lucerne is the use of resistant cultivars, so these have to be found.

MAJOR CULTIVARS FOR CANTERBURY FARMS

Traditionally lucerne in New Zealand has meant Marlborough or its bred derivative Wairau, and over 80% of lucerne grown in
Wairau is basically a selection of Wairau. Other cultivars such as Hunter River, Chanticleer and College Glutinosa are nationally of limited significance, are unlikely to increase in area and will be ignored in this discussion.

Lucerne arrived in New Zealand with the original agricultural settlers over 100 years ago. A century of natural selection in our climate and under the combination of haying and grazing produced the Marlborough strain of lucerne, which is well suited to the traditional lucerne areas on the east coast of the South Island. Wairau is basically a selection of Marlborough.

Wairau

Wairau has fine stems, a moderately broad crown, reasonably quick recovery after cutting or grazing, moderate winter growth and good persistence under grazing. However, Wairau has not been selected for resistance to any diseases and pests and has only a low level of tolerance to common pests and diseases. Thus, while Wairau still performs well in dry areas, its performance is disappointing in wetter areas, under irrigation, or where severe disease or pest infestations are present.

In 1970 bacterial wilt, the lucerne disease that has had most influence in North America, was recognised in New Zealand and is now known to be widespread in all the important lucerne growing areas. Wairau is susceptible to bacterial wilt and some irrigated stands have run out 2-3 seasons after infection occurred.

Saranac

After extensive evaluation of many bacterial-wilt resistant cultivars from overseas, Saranac was placed on the Acceptable
Cultivar List in 1974 (Palmer et al 1974). Extensive importation of seed supplied the initial demand for Saranac but there are now quite large quantities of domestically produced seed available.

Saranac was bred at Cornell University in the State of New York, U.S.A., and released in 1966. It is more upright than Wairau and has larger, darker green leaves and thicker, flesher stems. Trials in Canterbury have shown that Saranac produces at least as well as Wairau where there is no bacterial wilt infection, and persists in a productive state where bacterial wilt is killing Wairau plants, (Table 1).

**Table 1**

YIELDS OF LUCERNE CULTIVARS IN CANTERBURY

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Wilt-prone site</th>
<th>Wilt rarely severe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Winchmore (irrigated)</td>
<td>Lincoln (dryland)</td>
</tr>
<tr>
<td>Wairua</td>
<td>103</td>
<td>95</td>
</tr>
<tr>
<td>Saranac</td>
<td>113</td>
<td>111</td>
</tr>
<tr>
<td>Washoe</td>
<td>106</td>
<td>108</td>
</tr>
</tbody>
</table>

Saranac grows slightly less vigorously than Wairau over the winter and, because of its coarser growth, should be cut or grazed slightly earlier than Wairau for best utilisation or best quality hay. However analyses have shown little difference in either leafiness or digestibility of these two cultivars when cut at the late flower bud stage (Table 2). Saranac has a higher level of resistance to leaf diseases than Wairau (Dunbier et al 1976) and thus suffers less leaf loss and has lower levels of the associated phyto-oestrogens.
It is recommended for higher rainfall areas, for irrigation, and where bacterial wilt is present.

Table 2

ESTIMATES OF HERBAGE QUALITY OF LUCERNE CULTIVARS
CUT AT LATE BUD

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Leaf/Stem %</th>
<th>In vitro digestibility %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wairau</td>
<td>74.2</td>
<td>68.5</td>
</tr>
<tr>
<td>Saranac</td>
<td>79.3</td>
<td>67.2</td>
</tr>
<tr>
<td>Washoe</td>
<td>75.4</td>
<td>66.4</td>
</tr>
</tbody>
</table>

Washoe

Washoe is the most recent lucerne cultivar to be placed on the Acceptable Cultivar List, in 1976. Washoe is resistant to stem nematode (eelworm) as well as being about as resistant to bacterial wilt as Saranac. Stem nematode is a severe problem in some parts of the South Island, particularly North Otago, Waimate County, and parts of mid Canterbury and North Canterbury.

Washoe was bred in Nevada, U.S.A., by staff of the U.S. Department of Agriculture and released in 1966 (Hunt et al 1966). Subsequent tests in the U.S.A. (D.K. Barnes, U.S.D.A., St. Paul, Minnesota pers. comm.) have shown that besides its bacterial wilt and nematode resistance Washoe also has a high tolerance to Phytophthora root rot, a common cause of lucerne death in low lying areas or wet conditions. In field trials in Canterbury Washoe has shown a high level of tolerance to Verticillium wilt, which is caused by a fungus, and has persisted better than other imported bacterial-wilt resistant cultivars.
In Canterbury trials production of Washoe has been 10-15% below Wairau or Saranac in the first two or three seasons; however, in later seasons Washoe increases relative to other cultivars (Table 1). At least in Canterbury, Washoe is the most persistent cultivar available, and should be sown where soils are likely to be wet for long periods, as well as in areas where eelworm is present. In growth pattern and forage quality Washoe is similar to Wairau.

Washoe has one significant disadvantage - like most cultivars coming from an arid environment it suffers badly from most leaf diseases, when grown in more humid regions. In New Zealand Washoe can be almost completely defoliated in severe attacks in a wet autumn. This susceptibility to leaf diseases not only lowers production but may also cause problems with ewe fertility.

*Cultivar Recommendations*

In summary the recommendations for cultivars at present available are:

* Wairau is the traditional all-purpose cultivar for New Zealand but lacks resistance to most major pests and diseases and should be used only in those areas where bacterial wilt is unlikely to be important (dryland with less than 750 mm annual rainfall) or in planned short-term stands.
* Saranac is recommended where bacterial wilt is a known or likely problem (areas where annual rainfall is above 750 mm, and irrigated areas) but where neither eelworm or wet conditions are problems.
* Washoe is the most persistent cultivar presently available and should be used wherever eelworm is present or wet conditions are likely.
CROP RESEARCH DIVISION PROGRAMME OF BREEDING AND EVALUATION

It is apparent from the above discussion that while Saranac and Washoe have valuable roles to play in New Zealand agriculture, neither is ideal. The CRD breeding programme aims to provide persistent cultivars that produce high yields of quality feed under the range of New Zealand conditions of soil, climate and management. However, since breeding is a long-term business it is complemented by our testing of overseas cultivars.

This test programme is continuing, with a series of trials in conjunction with Soil and Field Research Division, Ministry of Agriculture and Fisheries. Trials have been established at sites at Whangarei, Helensville, Wairakei, Gisborne, Takapau, Hawera, Flock House, Nelson, Blenheim, Seddon, Lincoln, Timaru, Otiake (irrigated and dryland), Cromwell, Riversdale and Te Anau. More trials are expected to be established next spring. This gives good coverage of the entire country and should show which cultivars are most suitable for particular regions. Because cultivars resistant to several diseases are included in the trials, they should show whether disease problems are of general occurrence or peculiar to a region. The first of these trials were established in the spring of 1975, and already some information is available for the breeding programme.

At present disease and pest attacks are severely affecting lucerne production so most emphasis is being placed on selecting for resistance. Fortunately for New Zealand most of the diseases and pests now present are also pests overseas. Plant breeders in North America and Europe have been successful in producing cultivars that are resistant to one or more of bacterial wilt, stem nematode, verticillium wilt, phytophthora rootrot, blue-green aphid and leaf diseases. The job of the breeder is to combine these resistances with
the agronomic characters required for a successful cultivar.

Our approach is to use as parents a range of cultivars and breeding lines that differ widely in disease resistance and growth characters. Then by using seedling screening techniques for disease and pest resistance a pool of genetic material can be built up rapidly, adding resistances in a step-by-step fashion.

An example is the programme to select for resistance to blue-green aphid. By inoculating seven day old seedlings with aphids the resistant plants can be selected in four weeks and seed obtained from them four months later. With out-of-season seed multiplication in North America we should have an aphid-resistant cultivar commercially available 3-4 years after starting the project; by 1979 or 1980. This is good progress, but not as fast as in the U.S.A. where a blue-green aphid resistant cultivar CUFIOI was commercially available two years after the project was started. The major difference in varietal production between the U.S.A. and N.Z. is that seed increase is much more efficient (somewhere between 10 and 50 times the rate) than it is here. CUFIOI was tested here this 1976-77 season (Dunbier et al 1977) and shows a high level of aphid resistance and rapid growth, but is susceptible to bacterial wilt.

LUCERNE AND PHYTO-OESTROGENS

Considerable concern has recently been expressed about the effect of phyto-oestrogens on the fertility of ewes flushed and mated on lucerne. Coop & Clark (1960) and Scales & Moss (1976) have shown that grazing ewes on lucerne during flushing and mating has lowered lambing percentages, largely through reducing the proportion of multiple births.

Unlike subterranean clover and some other legumes, lucerne
does not naturally have a high level of phyto-oestrogens. Overseas studies (Loper & Hanson 1964, Hanson et al 1965, Dickoff et al 1967, Sherwood et al 1970), now confirmed in New Zealand (N.D. Hood, Applied Biochemistry Division, DSIR, unpublished data), show that healthy lucerne tissue has a level of coumestrol, the principal oestrogenic compound in lucerne (Hanson et al 1965) so low as to be virtually undetectable (Fig. 2). However, coumestrol has been shown to be produced in response to attack by fungi or bacteria and also to attack by some aphids. Thus healthy, actively-growing lucerne has extremely low levels of coumestrol but as the lucerne growth matures and the incidence of leaf disease increases, the coumestrol level and (presumably) the oestrogenic effect rise considerably.

![Graph](https://via.placeholder.com/150)

**FIG. 2. EFFECT OF LEAF DISEASES ON OESTROGEN LEVEL IN LUCERNE.**
Weather has a major influence on the occurrence and severity of leaf diseases such as common leaf spot, pepper spot and downy mildew. Dry weather is unfavourable to their spread but prolonged rainy periods, heavy dews, or spray irrigation, cause leaf diseases to increase greatly. They are most significant in humid areas and in New Zealand are of more concern in the North Island, but are also prevalent during moist periods in autumn and spring in the South Island.

There are extremely small differences in natural coumestrol content between different lucerne cultivars. There are, however, large differences in susceptibility to leaf diseases between different cultivars, and this can result in large differences in effective oestrogen levels. In general cultivars from arid regions have high susceptibility to leaf diseases while those from humid regions are much more resistant. In addition it is possible to select for resistance to leaf diseases so susceptibility should be able to be further decreased. Of the cultivars currently available in New Zealand, Saranac is more resistant than Wairau with Washoe noticeably more susceptible. (Dunbier et al 1976). Farmers growing Washoe should be aware of the risk of developing high oestrogenic levels with this cultivar.

Apart from growing resistant cultivars the farmer has two management options if he wishes to flush or mate his ewes on lucerne. The most obvious measure is to make sure the lucerne he uses at this period is not high in coumestrol by arranging his cutting or grazing sequence so that the ewes have available fresh young regrowth, three or four weeks after defoliation. This could be achieved in dry seasons only where irrigation was available, but the problem is likely to be of lesser magnitude then. This grazing at an immature growth stage in autumn will deplete the reserves of the lucerne stand. However, the safeguarding of animal performance should more than compensate and, so long as the lucerne
is not mismanaged over the rest of the season, should have little permanent effect. The second management possibility is to use a fungicidal spray to protect against disease infection (Hart & Close 1976) if conditions favour disease. This would seem to be the most likely place for fungicides to fit into a lucerne management scheme.

Thus, while it is probably a good general recommendation to avoid flushing and mating ewes on lucerne wherever possible, in instances where large proportions of the farm are in lucerne little reduction in fertility should be noticed if prudent management practices are followed. Verification in New Zealand of these overseas research results should allow definite recommendations in the near future.

SUMMARY

Recent research has shown how the effects of many of the diseases and pests limiting the production of lucerne can be overcome by using resistant cultivars. Cultivars bred for resistance to bacterial wilt (Saranac) and both bacterial wilt and stem nematode (Washoe) are now available to New Zealand growers. A cultivar resistant to blue-green aphid should be available within 2-3 years and cultivars with multiple resistance to combat the important pests and and diseases in this country should be available within a decade. In the meantime research on other methods of minimising effects of these diseases continues.

