The Proceedings of the 13th Lincoln College Farmers’ Conference 1963
SASSELLA TUSCOCK IN THE SOUTH ISLAND
The Proceedings
of the
13th Lincoln College Farmers' Conference
1963
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Hon. Secretary,

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### 1963

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PANEL DISCUSSION ON SECONDARY EDUCATION
It is always easier to think up a subject than to think up what to say about it. The "Politics and Economics of New Zealand Trade" is a sweeping and rather grandiose title. To attempt to comment on all those aspects of public policy which it could conceivably embrace would hardly be possible in forty minutes and in any event quite beyond my competence.

My aim in this address is to draw attention to certain considerations best described as "political" which seem to me to be important determinants of the kind of policy New Zealand ought to and can follow in its economic relations with other countries and in trying to expand trade. But first I shall try and set out quite briefly the order of our present trading system.

In earlier times what we seemed to be most concerned about was securing greater stability in export receipts and in farm incomes. Bulk purchase contracts with the United Kingdom and internal stabilisation schemes were intended to serve that purpose. We were less worried about the long term expansion of export receipts, partly because of a greater concern with securing adjustments in the distribution of the national income, and partly because quite fortuitously up to about 1956 export prices generally moved in our favour.

Now, however, we no longer have the benefit of improving terms of trade to provide us with the growth in export receipts that is needed if full employment and better living standards are to be provided for our increasing population. How much our export receipts must expand each year is not easy to determine, although all we need to know for purposes of policy formation is an approximate order of magnitude rather than a precise sum. The Institute of Economic Research has suggested under rather optimistic assumptions that it is of the order of £17 million a year. The Monetary and Economic Council suggests £12-£18 million a year. Personally I would regard both figures as rather on the low side since they assume thereby the maintenance of the present rate of growth of the economy, and by world standards this is very low. But for my present purpose it does not much matter which figure one takes. It is quite clear also that by far the greater part must come from increased exports of our traditional items - dairy produce, meat and wool. Exports of manufactures, of forestry products, and of miscellaneous farm products would need to grow at quite fantastic rates to come anywhere near meeting our requirements of an annual increase in export receipts of the order I have mentioned.

The achievement of these objectives of trade policy involves three different classes of problems. First, how to release a sufficient part of current production for exchange with other economies: in other words ensuring that a sufficient volume of exports is available on competitive terms. Secondly, although this is really part of the first, how and in what markets to sell our exports. Thirdly, how to secure the right to sell in other markets on stable, known and realistic terms.

My main concern is with this third group of problems, but let me deal briefly with the first two.

So far as selling is concerned, I prefer to leave this question to those who know more about it than I do. Next month there is to be an Export Development Conference in Wellington and I am sure that the problems involved will be fully covered there. But there is a good
deal more to the problems of expanding our export trade than simply employing high-powered go-getting commercial travellers. That is not to deny that salesmanship is necessary. Of course it is. For everything we export or want to export in the future there are already many competitors. Our products must be readily available to potential customers and competitive in price and quality. They must also be adapted to the customers’ requirements and not to ideas of what we think they should be satisfied with. The responsibility for this kind of activity is one which falls primarily on the shoulders of farmers, producers’ organisations and businessmen. It cannot be passed to Government. But Government policies will have a profound influence on the extent to which the use of resources in the economy can be adjusted so that exports become available to sell. I mean here the sum of all policies—monetary, fiscal, employment, social welfare and industrial development, not just particular measures to provide export incentives. If we want our economy to grow—which is another way of saying we want our standards of living to rise, then Government policies have to be tailored to fit. The social and political priorities must be right. To secure growth we have to ensure that sufficient incentives exist for people to save, work and invest; for businessmen and producers to introduce new techniques, improved productivity and so on. These and other requirements of growth may conflict with the objective of securing a better distribution of the national income. It must also be remembered also that we are starting from a position of balance of payments deficit, with receipts rising more slowly than external payments. This widening real deficit can be removed by export expansion but only if internal demand is not allowed to increase to absorb the gains made. A recent pamphlet of the New Zealand Institute of Economic Research summed it up as follows: “The crux of the matter is that if the community is faced with the prospect of a permanent deficit it must either reduce its consumption to allow resources to remove the deficit (by exporting more or replacing more imports) or it must work harder, i.e. use its resources more effectively so that the resources can be stretched to maintain existing production and to export more or replace imports more.”