ACKNOWLEDGEMENT

To T.L. Knight, Winchmore for data included in Table 1; N.D. Hood, Applied Biochemistry Division, DSIR, and L.R. Fletcher, Grasslands Division, DSIR for data in Fig. 2 and Table 2 respectively.
REFERENCES


In the past, Lincoln College Farmers' Conferences and particularly College field days at Ashley Dene have considered most aspects of fat lamb production on lucerne. This paper discusses our recent experience with a particular lucerne - Tama ryegrass grazing system for fat lamb production on dryland at Kirwee, Central Canterbury.

Based on experience with a 12 ha lucerne grazing demonstration farmlet at Ashley Dene, stocked up to 20 ewes per ha, Stewart and Taylor (1965) considered that the needs of a predominantly lucerne farming system would be later lambing (early to mid-September rather than early August for grass pasture), over-drilling for greenfeed and annual renewal of one eighth of the lucerne area, thereby providing for greenfeed and turnips. Hay-making would be in direct competition with ewe carrying capacity in late spring and early summer and so they had opted for turnips to be the basis of winter feeding.

The purpose of overdrilled Tama is, together with pure-sown Tama, to provide early spring feed, and thus grazing of pure lucerne may be delayed to obtain increased growth. Our earlier work at Ashley Dene (Vartha 1971) showed that where Tama was overdrilled into lucerne in a wet autumn, it contributed 5200 kg/ha to annual herbage yield, but in three consecutive years with dry autumns, the contributions were
less than 1500 kg/ha. Following this research, we wanted to see what problems were posed in the management of lucerne - Tama systems on light land.

At our Kirwee research area on Chertsey silt loam, we chose to study both dryland and irrigated lucerne grazing systems in which 33% of the area was lucerne overdrilled with Tama and 16% of the area in pure Tama. An area of 8 ha was divided to four farmlets, two each of dryland and irrigated, with six paddocks per farmlet.

We did not entirely follow Stewart and Taylor's prescription in choosing autumn grown lucerne, hay and Tama greenfeed rather than turnips for the winter. The choice of 33% of each farmlet as the area to be overdrilled with Tama was arbitrary, this being two paddocks out of the total of six. One paddock of pure sown Tama was taken for four successive crops of Tama. The remainder of each farmlet comprised three paddocks of pure lucerne. On one of these we fed out hay during winter. The treading caused delayed lucerne growth in spring. Stocking rate on dryland was 15-17 Border Leicester - Corriedale ewes per hectare.

**Pasture Operations**

After a summer fallow, Tama was sown in mid March at 20 kg per ha with 125 kg per ha of superphosphate. In late June 30 units of nitrogen was applied as nitro-lime. Lucerne was overdrilled with Tama at similar seeding and fertilizer rates using a triple-disc drill. No preparatory grazing was generally needed and a light grazing in late autumn utilized lucerne that was competing with establishing Tama. All lucerne pastures were topdressed with an annual application of 150 kg per ha of potassic superphosphate in spring.
Livestock Operations

Ewes were mated on lucerne to lamb from 25 August. After grazing all the lucerne grown in autumn, they were kept on one of the lucerne paddocks throughout winter and fed barley straw and lucerne hay, the proportion of the latter increasing as winter progressed. One month prior to lambing, feeding was changed to pure-sown Tama, then lucerne overdrilled with Tama was fed next. So, grazing of pure lucerne was delayed later into spring.

Feed Budgeting

We used a feed-budgeting procedure throughout the year, basing rations on their feed energy values (Jagusch and Coop 1971), the daily amount of herbage required for maintenance of a 55 kg ewe being about 820 g for fresh lucerne or Tama, 1080 g for lucerne hay and 1300 g for barley straw. The feeding standards used were:-

1 month prior to mating - 1.25 times maintenance
mating period - 1.25 times reducing to 1 times
early pregnancy - 0.66 times
late pregnancy - 1 times increasing to 1.25 times
lactation - 1.25 times increasing to 3 times

To effect this in practice, pasture yields were measured ahead of grazing. Then, daily requirements per ewe x stock numbers = days grazing, except that we did not graze for more than 14 days to ensure that lucerne regrowth potential was not affected. We break-grazed to obtain full utilization of feed, achieving this through the small paddock size, and growth that would become surplus to grazing needs was made into hay.

The years 1975/76 and 1976/77 give a recent comparison of the effects of the latters dry autumn weather on the contribution that Tama can make in a lucerne grazing system. (Autumn rainfall 211 mm and 94 mm). Further notable features of
1976/77 were cold and wet spring weather severely retarding lucerne growth together with the first incidence of blue-green aphid in the Kirwee area. We did not spray insecticide for this pest because its build-up was less in our grazed situation than elsewhere on lucerne taken for a first hay crop. This decision probably reduced the quantity and quality of the hay. We grazed the aftermath soon after baling. Aphis disappeared in the autumn of 1977.

### Table 1

<table>
<thead>
<tr>
<th>STOCK PERFORMANCE ON DRYLAND LUCERNE/TAMA RYEGRASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stocking rate (per ha)</td>
</tr>
<tr>
<td>Ewe live-weight at mating (kg)</td>
</tr>
<tr>
<td>Lamb survival-to-sale (%)</td>
</tr>
<tr>
<td>Mean lamb live-weight (excluding lambs less than 25 kg)</td>
</tr>
<tr>
<td>% lambs greater than 25 kg by January</td>
</tr>
<tr>
<td>Calculated meat/ha (kg)</td>
</tr>
</tbody>
</table>

### Results and Summary

The only results we shall discuss from the irrigated farmlets are the effects of an irrigation in autumn on the growth of overdrilled Tama.

Table 1 shows from dryland farmlets similar meat production per hectare for both years, the higher rate of stocking in 1976/77 offsetting the lower percentage of lamb survival-to-sale in that year. The dryland farmlets on average produced 7,400 kg herbage dry matter per ha. Table 2 shows that feeding strategy differed, a consequence of poor growth of overdrilled Tama from the dry autumn of 1976/77 (Table 3).
Table 2

FEEDING STRATEGY ON DRYLAND

<table>
<thead>
<tr>
<th>Percent of energy requirements as:</th>
<th>1975/76</th>
<th>1976/77</th>
</tr>
</thead>
<tbody>
<tr>
<td>lucerne pasture</td>
<td>25</td>
<td>39</td>
</tr>
<tr>
<td>overdrilled lucerne</td>
<td>47</td>
<td>32</td>
</tr>
<tr>
<td>pure Tama</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>lucerne hay</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>barley straw</td>
<td>7</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 3

YIELD OF OVERDRILLED TAMA FOR THE FIRST GRAZING IN LATE WINTER*

<table>
<thead>
<tr>
<th></th>
<th>1975/76</th>
<th>1976/77</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tama yield (kg/ha)</td>
<td>1350</td>
<td>less than 100</td>
</tr>
<tr>
<td>Total herbage</td>
<td>1700</td>
<td>400</td>
</tr>
</tbody>
</table>

*to 24 Aug. to 14 Aug.

Establishment was good in both years - in the latter, plants failed to develop in the dry weather and did not grow vigorously in early spring. Late sowing (i.e. after mid-March) even in a good year may give poor results as shown in Table 4, the comparison with overdrilled Tama from the irrigated farmlet in 1976/77 highlights the importance of autumn moisture for Tama yield. Our experience at Kirwee has shown satisfactory results with overdrilled Tama in two of the past four years - irrigation has given satisfactory
Table 4

EFFECT OF AUTUMN IRRIGATION ON GROWTH OF OVERDRILLED TAMA FOR EARLY SPRING* 1976/77

<table>
<thead>
<tr>
<th></th>
<th>Dryland</th>
<th>Irrigated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tama yield (kg/ha)</td>
<td>less than 100</td>
<td>1730</td>
</tr>
<tr>
<td>Total herbage</td>
<td>870</td>
<td>2300</td>
</tr>
<tr>
<td>* to 1st week September</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

results in all those years. Oats could be overdrilled later than Tama in a dry autumn, but their regrowth from grazing is poor and so pure lucerne would have to be grazed earlier than desirable in spring.

Table 5

HAY MADE ON DRYLAND LUCERNE/TAMA RYEGRASS STOCKED AT 15-17 EWES PER HA

<table>
<thead>
<tr>
<th></th>
<th>1975/76</th>
<th>1976/77</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bales/farmlet*</td>
<td>225</td>
<td>100</td>
</tr>
<tr>
<td>% of the amount required</td>
<td>244</td>
<td>78</td>
</tr>
<tr>
<td>* - 2 ha area farmlet</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The outcome of early grazing of pure lucerne, is to restrict the amount of hay that can be made (Table 5). A shortage of feed in early spring 1976/77, through failure of overdrilled Tama and coupled with slow growth of lucerne in cold weather, meant that lambs had to be early-weaned at six weeks of age. This checked their growth. Hay was able to be made because
of the prolonged wet weather in spring.

Table 6

<table>
<thead>
<tr>
<th></th>
<th>1975/76</th>
<th>1976/77</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (kg/ha)</td>
<td>6400</td>
<td>5200</td>
</tr>
<tr>
<td>When grazed</td>
<td>Early Aug.</td>
<td>Late July</td>
</tr>
<tr>
<td></td>
<td>11 days</td>
<td>14 days</td>
</tr>
<tr>
<td></td>
<td>11 days</td>
<td>4 days</td>
</tr>
<tr>
<td></td>
<td>Early Nov.</td>
<td>Late Sept.</td>
</tr>
<tr>
<td></td>
<td>7 days</td>
<td>4 days</td>
</tr>
<tr>
<td></td>
<td>Late Dec.</td>
<td>Late Oct.</td>
</tr>
<tr>
<td></td>
<td>10 days</td>
<td>2 days</td>
</tr>
</tbody>
</table>

Compared with overdrilled Tama, pure-sown Tama is less affected by the vagaries of autumn weather provided a summer fallow is used to conserve moisture (Table 6). We took four successive crops of Tama and land could be available for fallowing from late December when annual Tama ceases growth. Pure Tama would not fit in with a renewed rotation for lucerne because land has to be ploughed in August for sowing lucerne in September. The length of life of dryland lucerne stands is uncertain, but probably greater than six years. So, in years when lucerne renewal was required, oats could be grown instead of Tama. This means that less hay would probably be made in the year of renewal.

Increased meat production per hectare from grazed lucerne - Tama on dryland is linked with the certainty of Tama growth. Otherwise lambing has to be delayed, an operation which on dryland may reduce the hay supply. Some irrigation seems
essential for assured results.

REFERENCES


I do not think anyone is completely happy with education in rural areas any more than we can say we are completely happy with all aspects of the state of education in urban areas. For that reason alone I was pleased indeed to receive the invitation to talk for it has enabled me again to look at what we are doing and how rural education compares with education elsewhere in New Zealand. It may seem odd therefore for my first comment in this address to be that this has been a subject I have found it hard to come to grips with.

One of the difficulties I have found in preparing this paper has been trying to identify exactly what is the essence of the problems in country education. It is immediately obvious, for example, that many people, when first approached to comment on the problems of rural education, immediately declare that the problems are legion. They also comment that they are nevertheless capable of solution if only one was prepared to give some thought to the matter and, of course, spend some money. I must say that in most cases it soon becomes apparent that their identification of specific problems does not usually measure up to their earlier promise.

I am not saying that we do not have any problems. What I am saying is that their identification is not easy. I think,
too, that many solutions that are suggested tend to be rather superficial and tend to concentrate perhaps on the symptoms rather than the disease itself.

I also know that no one is completely reassured to be told that no matter what area we are looking at the policies and practices in education must of necessity represent a compromise between conflicting interests and between ideals and realities. Nor is it particularly helpful to be told that all areas have their problems and that in this respect country education is no different from other parts of the system.

What I propose to do is to look briefly at the situation as it now is and then raise a number of problems and dilemmas that must be resolved or reconciled before many fundamental changes can be made.

EDUCATION IN RURAL NEW ZEALAND

The first point to be made probably concerns the range and diversity of the activities that can be described as rural education in New Zealand. The range extends from early childhood education to the tertiary level, and from general education to specialist, vocational training. It includes a day school of almost 1,000 pupils and education by correspondence for isolated children. There are schools that are close to large urban centres, and schools that are very remote. Such range and diversity makes it difficult to summarize the development of education in rural areas. Indeed when faced with such a range it is tempting to fall back on the figures involved; something like the hackneyed example that last year approximately 3,000 vehicles travelled more than 37 million km to take 120,000 pupils to and from school each day at a total cost in excess of $16 million.

But what do such figures tell us other than the fact that
very large sums of money, and a great deal of time and effort are spent each day to ensure that as many children as possible have the opportunity of attending a day school.

The figures do not tell us that, in spite of these efforts, we are unable to cater satisfactorily for all children. Indeed my talk can be summarized by saying that we make strenuous efforts to achieve a high standard of education in New Zealand schools, and can point to some notable successes in the education of rural children, but we also face major unsolved problems. In thinking about these problems it must be stating the obvious to say that virtually all problems in the education of rural children have to do with distance and isolation. There is no way that these problems can be totally overcome by money or buses or buildings. Parents who live in districts where schools have been consolidated in the past may well regret the time that their children spend travelling. Perhaps they wonder if a small local school would provide a focal point for their district without serious loss of educational opportunity for their children. On the other hand parents whose children go to a small local school may perhaps regret the lack of social, sporting and cultural opportunities, let alone the more limited range of courses that can be offered in smaller secondary schools.

I said it is obvious that virtually all problems of rural education are related to distance and isolation, but it may be less obvious, especially to those who live in the country, that there are few problems peculiar only to rural schools. For example, transport is a vexed issue of rural education. Yet in the Wellington suburb where I live the majority of secondary school girls travel approximately 10 km each day. Boys travel further and longer. I estimate that average travelling time for Wellington College boys who live near me is between 40 minutes to 1 hour each way each day.

The 1975 National Survey of Rural Women showed that only
approximately 50% of secondary school pupils travel more than 45 minutes per day and the average distance to school is 16 km. You may also recall the news items last year about the bus drivers who refused to drive school buses in parts of Auckland city. So transport is not the problem of rural schools alone.

Of course I would hasten to agree with you that distance and isolation intensify some of the problems of education, but I must also say that living in large cities not only intensifies, but also creates, some particular educational problems of its own. All of these problems must be solved to the best of our ability to ensure equality of educational opportunity.

I shall return to the question of transport later for, as I have said, I think that in many ways, it lies at the heart of the problem - and I am not just thinking of the transporting of children from home to school and back again.

But first, let us look at each of the educational sectors in turn.

_Early Childhood Education_

In the last ten years there has been a growing demand throughout New Zealand for early childhood education, not the least, for rural children. At present there is a relatively small number of playcentres in country districts and no kindergartens. Indeed, it is clear that the traditional early childhood organizations, especially the kindergarten, are probably not appropriate for more sparsely populated areas. We have therefore begun to look at alternative ways of providing preschool facilities for children in country districts. Last year, for example, the Correspondence School started offering programmes for pre-schoolers. The first year involved 50 families, but this year's course began with 180 enrolments.
A different approach has been the provision of a mobile pre-school unit in the Marlborough district. The teacher-driver visits 5 localities on a trip of 400 km per week. A new van is due soon and a second teacher will be appointed.

A third possibility is the linking of pre-school with primary school, and indeed there are now 14 pre-school units attached to rural primary schools. Yet another possibility is some sort of self-help programme organized by parents themselves. The 25 field officers of the Pre-school Advisory Service all support a growing number of family playgroups established by parents.

It may be that none of these developments provide the final answer - if such a thing as a final answer is possible. It is more likely that there will be even greater diversification to provide the support required.

Of course there is a long way to go and I know that there are some disappointments. For example, some people are disappointed with the limited opportunity for pre-school children to travel on school buses. I have already noted that we will spend $16 million on basic transport to and from school this year. The extra running involved in meeting this and other requests would raise this substantially and the immediate answer must be that a marked increase is just not possible during a time of restraint on Government expenditure and wildly climbing transport costs. This is not, however, to deny in any way the ultimate importance of transport in the development of country education policies.

Primary

The provision of adequate educational opportunity has been a continuing concern in New Zealand since the earliest days of state education, especially at the primary school level. By
the 1900's the country was studded with a network of primary schools, but by the 20's there was growing concern about the limitations of small schools. The 1930's saw a policy of consolidation of primary schools in many parts of New Zealand and, while this policy helped to solve problems of social and sporting opportunity and improve conditions in many ways, the inevitable result was an intensification of the problem of transporting young children. This problem is with us today and skyrocketing costs mean that we must re-assess the current situation.

Just as there is a varied approach at the early childhood level, I believe we must show greater readiness to take a varied approach to solving educational problems at the more established primary and secondary levels.

For example, attracting suitable, permanent staff to schools has been a point of concern in New Zealand for a number of years. The most recent figures show that this is no longer a matter for such concern in rural primary schools. However, I personally view with alarm the emergence of a new problem in staffing. The change in the number of teachers available, the number of married women who have returned to the service, mainly in cities, and, to a lesser extent, changes in the career structure in primary schools, mean that we now have a much more stable teaching force. This is of course desirable, but my concern is that it appears to be increasingly difficult for teachers to move out of rural schools. Just as the rapid changes of relieving teachers is undesirable in any school, the opposite extreme of a teacher spending all of his or her professional life in one school is also undesirable.

Intermediate and Secondary Education

When people speak of the consolidation of schools at the present time they are usually referring to the changing of
small District High Schools to Area Schools or Form 1-7 schools. From an educational point of view these changes have been most worthwhile, and from the information we have it seems that the majority of parents appreciate the wider range of courses offered, increased staffing, and improved buildings and equipment.

I have also noticed with interest that the election of Committees of Management and Boards of Governors frequently increases community interest as well as influence in their local school. A combination of all these changes means that fewer children go off to boarding school, resulting in further increases in roll numbers. I have no doubt that the reorganization of District High Schools is a major advance in rural secondary education.

It is unfortunate that staffing in some subjects continues to be difficult in both rural and urban schools and recent investigations by the Department show that rural schools are somewhat worse off in commercial subjects, Maori, music and provision for slow learners. Officers of the Department are studying this problem, but there is no easy solution in view.

*Tertiary Education*

I have mentioned the beginnings being made in early childhood education, and the major change at the secondary level, but perhaps the widest ranging changes in education in rural areas have been made at the tertiary level. Because a great deal is happening, the precise pattern is not yet clear, and parts of this emerging pattern have few, if any, links with the Department of Education. Of particular significance has been the development of courses in Polytechnics, and the continued growth of Lincoln and Massey. Correspondence courses from Massey University, the Technical Institutes and the Corres-
pondence School have shown great expansion, catering for rural adults with courses that range from vocational training in agriculture and horticulture to university science and arts subjects and to teacher training.

Mention of the developing Farm Cadet Scheme, and the work of Flock House and Telford still would not cover the full scope of tertiary education and its growing place in the country. I find the atmosphere of confident development most heartening and the willingness of the various organizations to diversify and innovate in order to answer specific needs provides a model that could well be an example to other levels of education.

SOME PROBLEMS

I said earlier that my research into present and possible future developments in rural education had highlighted a number of dilemmas that will have to be resolved before we can come to grips with the real problems.

Consolidation

For example, while there has been strong pressure over the last two decades to upgrade country secondary schools - and the introduction of Forms I-VII schools and five day hostels are outstanding examples of what improvements can be made - there is equally strong pressure for the provision of boarding establishments and for regular increases in boarding bursaries to enable children to leave their local districts. Is this a case of wanting to have one's cake and eating it too or is it merely another manifestation of the concern expressed by the Agricultural Development Conference in 1962 that lack of adequate educational facilities at the secondary level was a major factor in causing farm labourers to move to the towns - the assumption being, presumably that farm owners would continue to send their children to boarding schools (both
But then employees would have to reply on locally provided state schools. Should Government be expected to implement policies to meet both these requirements? We have, too, problems on the consolidation issue. On the one hand Education Boards acting presumably in accord with the wishes of the local communities close small schools with what appears to be monotonous regularity. On the other hand, surveys such as that on "The Rural Women of New Zealand" report a strong concern on the part of the country dwellers that these schools are in fact being closed without, apparently, any hope of them being re-opened.

I note that the relevant section of the Education Act stemming back, presumably, to 1877 appears more concerned with economic than educational reasons - no doubt understandable when the first priority at that time was the introduction of education for all in a small sparsely populated country. The Act, for instance, gives the Minister of Education power to direct the Education Board to close a small school. It does not give him authority to prevent a Board closing a school if it decides to do so.

I realise that I may be unduly influenced by my own educational background, and by an increasing awareness in many areas today that big is not necessarily beautiful, but I do wonder whether when the closure of a school is under consideration we have really fully analysed the educational or social advantages and weighed them against the added problems of travel, let alone the removal of an asset as valuable as a school from the heart of a small community. I would like to think that Education Boards and parents do indeed take all relevant factors into account and come down with a clear margin in favour of consolidation before a final decision is taken.
Transport

I have already touched on the question of transport and this now follows logically from the consideration of consolidation. I have also talked of the large costs involved if there is to be any significant extension of existing policies.

I must say, however, that transport has generally meant the transport of children from home to school, or, in the case of some, from primary school to a manual training centre.

It has, therefore, been very much a one-way process in the same way as consolidation has been irreversible in that it has meant the closing of small schools and the aggregating of children and facilities into larger centres.

The question comes to mind, therefore, of why we could not think of some variations. For example, should we try to reverse the process and instead of bringing the mountain to Mohammed all the time, take, say the teachers, the equipment and whatever else is needed to the pupils?

Should we be thinking of using transport more positively and more flexibly to assist the teaching programme by taking classes of children to larger schools from time to time, or to the cultural and other facilities that city children take for granted?

Perhaps we could also do some back-loading by taking the city children back to the country to see something of the other half of New Zealand.

Teachers

I have left until last the question that many would consider to be at the core of the quality of country education - the
teachers. Although it is not a simple task to measure the quality of the teaching force at any particular time, indications are that, in contrast to the situation in the 1950's the quality of the teachers in country schools has improved and they cannot necessarily be regarded as inferior to their urban counterparts.

There are of course still a number of disturbing aspects. There are, for example, those in the service who are inclined to equate teaching in the country with vegetating. Although there have been, no doubt, cases of teachers who have deliberately chosen to teach at a particular school with a view to the selection of a desirable place for retirement, there is now also the reverse problem I have already referred to, of teachers who are willing and keen to move on once their tours of duty have been completed, but who now find that the increasing stability of staffing prevents them from finding appropriate avenues of promotion.

THE FUTURE

What is the future of education in rural New Zealand? Of course, no one can answer such a question with total confidence, but I can say that the objective of education in New Zealand is the provision of appropriate early childhood experience; a wide general education for school age children that will provide the skills and attitudes so that all may take their places in the New Zealand community; and the provision of continuing educational opportunities flexible enough to meet the changing demands of the adult population. There are the beginnings of a diversified approach at early childhood and tertiary levels and these will continue. At the primary and secondary levels we must identify the problems and not just adopt and hanker after city models in the search for solutions. We must suit the local requirements. We must re-evaluate the place of the small primary school in
rural districts and examine ideas like a confederation of neighbouring schools perhaps with one overall Principal. The sharing of staff expertise, and itinerant advisers for rural secondary schools could also be explored.

Many schools are putting money into outdoor education but perhaps we should look at linking this with country-city interchanges that provide more than the usual superficial two-day visits. Above all the trend should be towards local flexibility rather than rigid national policy. To achieve such ends farming, and other rural organisations must work together with the Department of Education to highlight the advantages of education in rural New Zealand as well as solve the problems.

Teacher quality concerns me. In country schools a 'bad' teacher can have far greater effect, for he or she may teach the same children for three or four years; and country children do not have the same access as city children to remedial work such as special reading classes. This is of continuing concern and it does not apply to country districts. It applies to all schools. We have been having discussions with the teacher organisations about this very problem. My first response to you is that if you find yourself in a position like that, get in touch with the Departmental inspectors. You may find that they know about it already, but see that they try and do something about it. I get very critical of some of our inspectors who come and tell me that they have known about a problem for a couple of years and have not done anything about it. We have a very real obligation to make sure that the quality of education is a high as possible. I would hope that parents would feel that they could come to the Department and ask "What are you going to do about it". There are ways in which you can do something about it.
* What can parents of pre-schoolers do to provide experience for their children when they live too far from any town to participate in organised and recognised pre-school education.

I did mention that the Correspondence School, for which I have a very direct responsibility, has moved into the pre-school area and this is becoming one of the major growth areas in that school. We have doubled the staff since last year. We are trying the mobile pre-school unit to see if we can overcome the problem of distances there. We are also looking at ways in which we may be able to help perhaps by funding administration. It is largely a question of the local community trying to define what it's needs are, and then seeing if we can work out an appropriate solution. An approach to the Department could be in the form of "This is what we would like to do. Is there any way in which you could help?"
EDUCATION IN RURAL AREAS - DISCUSSION

Following the address by Mr. P.W. Boag, a number of people with varied experience in this field formed a panel to discuss the issues raised by those attending.

The opening comments of the panel members are reproduced here with, in some cases, some of the questions and answers that followed.

Panel members included:

Dr. R.T. Baker, Ashburton; Medical practitioner and sometime member, Ashburton College Board of Governors, and New Zealand Secondary School Boards Association.

Mr. D.G. McKay, Akaroa; Principal, Akaroa Area School.

Mr. R.I.M. Ryburn, Darfield; Principal, Darfield High School.

Mrs. A. Baigent, Nelson; teacher with teaching experience in both town and country school.

Mrs. S. Blunt, Kaikoura; country mother.
I want to say something about my particular concept of education. And to start with I should list the four main objectives of education. They are the promotion of

* academic or intellectual growth
* physical and mental health
* cultural and aesthetic appreciation
* moral and ethical behaviour.

Few people would question that we live in an increasingly mobile, fragmented and materialist society; or that we are losing the strength and cohesion of the family, the neighbourhood and the community upon which our society was once based. We do not seem able to arrest an increasing polarisation of opinions and attitudes with consequent deepening of divisions in our society to a dangerous level. We do not seem able to get back to our traditional pattern of resolving differences by logical argument in an atmosphere of goodwill and tolerance for the other's point of view. We most certainly will never rebuild without considerable individual effort the kind of society which I believe most people desire.

I would like to advance a concept of education in its broadest sense as a unifying and cohesive force in society.

Many statements have been made in the last few years by various commissions, committees and councils about community involvement in education. New Zealanders have an increasing fancy for setting up such groups which produce lengthy documents which are studiously ignored.
It is long past time for individual school communities to be moving actively in the exploration of their own particular needs.

Schools must take the initiative through their professional staff and their elected lay committee or board of control. They have an established organisation and they should have the confidence to proceed.

They must convince their communities of certain things before they have any hope of success:

* The sincerity of their beliefs in community-based education.
* The importance they place upon their objectives.

They must also:

* Establish free and open dialogue.
* Listen to and strive to incorporate community ideas and requests.
* Involve lay people directly in establishing priorities and making decisions.

This should lead to an emergence of a true community educational association and see the school established as the neighbourhood educational centre providing together the organisation for:

* increasing community use of school facilities
* increasing community support of school needs by the recognition, deployment and utilisation of human and material resources in school and community to their mutual advantage.

Having established the type of whole community basis I have proposed it will be necessary that they then have the freedom to develop programmes to meet their own particular needs. Financial allocations from the Department of Education should be on a block basis with local school authorities free to use
them to fulfil their own programmes. School authorities must have the courage to vary professional staffing again according to their particular needs. Support services from the Department of Education should be similarly flexible in helping particular areas to work out their own requirements and in devising programmes to meet them.

The whole concept, once initiated, should be self renewing, highly rewarding and a great deal of fun. Initially it will require dedicated hard work to overcome traditional inertia and widely held views that this kind of thing is always someone else's responsibility.

I believe it can lead to a new kind of neighbourhood and community.

THE VIEWPOINT OF THE HEADMASTER OF AN AREA SCHOOL

Mr. D.G. McKay

The area school has risen from the district high school. The district high school system was not providing as good a form of education as the city form 3-7 high school and during the 1960's it was looked at very closely to find out what the problems were and how they could be improved.

The larger district high schools translated to forms 1-7 and this left the problem of the smaller district high school with a form 3-5 population of about 35-50. The idea came about of the area school and I will base my remarks on my experience of the area school at Akaroa and from the experience of other area schools within the Canterbury-Nelson-Westland area.

One of the problems under the district high school system was
that although it was known as a 'district high school' two independent units existed, usually under a primary school headmaster who had little or no secondary experience; so he left the secondary education of forms 3-5 well alone in the charge of a senior secondary assistant. In many places the relationships between these two people wasn't the best and neither would tolerate the interference, as it might have been called at the time, of the other. Now this was really quite an unsatisfactory state of affairs in many instances.

So we have the concept of the area school where the school was to be run as a single unit the whole way through. The teachers could be used not only in the forms 3-5 or 3-6 area but also in standards 3 and 4, and in some cases even in the primer level. In the case of one of the Otago area schools for example, the teacher of fifth and sixth form science also takes the new entrants - so he goes from his rather academic Biology classes down to the little chaps in the primer room to teach children at that level. The idea is to get the school working as a whole rather than two units working against each other. We grab any chance we can find in a standard 1-4 situation, intermediate situation and in a high school situation to build a united school. The various teachers' organisations have argued for a long time about just how small a high school can be. Surely so much depends on how closely all levels from infants to form 6 can pool resources. I find that there are a lot of advantages in being able to work the school in a unified way. One of the particular advantages of the area school is the new staffing ratios. We are able to offer, particularly at the fifth form level, a greater range of subjects than could be offered under the district high school system.

Akaroa Area School has about 173 pupils; this is everybody from primers to form 6. In the fifth form we are able to offer 12 subjects and this is in contrast to what might be offering under the district high school system where it may
be four or five subjects, and those subjects may be taught by one teacher. Because all area schools have such a good staffing ratio a lot of the classes are smaller and children who are lost or might be doubtful candidates for school certificate in a bigger school have a much greater chance in an area school. Since the area school has been established at Akaroa a number of parents have been looking at it from a point of view of their own children. In some cases children are sent on to a certain school "because dad went there". A number of families are now looking at the situation of which school suits the child best. I think it is a very important way to look at the particular features of a school when you come to send your child on to secondary. I think the area school has a lot to offer. It's interesting that six or seven years ago the argument against using the local school would have been "they don't have a very good fifth form pass rate" or "they haven't got sixth form so the children will have to go to a town school at the sixth form level". The argument now has swung around the other way seeing that the pass rates of school certificate level are good and often better than city rates and that they do provide for sixth formers and in some instances even accrediting. The argument has gone right back the other way to sporting and cultural activity and I think it is quite plain that this is a bit of a bogey. I believe that the quality of education in area schools has increased tremendously.

I want to look at the fifth formers who went through Akaroa last year for School Certificate. There were only nine of them which isn't a great number. Obviously staff get together before hand and say "Who is going to pass and who will get four passes, who is going to get five" and so on. And I can say with a lot of satisfaction that all of these children gained sixth form entry; all but one got over 200 in their best four subjects and the other one got 194. The staff sat down and talked about this and we believe that in a larger school the children couldn't have received the individual
attention that ours did.

In summary I'd say that the area school has tremendous potential. It's got the ability to use staff and facilities right through the school; it has a relatively generous staffing ratio and we are able to offer almost individual teaching.

SOCIAL EDUCATION IN THE COUNTRY - A PERSONAL VIEW

Mr. R.I.M. Ryburn

Clearly there are differences between schooling in town and country. I believe there are certain things that are characteristic of country education. I also believe there are certain things that need special emphasis. One aspect I'd like to elaborate on is the social place of the rural school in its community and the social influences that come to bear on children in the rural system.

When one thinks of a rural school, one tends to think of a sole teacher school and there one has a school that is very much part of its community, in that the teacher is known to probably all the parents and may well have been to a meal at all their houses. The parents are very closely associated with the school and they all get behind the committee and appear when there is work to be done round the school. Perhaps they even bring a load of firewood for the teacher! The teacher on his part does far more than his duty calls for the children he has with him. His is a very intimate contact, even a family sort of atmosphere and there is a very close tie between the community and the school. This does not occur in town schools to nearly the same extent. This gives a very valuable but somewhat sheltered environment for
the children concerned.

So what is social education for children? It's probably getting used to relating to increasingly larger groups. To start at the rather obscure level: before birth the association is with one person only - the mother. After birth the child is with the family and then later the local primary school - or if the community is fortunate there may be a pre-school stage - where the child reaches a larger group and then a larger group again. By the time a child goes to high school he is ready to live within a larger group than can be found in most country primary schools.

The country high school then provides this opportunity. It's one more stage removed from home. Parents tend to think of sending their children from 'our community here' to 'out there', and they feel they are losing control. But this is of course just part of social education. The child should move away from the home and learn to a greater extent to stand on his own feet. One of the advantages of a school like Darfield High School is that it does serve a very large community and almost all children of high school age from that community come to it. So in a very real sense we have a cross section of the community represented and children at it can relate to those who are well off and those who are poor; those who come from culturally rich homes and those who come from the reverse; those who come from remoter homes and those who come from almost urban homes.

While third formers often come with some trepidation for the first day or two to such a 'big' school, it is by high school standards one of the smallest in the southern region. Compared with city education the child is still in an environment where he is known. It's a personal sort of environment. I think that most of the teachers in my school know most of the pupils and probably many of the parents. This
has a very definite influence on the quality and character of the education in the school. Children cannot hide behind anonymity. They are known and almost certainly if they kick up their heels at school the parents will hear about it. This is not necessarily the case in town schools. Among the children in the school they know each other well, having grown up together. Therefore there is no need for them to put on a veneer which is sometimes seen in city high school children. This is put on when the child feels that he or she must compete with others, when he or she feels that they do not quite know where they are in the pecking order of the group and must put on some artificiality in order to be near the top. But in the country school with children growing up together this veneer is just not needed.

This social factor brings us to another area of difference between the rural and city schools and also perhaps between smaller and larger schools. This is a higher participation in school activities in rural schools. The children are not self-conscious in a way that perhaps their city counterparts are about trying to handle a new sport, involving themselves in athletics, swimming, crosscountry.

And let's not forget the adults. Our school provides adults with avenues to meet social needs through night classes. Many of these classes have definitely filled a social need in the community. Many of the parents on some of these evening classes have come year after year perhaps because of the need to meet people and work with them rather than master a practical skill. At the other extreme the evening classes can also fill an educational need and we have in close association with the Ministry of Agriculture and Fisheries developed farm-centered courses over the past three years. A farmer who is now Chairman of the Board was particularly interested in this and helped to initiate it. The Ministry of Agriculture and Fisheries in the local office was also
behind this and so also was the Rural Development and Extension Centre at Lincoln. We meet as a planning group each year and we try to set up a number of night classes, but not too many because we want it to go well. We have covered such topics as farm budgeting and record keeping for farmers' wives, farm machinery maintenance and this year we plan to offer welding also.

Perhaps the last thought I'd like to share with you is that a country school is very much part of its community. It has to carry out its traditional tasks. But increasingly also it must be alert to the obligation it has for the social education of youth and the continuing education of adults.

*While accepting the sense of obligation Mr. Ryburn feels towards the social education of his pupils, is it not a fact that, although a number would like to stay in the country, they will have to go to urban areas and should we not equip them for such a wider world?*

One of the disadvantages that I see for the boys and girls at my school is at the time they come to get jobs. Many of them have been in close contact with only a limited number of trades, professions and callings and their horizons I believe are pretty narrow compared with their city counterparts. I am also concerned with those that have to move out into the city to board when they start work or perhaps to go to technical institute or university. I feel that this becomes a shock to their system. They move out from rather small high school and small town environment into a big city. I feel that they are not as well prepared as their city counterparts even though we do our best to prepare them.

*Dr. Baker.*

Could I say something about this question of country children moving into an urban culture. I would think that this problem for the average New Zealand family is far more apparent than
real. I would think that the problem of relationship to urban culture is immeasurably more acute for Polynesian peoples than for the white rural community. I would be very surprised if there are very many families in New Zealand today, however isolated, who don't have fairly adequate contact with a technological type of society and with the cultural background of our society. I think that in many ways the remote country child will orient himself far better to an urban society than an urban child will to a remote country district. I don't agree that this is a major problem of a large number of people and I would agree entirely with anyone who says that if it is, then it is a parents' responsibility.

A VIEWPOINT FROM A COUNTRY TEACHER WHO NOW TEACHES IN A CITY

Mrs. A. Baigent

I am rather concerned that people feel that they are disadvantaged living in the country! Really, living in the city is not all 'beer and skittles'. It concerns me even more than it did before I came to this conference. I feel that some of you have a distorted perspective on what is available in the city and what is available in the country.

In going from a small country school where I have been teaching, to a big school this year, one of the things I imagined I'd have were all those wonderful facilities that you people are talking about. How I would have all these things at my disposal and all these children would do these wonderful cultural things; it was going to be paradise. This was not so. Perhaps a few are really interested, but children who are going to take advantage of cultural and sporting opportunities will take advantage of them whether they live in the country or
the town. I am not talking about children who are really isolated. But remember that in Canterbury the bulk of rural people live within fairly easy distance of a main centre.

A lot of rural schools take their children to the cities for their cultural opportunities. I saw more theatre when I was a pupil in a country school than I ever did in a city school! We were keener to go and also part of it was the bus trip and all that went with it. We saw things that we would never see at home, whereas the city children were so blase it was almost impossible to organise a group to go.

As far as country education is concerned the numbers question comes up again. The thing I find most difficult as a teacher is getting to know my pupils in a big school. Talking about mental stimulation again for the teacher, I have gone from virtually heading my own department - and there is nothing more stimulating than that after two years experience - to a situation where after four years experience I have about three senior teachers above me. This I do not find at all stimulating! I have over 150 children passing through my hands every day. Usually within the first fortnight I know their names, by the end of the first term I am getting to know each child. This year I think I know most of the names now. That's one term later.

Now some of you are keen to put your children in this environment. I am not really sure that it's best for every child. There are those who survive; these children will survive anywhere. There are those who exist and that includes a lot of them. When I look at my classes I know a few of those children well but the bulk of them just sit there. Parents come on P.T.A. nights and say "I am Jonathan's father" - I don't even know Jonathan, let alone his father! I have to tell you that big is not beautiful.
In the smaller schools we have seen the new arrivals come to school as children; they leave as young men and women. We have watched them develop. You have some say in the way they have developed. This is a big responsibility for a teacher and it is not to be taken for granted. But it's rewarding if say a child has an off day; then you know about it straight away. You are so quickly alert to his troubles. I know virtually nothing about the children I teach now. In fact before I came south I was concerned about one of my pupils; I couldn't get any of the background I felt I needed in order to help him. There was something missing and there is just no way I can find out anymore without being told I am getting personal. In the country though I have always known a lot about the children. Since coming down here with one week away from the school I have forgotten even this boy's name!

So therefore I feel that you people are making 'mountains out of mole hills!' Certainly you have got your problems. You have got real problems, but I think that city parents have far bigger problems.

RURAL SCHOOLING - THE VIEWPOINT OF A RURAL MOTHER

Mrs S. Blunt

It seems to me that my role on this panel of rural education specialists is that of the 'country mum'! So I feel I should say a little about the way the quality and structure of rural education has affected our family, our farm and our lifestyle.

We have three children, girl, boy, girl, aged 15, 14, and 11. We live on a sheep, cattle and cropping farm with country
ranging from pancake flat to wild and woolly, and rising to 3,000 ft although only a few miles from the sea.

We are nearly two miles from our sole teacher primary school and high school bus, and twelve miles away from Kaikoura College. These distances may sound like mere chicken feed to some of you, but our situation is complicated by having three unbridged rivers on our side-road and the smallest of these can reach widths of up to 100 ft after a typical Kaikoura "shower".

It's probably a little difficult for some of you to visualise the problems this causes, but a few details may help. Have you ever tried to get to school with neat hair, spotless white socks and shiny black shoes after an epic voyage on a fresh pony, tennis shoes flying out of the saddlebags, tomatoes, bananas and sandwiches all getting squashed! Or better still after an exciting tractor voyage across turbulent floods, where currents and banks change by the hour? Tractor wheels throw up such delightful dollops of mud and slosh as you grind down the road perched on the top of a wet mudguard.

Landrovers and tractors that swim a lot don't always start in the mornings. They consume quantities of fuel and are extremely costly to maintain. Rivers that are crossable in the morning aren't always the same in the afternoon and when you spend from 7.30 a.m. to 4.30 p.m. getting to and from and attending school, there isn't much time for homework.

In spite of these handicaps, I can say with feeling that a good, two teacher country primary school with good facilities takes a lot of beating and our children were able to learn academically and also participate in gardening and animal raising ventures.

From standard 5 upwards our children then had an additional 24 miles a day by bus to get to and from the newly formed Form 1 - 7 high school, and we were told by enthusiastic
politicians and officially from the Education Department that a brand new spacious school would replace the battered arrangement at present calling itself Kaikoura College.

Nineteen seventy seven is here, the new school is not and my two eldest children are now in Christchurch at boarding school. In Kaikoura there are 600 children squashed together on just over 4 acres and these include children from the primary school as well. Buildings are dilapidated and run down. No hot water in the staff cloakrooms or the pupils' for that matter. The children are frustrated, tense and get bored to sobs at break and lunch. The teachers (and there are some marvellous ones) are fully extended in trying to even cope with the situation let alone teach, and still the politicians and authorities diddle and daddle and put off the hour. This then is the standard of rural secondary education in Kaikoura. One teacher said "It's disgraceful!" A Board member said "It's shocking!" I could say a lot more.

Our children couldn't take part in after school activities and so missed out on team sports, but they did learn to cope with other very angry and stressful children of their own age and they did learn to look after themselves and their property.

So far they have been able to cope academically in their main subjects in Christchurch but experience difficulty in coping with team sport skills. We feel they get city experience under sensible supervision and learn more independence at boarding school but the cost places a considerable burden on the farm and means that much needed development has to be delayed several years and we all have to try to make a good deal more money! Costs have to be cut and cut again whilst school fees rise and clothing prices skyrocket.

This then is our own personal situation, but I would also like to mention problems arising from other types of schooling in
our area.

Firstly the correspondence mother; of course she should receive government assistance for the wonderful work she does. She has only a certain amount of energy and health and also needs her own recreation to function effectively. If she is required to do all those things a farmer's wife has to do and teach as well then she needs some financial assistance to enable her to balance her life.

Secondly car allowances; parents who have to drive their children to isolated schools receive only eight cents a mile. What do government servants and others get - 20 cents? How can one run a car these days for eight cents? Children from these schools suffer from lack of competition and suffer more if they have a bad sole teacher. Fuel prices force parents to reduce their childrens outings and therefore their experiences.

And finally, sole teacher primary schools: after the Form 1 - 7 College was formed our primary school became a sole teacher school and it has become quite obvious that it is utterly impossible to give adequate teaching to 22 children aged from 5 - 12 years all in one room. Yet there is an empty classroom next door and surplus teachers desperately looking for positions.

If only politicians would pay more heed to the gross national product output per person in rural areas and provide services accordingly instead of just being influenced by voting power.

If only Education Boards and Governments Departments would busy themselves getting on with the job for the good of the children instead of 'humm-ing and haa-ing' and stalling and stalemating.
Inferior education, rising petrol prices and a feeling that the rural community is of secondary importance are having a stifling effect on all our country areas and so much could be done to change this sad situation.

* Do you qualify for a boarding bursary, being as close as you are to a bus route?
We are a mile and threequarters away. Naturally you only get an allowance for two miles, but when I filled out my first form for my daughter to attend boarding school in Christchurch I put 'see over-leaf' on the form and wrote a great deal about our situation; we were fortunate enough to get the boarding allowance. We have not had any answer yet for our son and I think it usually comes in the first term.

* What about academic bursaries?
A lot of parents don't realise that there is an academic bursary. This is for children who want to study a subject that's not available at the nearest school. My son, for example, takes German which is not available at Kaikoura. He should be able to get an academic bursary which will cover part of his boarding costs in Christchurch. But there's nothing automatic about it. You must make special application to the Education Department and I understand there are only a limited number available.

Dr Baker.
I would like to support Mrs Blunt's remarks about the disadvantage of a country child. My own Board some years ago collaborated with Federated Farmers in producing strong submissions, as we thought, for extra subsidies for bus services for country children. We are told all the time that there is only so much money for education, that it is a huge vote and that if you take
a certain amount more for bus services you are going to have
a certain amount less for something else. Maybe that is true,
but I think country people are far too timid in pressing
political points and exerting political pressure in areas
where the children are definitely disadvantaged. The only
thing that will make any difference to this is true political
pressure for a greater portion of the national funds to see
that country children are not disadvantaged, or at least less
disadvantaged. We have to accept that those of you who
choose to live in isolated areas will suffer some disadvantages
because of that choice. But none the less I think that if
the whole rural community of this country spoke with one voice
and demanded a better deal for country children and made it
a real political issue then you would be able to do something
better about it. We get a few extra dollars and slight extra
changes in our bus routes.

The Education Boards do the best they can with the money they
have got, I am completely convinced of this. But until we
get a single voice on the subject from the whole of the rural
community speaking together and also gaining support from
townsfolk I don't really think we will get anywhere. We
will have small groups like this sitting around commiserating
with one another and the same thing will go on year after year.
SOME ASPECTS OF MILKING MANAGEMENT

G.A. Mein
Werribee, Victoria, Australia

The management of the milking process is complex, requiring careful manipulation of the cow, the machine and the man. The cow only recognises the machine as a teat cup and it is at this point that the action of all three members of the milking team interact. The following section describe current research work in the action of the teat cup in causing movement of micro-organisms within the milking space; milking management techniques which allow penetration across the teat end will also be described.

THE TEAT END

At the bottom of the teat is an opening about 10 mm long called the streak canal. This opening is formed from two distinct parts. First it has a section of epithelium which is continuous with the outer skin layer. This section occupies about three quarters of the canal up to the point where it meets a folded structure known as the Furstenberg rosette. There is no continuous hole through the rosette as the folds form a network at the top of the streak canal. Between milkings the streak canal is filled with a substance called Keratin; a substance which has antibacterial properties.

It is through this 10 mm orifice that micro-organisms must
penetrate to establish an infection within the udder. There are many actions in the operation of the milking machine which create physical forces necessary to allow penetration of bacteria through the barriers of the teat end.

**ACTION OF THE TEAT CUP**

As conclusions obtained with transparent teatcup liners seemed applicable to conventional liners (Mein et al, 1970), the former were used in cinemographic studies of firstly the appearance and behaviour of the teat within the liner during milking, and secondly the milk flow in relation to liner movement.

To provide simultaneous views of the teat and liner, both parallel and perpendicular to the plane of collapse of the liner, a mirror was mounted vertically on the teatcup at a horizontal angle of 45 degrees to a cinecamera operated at 100 frames per second. A clock marked at 0.01 second intervals mounted beside the teatcup, activated an event market to provide synchronizing pulses on a UV oscillograph on which liner vacuum, pulsation chamber (PC) vacuum and liner wall movement were recorded simultaneously. Reference marks were applied at 10 mm intervals with a felt-tipped pen to the skin of light-coloured teats of 4 Friesian cows and to the outer surface of the barrels of 3 liners.

Liners were mounted at tensions of 13, 37 or 71 N in individual teatcup assemblies. Liner vacuum (50 kPa nominal) varied cyclically from 44 to 52 kPa during peak milking. Pulsation rates were 40, 60 or 120 cycles per minute. Pulsator ratio was 70%. Rates of change of PC pressure were adjusted so that both the increasing and decreasing vacuum phases were 0.05, 0.1 or 0.2 second duration (IDF, 1972).

The teat was elongated by 33 - 50% as it entered the liner.
Further stretching of the teat skin throughout milking was negligible.

No cyclic movement of the teat relative to the liner was apparent during the peak flowrate period. After this period, the teat occasionally was seen to slide 2 - 3 mm along the barrel as the liner opened and closed, thus reflecting the reduced frictional force in this region later in milking.

An abrupt colour transition, from the whitened appearance of the teat in contact with the open barrel to the reddened end of the teat, was evident throughout peak milking. After this period, this transition line disappeared and the whole of the teat reddened. A whitened region near the tip of the teat within the collapsed liner indicated a localised zone of high force exerted by the liner in bending around the teat.

Table 1
MEAN PRESSURE DIFFERENCE ACROSS LINER WALL WITHIN PULSATION CYCLE

<table>
<thead>
<tr>
<th>Event Description</th>
<th>Opening</th>
<th>Closing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time (s)</td>
<td>Press. Diff. (kPa)</td>
</tr>
<tr>
<td>Start moving</td>
<td>0</td>
<td>33</td>
</tr>
<tr>
<td>Start or end milk flow</td>
<td>0.03</td>
<td>14</td>
</tr>
<tr>
<td>Liner walls touching beneath teat</td>
<td>0.04</td>
<td>9</td>
</tr>
<tr>
<td>Liner half open or half closed</td>
<td>0.06</td>
<td>7</td>
</tr>
</tbody>
</table>

Mean times from the start of liner movement, and mean pressure differences across the liner wall for events within a pulsation
cycle during peak milking are shown in table 1.

Increasing liner tension, pulsation rate and rate of PC pressure change did not alter the relative sequence of events although the times and pressure differences at which events occurred varied with rate of PC pressure change as expected.

Results are similar to those of Ardran et al. (1958) except that milk flow ended later in the pulsation cycle. This might reflect physical differences between the liners or teats, or better visibility with cinemophotographic techniques.

Changes in appearance of the teat during milking were consistent with changes in friction and pressure conditions in the teat and liner (Mein et al. 1973).

PREVENTING INFECTION MOVEMENT

Data from mastitis control programmes in Victoria (Thompson, p. comm.) and elsewhere (Dodd and Neave 1970) indicate that ten-fold variations in new infection rates can occur between farms which adopt apparently similar control procedures. These variations appear to reflect, at least in part, a milking machine effect of varying intensity from farm to farm (Thiel 1974).

Nyham (1968) reported the first real evidence linking increased infection with unstable milking vacuum. A series of experiments in the UK provided further evidence of this relationship (Thiel et al., 1973; Cousins et al., 1973). This work also indicated how the machine may cause infections through droplets of milk travelling back up the short milk tube as the liner opens and hitting the teat orifice with sufficient force to penetrate the pathway into the teat canal. Small discs inserted into the teatcup beneath the teat appeared to shield the teat orifice from such impacts without
interfering with milk flowing away from the teat (Thiel 1974).

Field studies to evaluate the practical significance of these results were carried out in the U.K. and Victoria. Shields fitted into two teatcups in each set in a milking shed, such that all cows in a herd always had the same two quarters shielded, allowed a half udder comparison to be made on 1222 cows in 16 commercial herds in Victoria.

Herds were quarter-sampled when shields were fitted at the start of lactation and again in mid and late lactation. Milk samples were screened using the Rapid Mastitis Test. Positive samples were cultured and examined for mastitis pathogens. Analyses were based on new infections - defined as quarters that were sampled and found to be clean at the first or second test, but which had a subclinical infection at the second or third test, or developed clinical mastitis during the lactation.

Shields gave a significant reduction in infections on 5 of the 15 U.K. farms. The combined results from the 15 farms showed a non-significant difference amounting to 17% fewer quarters becoming infected when protected by shields (Thiel 1974). Six of the 16 Victorian herds showed a reduction of 17% or more. Three herds appeared to increase their infection levels. The overall reduction in the 16 herds was 12%. On the 8 farms using a teat dip, the reduction with shields was 18%. Results are given in Table 2.

These results must be interpreted with caution. Nevertheless it seems that the effect cannot be ignored. The great variability between farms presumably reflects differences in milking equipment or milking procedures and it now seems likely that this specific machine effect will occur on some farms and not on others. If so, further work on how to identify easily the farms affected would be worthwhile. Accordingly, information from tests made on the 16 milking
machines, recordings of vacuum changes throughout milking and observations of the farmer's milking routines, are now being analysed with this in view.

**WHAT CAN THE FARMER DO ABOUT THESE RESULTS?**

* Careful cup changing, to minimize irregular vacuum fluctuations when putting on and taking off cups, is perhaps the single most important means by which the farmer can reduce or eliminate such a machine effect. It is likely that the way in which the teatcups are removed is even more important than when they are removed. At present, the remedy is under the farmer's control rather than the manufacturer's.
* Remove cups so carefully that no air rushes into the machine at all. The use of automatic vacuum cut-off claws, or pinch clamps on the long milk tube near the claw, would help to make this easier to achieve without excessive spillage of milk residues.
* Have an adequate amount or reserve vacuum capacity.
* Keep the vacuum regulator in good condition.
* Keep claw air admission holes clean and functional.
* Use teatcups that do not skip, fall or get kicked off too often.
The modern farmer has to manage a wide range of disciplines in milking. He has to be veterinarian, sanitation engineer, water quality specialist, milking machine operator, refrigeration engineer and, when he has time, farmer. Although the quality standards have changed and more is expected from farmers in supplying milk to meet higher manufacturing requirements the basic principles of hygienic milk production have altered little in the past decade.

The need for increasing standards is brought about by international marketing requirements for dairy produce and changing patterns for milk storage and delivery in the local town milk industry. In justifying such increases it is often necessary to explain to farmers the consequences of poor raw milk quality on processed milk products.

COMPONENTS OF MILK QUALITY

Milk is practically a liquid tissue and is subject to breakdown by enzymes derived from the cow and contaminating bacteria. The operation of the milking machine and its care and maintenance contribute to lipase action. This enzyme is produced by the cow and will attack butterfat if the protein membrane surrounding fat globules is damaged. Excessive aeration of
the milk resulting from faulty cup changing, overmilking, excessive air from cups and claws, diaphragm pumps and vat agitators, is the main cause of globule damage. An example of the extent of fat globule damage is shown in Table 1.

### Table 1

**FAT DAMAGE RESULTING FROM EXCESSIVE INCORPORATION OF AIR**

<table>
<thead>
<tr>
<th>Cow</th>
<th>Before Milkpump</th>
<th>After Milkpump</th>
<th>Cooler</th>
<th>Vat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milking system 1</td>
<td>5  22  29  30  30</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2  5  8  11  12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In this trial a pulsation system which admitted excessive air
resulted in damage to fat globules. Free fatty acids were released and the farmer lost money through fat in the froth not collected by the tanker and through fat which was not measured by the factory. The problem of lipolysis is not widespread in New Zealand but there is a potential problem.

It has recently been discovered that many bacteria produce heat stable enzymes which attack milk fat and protein. The particular bacteria occur commonly in milk and unfortunately grow even in refrigerated milk. The bacteria degrade milk constituents during the storage period in the farm vat and factory silo and their enzymes continue to break down milk components after pasteurisation. The breakdown products cause flavour defects in processed dairy products and liquid milk.

A group of bacteria called spore formers Bacillus spp produce both heat resistant enzymes and spores. The spores can germinate under suitable conditions and produce a very rapidly growing population of bacteria which have a high product spoilage potential. Common defects produced are flat sour flavours in condensed milk and bitty cream in bottled milk.

Mastitis has a direct effect on the solids not fat (S.N.F.) content of milk affecting mainly the lactose fraction. Decreases of 25-30% S.N.F. have been recorded for individual cows. The milk proteins are affected by mastitis and become more heat sensitive, affecting physical and chemical properties of milk powder. Flavour defects associated with production from mastitic milk are reported for butter, cheese, milk powder and bottled milk.

Mastitic milk is high in white blood cells and may contribute high numbers of Staphylococcus and Streptococcus to bulk milk. Occasionally high levels of coliforms in bulk milk result from mastitis.
Sediment in bulk milk usually results from poor udder preparation. It can affect milk powder and casein quality.

PRINCIPLES OF QUALITY PRODUCTION

Milking Machine and Farm Vat Cleaning

Most of the bacteria occurring in milk are derived from the milking machine and farm vat. The types of bacteria will depend on the effectiveness of cleaning, the type of detergents and sanitisers used and the temperature of cleaning solutions. The control of microbial growth on milk contact surfaces is affected through altering the surface deposits to such an extent that they will not support life. The surface environment can be modified by reducing the available nutrients or drying them or by making it toxic through the presence of sanitisers or detergent residues.

Reducing Food Supply. The most effective method of controlling the build up of milk residues on the milk contact surfaces is through the use of a cleaning system. This is the alternate use of acid and alkaline cleaning and sanitising solutions.

\[
\begin{align*}
\text{Fat} & \rightarrow \text{Removal by alkali} \\
\text{Milk} & \rightarrow \text{Protein} \rightarrow \text{Removal by alkali} \\
& \rightarrow \text{Mineral} \rightarrow \text{Removal by acid}
\end{align*}
\]

The protein and mineral fractions are combined in milkstone, the relative proportions varying with the type of cleanser and minerals in the water supply. Acid detergents tend to leave deposits high in protein while caustic soda results in high mineral deposits. There is no single product that will effectively remove all milk constituents when used over a range of water supplies of varying chemical composition.

Good quality cold water, preferably rain water, is the cheapest
and most effective component of a cleaning system.

*Creating Unfavourable Environments.* Creating an unfavourable environment for microbial growth will assist in producing milk contact surfaces with low numbers of bacteria. However, a poor cleaning system can eventually result in accumulation of sufficient milk residues and allow bacteria to be protected from the inhibitory effects of the changed environment.

Cleaning solution temperatures have a marked effect on the numbers and types of bacteria occurring on the milking machine surface. This is illustrated in Fig. 1. As the temperature of cleaning is increased to $65^\circ C$ or higher, the proportion of milk spoilage bacteria decreases.

![Graph showing the proportion of milk spoilage bacteria vs. cleaning solution temperature](image)

**FIG. 1.** THE PROPORTION OF MILK SPOILAGE BACTERIA OCCURRING ON MILK CONTACT SURFACES CLEANED AT VARYING TEMPERATURES.
This effect results from the death of spoilage organisms from heat and dehydration of the surfaces.

Extremes of pH will also be inhibitory to bacterial growth. Caustic soda soak cleaning systems have been used effectively by Irish workers to control the growth of spoilage organisms and effectively remove most of the milk deposits.

In New Zealand it has become a common practice to give a final rinse with an acid iodophor which provides both a low pH and a toxic chemical. More recently an acid quaternary ammonium compound has been introduced as a single process detergent sanitiser which is left in the milking machine between milkings. This product has an effect similar to iodophors.

The farm vat poses the biggest problem for control of micro-organisms. It is almost impossible to provide sufficient heat to remove spoilage organisms and the large enclosed vat cannot effectively be dried. It is in this area that greatest care must be taken and possibly the use of creating unfavourable micro-environments must be exploited.

Mastitis control

Our whole milk quality programme has included somatic cells (white blood cells) as a quality indicator. Somatic cells provide a good guide as to the mastitis status of a herd and are an excellent indicator of the success of mastitis control schemes. The control of mastitis has been based on a five point plan.

*Machine Checking and Milking Management.* All milking machines should be given an efficiency check at least once per year. In particular pulsation efficiency should be examined to ensure that the pulsator reaches atmospheric pressure for sufficient time.
Teat spraying. This should be carried out as soon after milking as is practicable. The teat sanitiser kills most of the contaminating bacteria and when used for long periods will eliminate *Staphylococcus* colonies from the teats.

**Treatment of Clinical Cases.** Prompt treatment of clinical cases for the full period prescribed for the particular antibiotics used is essential. When clinical cases fail to respond consult your veterinarian.

**Dry Cow Therapy.** Test the cows two or three times during the lactation with the Rapid Mastitis Test (RMT) and record all cows having clinical infections. At drying off treat all the quarters of all the cows that have been RMT positive or have had clinical infections.

**Culling.** Cows which do not respond to dry cow therapy must be culled irrespective of their production.

**TECHNOLOGY OF CLEANING**

There have been many technological developments which assist in implementing the principles of cleaning.

**Reverse Flow Cleaning**

This system of cleaning uses a pump to convey rinsing, cleaning and sanitising solutions through the milking machines. If properly installed it will save considerable labour. The cost of cleaning will be slightly higher. It is important that farm workers learn how to operate this equipment and all machinery companies should provide written instructions.

**Rubberware Cleaning**

The most effective method of keeping liners in good quality is
to soak them in caustic soda every four weeks. Once a day cleaning reduces the life of liners by about 25%. Cold cleaning systems allow rapid build up of butterfat in milker rubberware and this results in a shorter lifetime.

Recently our laboratory has been engaged in studies on silicone liners which appear to have a complete resistance to butterfat, do not have surface cracking problems, and would last five to eight years of normal milking life. They are affected by sunlight.

**Low Temperature Cleaning**

The energy crisis has given renewed vigour to studies on cold or low temperature cleaning systems. New Zealand farmers have been practising semi low temperature cleaning by using cold water or cold water and iodophor at night, for some years. The two limits that exist at present are the breakdown of rubberware due to high fat buildup and a failure to control spoilage organisms developing on milking machine surfaces. We are optimistic that a low temperature cleaning system will be developed in the near future, and these limitations will be overcome.
BIOGAS AND SOLAR ENERGY COLLECTORS FOR DAIRY FARMS?

D.J. Hills & D.J. Painter

N.Z.A.E.I., Lincoln College

BIOGAS GENERATION

Biogas generation through the anaerobic digestion process is well known and widely practised in municipal sewage treatment plants but has not been extensively applied to dairy cow manures in the developed countries. Laboratory and pilot plant studies in various places have demonstrated that heated, mixed digesters treating cow manure can stabilize the organic material, reduce odour, and provide biogas, without decreasing the fertiliser value of the fresh manure.

The Process

The anaerobic digestion process is a highly complex series of reactions brought about by a mixed culture of bacteria. Figure 1 indicates that digestion takes place in two stages. The first is performed by bacteria classed as acid formers. These secrete extra-cellular enzymes which attack the complex organic substances and convert them to simple organic compounds. The simple organic compounds can then be absorbed into the bacterial cell for food. The waste products of this process are short-chain volatile acids, mainly acetic and propionic, and carbon dioxide. The second stage of the process, known as gasification, is accomplished
ORGANIC SOLIDS

1st STAGE
COMPLEX ORGANICS
ACID FORMING BACTERIA

2nd STAGE
ORGANIC ACIDS
METHANE FORMING BACTERIA

GASES + WATER

65% CH₄

35% WATER + 6% BACTERIAL MASS

52%

58% ORGANIC SOLIDS

FIG. 2. THEORETICAL BREAKDOWN OF DAIRY COW MANURE.
by methane-producing bacteria. These utilize an intracellular enzyme that breaks down the acid and employs carbon dioxide (CO₂) as a hydrogen acceptor. The carbon dioxide is reduced in this process to methane (CH₄).

Digestion upset and failure occur when the rate of acid production exceeds the rate of acid utilization, and intermediate volatile acids accumulate. The balance can be maintained by controlling factors such as temperature, pH, feeding rate, retention time and the degree of mixing.

**Gases Produced**

A properly operating digestor for dairy wastes may convert up to 48% of the entering organic solids into gas and convert the remainder to a sludge less offensive and more easily handled than fresh cow manure. The composition of biogas produced may be expected to be about 65% methane and 35% carbon dioxide with a small amount of hydrogen sulphide and trace quantities of other gases.

Methane, which is colourless, odourless and tasteless, is combustible and therefore potentially hazardous. Carbon dioxide, also colourless and odourless, will not burn. It is however, a potential hazard to people in concentrations greater than ten per cent since it acts on the nerves that control breathing and causes suffocation within a few minutes.

**Digester Size**

As indicated in Figure 2, an average size dairy cow (500 kg) will defecate 3.6 kg of manure per day. Water will need to be added to this manure to create a slurry that can easily be pumped into the digester and mixed. Excess dilution, however, would lead to extravagant digester volume and larger-than-necessary effluent discharges from the system. An input
slurry of 8.1% total solids is ideal. Since bacteria within the digester are most efficient when food is furnished in small quantities at frequent intervals, the feeding rate should be maintained as uniform as possible.

The digester volume required for an average size cow is 0.95 cubic metres. Therefore a herd of 100 cows would require a digester of 95 cubic metres. This volume allows for a 17-day retention time within the digester which gives the bacteria an opportunity to break down the organic matter and convert it into biogas. About 1.1 cubic metres of biogas are released each day per cow.
Returns

Approximately 60% of the biogas production can be assumed available for farm use. The remaining gas is necessary to maintain the digester at the desired operation temperature, 35°C, (that is, to compensate for digester heat losses and provide for fresh manure heat requirements). The estimated total heat requirement is a function of ground, air and fresh manure temperature, operational temperature of the digester and construction materials employed. The gas requirements are therefore variable throughout New Zealand and might vary between a minimum of 25% of the total gas produced in Northland to a maximum of 75% of the total gas produced in Southland. A value of 40% is assumed required for heating purposes in the economic analysis shown in Figure 3. The cost value of the biogas is based on the cost of diesel fuel of equivalent calorific value (that is, 10.1 cents per cubic metre when diesel costs 15.5 cents per litre - May 1977 prices).

FIG. 3. SUMMARY OF ANNUAL COSTS & RETURNS FOR THREE DIGESTER SIZES.
The fertiliser components of the raw waste are consumed in anaerobic digestion, but some are changed in form, notably nitrogen. Nitrogen in fresh manure exists in either the organic nitrogen form or in the ammoniacal nitrogen form. During digestion it is changed from predominantly organic form to predominantly ammoniacal form. Since the ammoniacal form is the nitrogen form readily available for plant use, this change can be credited as a value of the digestion process. A cost value of 31 cents per kg of nitrogen is used in the analysis in Figure 3.

Costs

Capital costs were obtained from a local manufacturer of livestock digester plants. These costs are approximate, since each job is priced separately, taking into account site conditions. The annual costs for each digester size shown in Figure 3 include the yearly amortization of the initial capital investment and the necessary operational and maintenance costs. Capital costs are amortized at a rate of 8% by assuming a 20 year life for structures and a ten year life for equipment. Maintenance costs consist of equipment maintenance and repairs, and insurance which are assumed to total 5% of the initial investment per year. Electricity is required for pulping and mixing, and its annual cost is assumed to be 2.5% of the initial investment per year. The costs of labour are indicated separately in Figure 3, since farmers may or may not wish to include it when evaluating the process. It is assumed that a minimum of one, one and a half, two hours per day, respectively for the three digester sizes, are required for operation of the plant. A value of $4 per hour is allowed for labour.

The cost of final disposal of the effluent from the digester is considered to be essentially the same as that for fresh manure and hence is disregarded in Figure 3.
Economic Feasibility of Biogas Generation

The values indicated in Figure 3 show conclusively that the quantity of manure (in other words the farm capacity) and market gas prices have marked impact on the economic feasibility of energy production by anaerobic digestors. It is expected that with increase in petroleum prices, lower plant capacities will be increasingly attractive. As fertiliser prices increase, the improved fertiliser value of the digested manure over fresh manure will contribute to the economic credits of the process.

SOLAR WATER HEATING

A dairy farmer's objective is to produce milk economically. He produces energy, in the form of a versatile food product, and he uses energy, in the form of petrol, diesel and electricity. He also uses solar energy to grow his pastures, and he could also use it instead of some of the electrical energy used for heating hot water, if it proved more economical to do so. In the face of rising costs of electricity, what about using some freely available, self-renewable solar energy in the dairy shed?

About 50% of the electrical energy supplied to a typical dairy shed is used for water heating. The large volumes of water required by law for cleaning, and the fact that this cleaning is done at set times twice a day make solar water heating particularly attractive for part of this heating load, as Jim Currier of the National Dairy Laboratory at Ruakura and John Riley of Massey University have recently pointed out.

How Much Solar Energy is Available?

Solar energy arrives at the outside of the earth's atmosphere at a rate of 1395 watts/m² (1.395 kWh/m² per hour). Although
it is reduced during its path through the air, dust and clouds above us, there would still be typically one kWh arriving on each square metre of Canterbury farms each hour of a clear, fine, summer day. The average daily values at Lincoln College during each month of one year are shown in Figure 4. But it is impossible to convert this energy with 100% efficiency to heat water. It might be possible to convert, say 20-30% of the incoming energy to raise the temperature of the cold water supply to something nearer what is required, and 'top it off' with a reduced amount of electricity. A bigger area of collectors will of course collect more solar energy, so that 20 m² of collectors is as good as 10 m² of efficiency 40%.

Although there are various systems which could be suggested for solar heating of hot water, we will consider here only...
collectors commercially available in New Zealand, directly heating the water to be used in the dairy shed. The water could be circulated by a pump, or on a natural 'thermosiphon' arrangement, which relies on hot water being lighter than cold water, to circulate at its own rate.

The problem then becomes one of deciding how much solar energy to collect. A bigger or a more efficient system collects more solar energy and cuts the electricity bill more, but it costs more to install. A greater volume of stored water will carry over longer spells of low sunshine, but also costs more. What we are seeking, therefore, is to have a system which makes an optimum contribution, in that if it were bigger or more efficient, its extra cost would not be offset by the electricity charges it would save, and, if it were smaller, the increased electricity charges would have a greater effect than the saving in initial cost.

An Existing Installation

The volume of hot water required in a dairy shed is a legal requirement, ten litres per milking unit, 50 litres for incidentals, and 50 litres per milk-holding vat. Cleaned-in-place systems require even more water at 14 litres per milking unit, 90 litres for incidentals and then 50 litres per vat. As solar energy is not available at night, any contribution to heating the water used after the morning milking would have to be made on the previous day (or days), which would mean a bigger volume of water stored than is used at each milking.

An example of a solar-electrical water heating system is one near Te Awamutu run as a trial using funds from the Ministry of Agriculture and Fisheries and the New Zealand Energy Research and Development Committee. This was a 230 cow factory supply farm with a 24 unit milking machine. It has
three 200 litre hot-water heaters and one of these was left heated by electricity alone. The other two were fed by a storage tank of solar-heated water containing enough water (800 litres) to fill them each night and morning before being refilled itself with cold water.

The National Dairy Laboratory staff who designed the installation decided on 2 m² of collectors for each 100 litres of solar-heated water, which was provided by 24 commercially available panels of 0.72 m² each (17 m²). Although their system used a pump to circulate the water to panels on the dairy shed roof, they are now changing over to a thermsiphon system, which means re-fitting the panels lower down and putting the insulated storage tank above them.

This system supplied 25% of the energy needed for water heating between March 1975 and May 1976 (except for June and July when the cows were dry, when it supplied 10% of the much lower power use). Of course, more energy could have been supplied by having more collectors, and therefore a greater cost, as already stated.

Costs and Benefits

It is not possible to give costs per kilowatt of collector which apply to all commercially available collectors, not only because of the variation between suppliers, but because the kinds of collectors vary, some having storage built in and some requiring much greater area for the same power. Also, the only costs which are really meaningful are the total annual costs (initial cost as an annual equivalent, depreciation and tax savings, maintenance) of the complete solar-electrical system to supply the dairy shed hot water needs.

There are now some 15 manufacturers or suppliers of solar
water heating equipment in New Zealand. A farmer interested in knowing the likely cost, for his particular situation, of converting to a solar-electrical system, should ask reputable suppliers to provide suggested designs and itemised quotations.

Some idea of likely costs and benefits can be gained by looking first at the Te Awamutu farm studied in detail by Jim Currier, and secondly at an imaginary, local situation. When milking, the Te Awamutu farm average use of energy for water heating was about 80 kWh per day. The system already described provided 20 kWh from solar energy on average, although on some days there was 40 kWh, and on other days none at all. For most of June and July, with the cows dry, 3 kWh of the 30 kWh per day needed was supplied on average by the solar collectors. Their cost estimate was $2,000 (in 1975) for the panels, piping, pump, insulated tank and control unit. By considering the investment to be spread over 10 years, the cost was 68 cents per day over a 300 day milking season. Their solar contribution was therefore costing 3.4 cents per kWh (20 kWh average daily for 68 cents).

As most farmers in the Central Canterbury Electric Power Board area will now be paying 2.15 cents/kWh for electricity, with a $3 per month fixed charge, 3.4 cents per kWh for solar energy might not sound attractive. But it should be noted:

* the Te Awamutu installation was experimental, and was a forced circulation system using a pump.
* the simple economic analysis made no allowance for an advantage through depreciation.
* that 1977 costs of both electricity and solar energy collectors are different from 1975.

One Christchurch supplier has recently supplied a quotation for a system said to be suitable for a dairy catering for 50 milking cows. It is intended to provide about 270 litres
per day of 32°C water, and 360 litres/day of 90°C water. Having 11 collector panels of effective area 8 m², the quoted cost for the solar energy collection system was $1630, or about $200 per m² of collector area. (Cost included panels, piping and heater tanks). This is about the same cost as recently quoted in a U.S.A. report (Christchurch Press 12.5.77), which predicted that costs would be halved by 1980.

The following two examples show how costs and benefits could be worked out in a local case, and might enable you to consider your own case in a similar manner.

Example 1

200 town supply dairy cows near Lincoln require 600 litres daily of hot water (95-98°C) for reverse-flow cup cleaning, vats and incidentals, plus 200 litres of warm water (30°C) for udder washing.

A combined system comprising solar collectors and solar/electrical heater tanks is commercially installed.

Charges for hot water heating by electricity alone

<table>
<thead>
<tr>
<th></th>
<th>$6/2 months</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>summer</td>
<td>5300 kWh/2 months</td>
<td>120</td>
</tr>
<tr>
<td>winter</td>
<td>6,700 kWh/2 months</td>
<td>150</td>
</tr>
<tr>
<td>total annual charge for 36,000 kWh</td>
<td>810</td>
<td></td>
</tr>
</tbody>
</table>

Total annual charge: $810

Installation and equipment cost for 800 litre, 12 m² collector area, thermosiphon solar system

2500

Tax saving (in year following installation) due to 60% depreciation allowance

750
Net installation cost as lump sum  
- as equivalent annual cost plus $100 maintenance over 10 years, 8% interest
  10 10% 360
  8 8% 385
  9 10% 405 $405
  9 10% 403 $403

Savings in electricity charges due to solar heating contribution (25% of incoming energy) of 18700 kWh over the entire year 402 $402

Example II

100 town supply dairy cows near Lincoln require 400 litres daily of hot water (95-98°C) for reverse-flow cup cleaning, vats and incidentals, plus 100 litres of warm water (30°C) for udder washing

A combined system comprising solar collectors and solar/electrical heater tanks is commercially installed.

Charges for hot water heating by electricity alone at 2.15 c/kWh, $6/2 months $  
summer 4370 kWh/2 months 100
winter 5300 kWh/2 months 120
total annual charge for 29000 kWh 660 $660

Installation and equipment cost for 500 litres, 7 m² collector area, thermosiphon solar system 1600

Tax saving (in year following installation) due to 60% depreciation allowance 480

Net installation cost as lump sum 1120
- as equivalent annual cost plus $80
maintenance over 10 years, 8% interest

10  10%
11  8%
13  10%  

Savings in electricity charges due to solar heating contribution (25% of incoming energy) of 10,900 kWh over entire year

<table>
<thead>
<tr>
<th>Year</th>
<th>Savings ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>237</td>
<td>$237</td>
</tr>
<tr>
<td>238</td>
<td>$238</td>
</tr>
<tr>
<td>234</td>
<td>$234</td>
</tr>
</tbody>
</table>

The system in the first example pays for itself in less than 10 years. After that, it saves about $400 in electricity charges each year for the rest of its economic life. The system in the second example, pays for itself in less than 14 years. After that it saves about $200 in electricity charges each year for the rest of its economic life.

Some additional points should be noted:

* There is no charge for solar energy. If electricity charges per kWh rise, the future savings are greater.

* A change in pricing structure by electrical supply authorities such as a greater fixed charge would alter the example.

* A farmer who buys components, and converts an existing system himself, will make greater savings, but of course this must be done with due regard to plumbing and electrical regulations and good practice.

* The examples are intended to be realistic, but they cannot be claimed as optimum. Different volumes of water stored, or collector area, might give better results. The major unknown is exactly how much energy such a system would collect over many years. Also, a proper economic analysis would need to compare systems on the basis of their net present worth.
Energy from biogas produced by anaerobic digestion of dairy cow manure is not at present economically competitive with conventional sources, unless very large installations are considered. A continual rise in petroleum and electricity prices might combine with simpler and more efficient digester designs in the near future to change this situation. The process might be economic as a waste management practice, when liquid manure handling is the alternative.

Energy from the sun could make a substantial contribution to water heating in dairy sheds. Combined solar-electrical systems installed commercially might well pay for themselves in about 8-14 years, and go on saving about half the charges of a solely electrical system. Farmers converting an existing electrical system themselves stand to make even greater savings.
FEEDING THE DAIRY COW

P.G. Floyd

Méren Sharp & Dohme (N.Z.) Ltd.

The majority of pastures in the main dairying areas of New Zealand are capable of producing between 500 and 700 Kg of milkfat per season for each hectare grazed. Proof of this is the 2 - 3% of commercial farmers spread throughout New Zealand who repeatedly achieve production levels within this range.

Features of high-producing farms

* Stocking rates of 3 - 4 cows/ha to ensure conversion to milk of most of the pasture grown.
* A low replacement rate with well reared, genetically superior young stock.
* Well conditioned cows at calving achieved by optimum management during winter and at times of drying-off and calving.
* Pasture management that results in full feeding in early lactation and efficient early conservation of surplus pasture growth in spring.
* Flexible summer - autumn management that absorbs the uncertainties of summer with a minimum loss of profit.
MAJOR FACTORS DETERMINING DAIRY COWS PRODUCTIVITY

FEEDING        BREEDING        HEALTH

It has long since been agreed that FEEDING is the most important daily input. Over the past thirty years there has been a large investment in facilities to research the optimum feeding practices for the New Zealand dairy herd. Most of the research has been done at Ruakura Animal Research Centre and Massey University, but trial work on demonstration farms and by farmers and advisers, has also contributed.

A study group with representatives from the Ministry of Agriculture and Fisheries' Ruakura Animal Research Centre and Advisory Services Division, New Zealand Dairy Board, Massey University and Merck Sharp & Dohme (NZ) Ltd has summarised results of the research into an objective feeding plan which will increase returns to the New Zealand dairy farmer.

THE FEEDING PLAN

The basic message of the plan is
* Good rearing of young stock
* Adequate preparation of the cow for lactation
* Full feeding in early lactation
* Adoption of flexible summer - autumn management
* Matching cow requirements and feed supply

Good rearing of Young Stock

The objectives during rearing are to keep deaths to a minimum, to have stock of a sufficient size for successful mating at 15 months, and to rear to such a standard that subsequent milk production and fertility are in relation to the breeding potential of the animal. Provided calves receive adequate
colostrum initially, milk or milk replacer subsequently, and hygiene is of a high standard, average weight gains will be around 0.5 kg/day, and the target weights in Table 1 will be realised.

Table 1

<table>
<thead>
<tr>
<th>Minimum weights for young stock (kg)</th>
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<tbody>
<tr>
<td>Age (months)</td>
</tr>
<tr>
<td>Weaning</td>
</tr>
<tr>
<td>Mating</td>
</tr>
<tr>
<td>Calving</td>
</tr>
</tbody>
</table>

Access to an abundance of high quality pasture is required during the first 12 months from about two weeks of age. In practice this is best provided by rotational grazing ahead of the milking herd or set stocking over most of the farm with 2 - 3 calves in each paddock. Regular inspections of replacements are required to ensure that their weight or condition is not allowed to deteriorate to the extent that targets, whether at mating or calving, cannot be achieved.

Adequate Preparation of Cows for Lactation

The proper feeding of cows before calving is essential for high milk yields during lactation. Enough feed must be provided to maintain the cow and her developing calf, and to allow storage of fat as an energy reserve for early lactation.

Poor feeding before calving will result in a reduced feed intake in early lactation, a low peak milk yield and a reduced test, which together amount to a 10 - 20% reduction in total
production.

There are three guides to the adequate preparation of the dairy cow for lactation.

Assessing Feed Intake. Following drying-off, the cow in good condition requires each day, pasture dry matter (DM) equivalent to about 1.2% of her liveweight for maintainance. Requirements increase to about 1.7% in late pregnancy, increasing further to reach about 4%, two months after calving. These percentages are equivalent to 5, 7, and 15 kg DM each day for a 400 kg cow. Greater quantities of feed will be required if the cows are under weight since each 1 kg gain in liveweight will require an additional 4 – 5 kg of feed DM. They will be further increased if the diet contains appreciable quantities of hay or silage for the digestibility of the DM present in these feeds is lower than in well managed pasture.

Visual assessment of the intake of the grazing animal can be used to adjust areas grazed and supplements offered so the appropriate food intake is achieved and wastage minimised.

Cow Liveweights. Target liveweights immediately before calving can be set (Table 2) and feeding arranged so these are reached.

Table 2

<table>
<thead>
<tr>
<th>Age (Year)</th>
<th>Jersey</th>
<th>Friesian</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>320</td>
<td>410</td>
</tr>
<tr>
<td>3</td>
<td>380</td>
<td>460</td>
</tr>
<tr>
<td>4 +</td>
<td>420</td>
<td>540</td>
</tr>
<tr>
<td>herd average</td>
<td>385</td>
<td>470</td>
</tr>
</tbody>
</table>
It doesn't matter how target weights are achieved. For example, if a cow is dried-off at 385 kg and she maintains this weight through until calving, her subsequent production would be the same as if she were dried-off at 340 kg but subsequently fed to reach 385 kg at calving.

As every kilogram of bodyweight represents 4 - 5 kg of dry matter the most important factors determining calving down weights include drying-off weight, available feed supplies and length of the dry period.

**Cow Condition.** Visual assessment of cow condition - degree of fatness - is a useful measure that is independent of cow size or gut fill, requires no capital outlay, and involves little time. Cows can be scored periodically on a numerical scale and records kept. Changes in condition of individual cows and the herd as a whole, indicate when feeding levels should be adjusted to reach the desired condition at calving. For practical purposes one condition score on a 1-10 scale will represent around 25 kg of liveweight.

Whether target weights at calving are reached depends primarily on available feed supplies, liveweight at drying-off and length of the dry period. Each of these in turn is influenced by time of drying-off.

**Full Feeding in Early Lactation**

Cows will produce 0.9 kg milkfat per day or better within two months of calving if they are fed to appetite for the first two and preferably three months of lactation. This level of production can be achieved on pasture alone provided it is of high quality and is grazed lightly. Supplements may be used but should not constitute more than 25% of the diet, otherwise cow performance will be prejudiced.
Good post-calving management will not compensate for your management before calving, nor will good pre-calving feeding compensate for poor management after calving. Good management during the two to three months either side of calving is essential for high production. It requires the careful balancing of the demands of pre- and post-calving feeding and conservation. If feed supply is consistently in short supply, adjustments should be made to the drying-off date, winter management, fertiliser policy, calving date and stocking rate.

*Adoption of Flexible Summer-Autumn Management*

Summer is the least predictable of all seasons. The best and least expensive insurance against low rainfall is full and efficient use of pasture during spring and early summer when at average stocking rates, pasture is accumulating at a rate at least twice that required by the cows. There is ample scope both for proper feeding of cows and conservation of sufficient feed for future needs. To achieve this, surpluses must be anticipated, recognised as soon as they occur and conserved in the best way possible.

Too frequently conservation programmes start too late, paddocks are closed for over eight weeks, and finally hay is made in December or January. If pastures are exposed to drought about the time of harvest there will be little growth until the following autumn.

Planned summer feed programmes based on crops or special-purpose pastures are invariably more expensive and are often over-protective or inadequate. They should be considered only if existing feed resources are exploited fully.

Use of supplements such as hay and silage during summer feed shortages can hold cow condition but research shows that in the short term it will not result in profitable increases in
milkfat. Liveweight and condition of the herd in late lactation should influence autumn and winter management, and can have a marked effect on next season's production.

In summers of poor pasture growth it is imperative that the liveweight or condition of the cows does not fall to the extent that target weights at calving cannot be reached. Progressive drying-off is necessary, using condition scoring as the main criteria and paying particular attention to first calvers. Drying-off has a big impact on feed requirements since in late lactation a dry cow will maintain liveweight on about half the feed required when milking.

Matching Feed Supply and Cow Requirements

To apply the principles outlined and achieve the targets set requires three basic skills. They are the recognition of cow requirements, the identification of the amounts of feed necessary to satisfy these, and the organisation of feeding and management programmes so that as far as possible, the best and least costly feeds are available at the most critical times. Of all the skills these features imply, the most difficult to acquire is that of matching cow requirements with feed supplies. For those who find experience too slow a teacher it will be of great assistance to assess and record regularly the total quantity of feed on the farm and from this determine the rate at which it is changing. This, and knowledge of the amounts of feed needed to achieve target weights and productions, and estimates of grass growth provide a sound basis for planned grazing management and optimal feeding of the dairy herd.

Such an approach removes much of the guess work from feeding and managing the herd, and encourages the confidence necessary to make the changes in management that will raise farm
efficiency through increased stocking rate without depressing individual animal performance.

ACKNOWLEDGEMENTS

This paper is based on material presented at a series of farmer meetings throughout New Zealand. They were convened by P.G. Floyd, of Merck Sharp and Dohme (N.Z.) Ltd. Participating in these meetings were S.A. McKenzie, N.Z. Dairy Board; A.W.F. Davey and R.E. Balford, Massey University; and A.M. Bryant, Research Division, Ministry of Agriculture and Fisheries.