All of these are matters which largely lie within the power of Government and the New Zealand community to determine of its own accord. But even if we do organise our internal economic and political affairs so that the required volume and the right kind of additional exports each year are forthcoming—whether we can sell them—whether we can engage in trade—will depend on whether other countries are prepared to permit our products to compete with their domestic production of similar goods. And this is not a matter of economics so much as a matter of politics. It requires political decisions on the part of other countries. These do not lie directly within our power to control; any more than other countries can control or influence decisions of a similar kind—our tariff and import licensing policy—which we make in New Zealand. If we want to have rights of access to other markets on terms which enable trade to develop smoothly and at satisfactory returns then we have to negotiate for them at the international political level. The particular merits of the goods we have to sell are then only of minor relevance. The fact that our products may be as we think the best and cheapest of their kind would no doubt, in a world of free trade, be a significant point in establishing or expanding markets. But it doesn’t mean very much at all, at the bargaining table when you are trying to persuade another country to reduce tariffs or remove import restrictions. Indeed, in international bargaining it is often a good deal wiser not to stress how efficiently produced and competitive one’s exports are. Arguments about the benefit to consumers of cheap imports seldom
influence governments whose position is sensitive to the reaction of producers who are likely to be put out of business. What does matter are the advantages to their exporters one can offer in return; because to reduce protection raises an internal political problem since some producers must get hurt even though others may gain.

The visible gains for some exporters or in general political terms as a result of negotiations with other countries must be sufficiently great to persuade a government to face up to the internal political problems that the reduction of protection for other domestic producers will almost certainly bring.

New Zealand is unfortunately in a very weak bargaining position internationally. A country with a large internal market and taking a large share of world imports is much better placed since it can offer more actual or potential gains to another by reducing protection. But New Zealand's market is small and takes only a small share of world imports and even though our tariffs and preferences are relatively high, quite substantial reductions may not lead to very attractive possibilities for others. Furthermore, imports from certain countries from which we would like to secure better or more assured access terms in the future already enter New Zealand at fairly low rates of duty—the United Kingdom and Australia. The concentration of our exports on a few markets and in terms of products also makes our bargaining power weaker; and weakened even further by the fact that our exports—apart from wool—compete directly with sensitive areas of production in other countries. There is always some pressure to keep our products out and one can never tell when such domestic interests might succeed.

Differences in stages of economic development or in economic structure are another aspect of relative bargaining power. A wealthy balanced economy can afford to support its less efficient parts, it can afford not to achieve optimum economic efficiency; it can afford to place a higher value on domestic political harmony than on promoting efficiency in international use of resources. Some countries may go further than this, and consciously decide as part of its international goals, as part of a desire however mistaken and illusory, to fulfill some mystical national destiny, to make themselves economically as well as militarily and politically self-sufficient. These are luxuries which smaller countries cannot of course afford—and perhaps they can be thankful that their resources do not permit them to indulge in these pathological fantasies of nationalism. Unfortunately however we and other small countries have to bear part of the cost of such dreams. And we are obliged also to be careful in our political as well as economic dealings with the large powers not to offend too greatly their sensitivities in these matters of political grand opera, even though we may consider them misguided or distasteful.

At the international level the economic policies followed by various countries cannot be explained solely in terms of the desire to placate vociferous and politically powerful farmers or businessmen. This has a lot to do with it, and for many small countries there is not much else to be said. But in the case of large countries such as the United States, the Soviets, the United Kingdom or the E.E.C. much bigger issues of national power and prestige and of fundamental ideological conflicts cannot be ignored. We may if we wish adopt a position of rugged agnosticism towards such matters saying loudly, "A plague on all your houses." But it still does not enable us to escape the consequences; if our economic and trading interests are unfavourably affected, this is not going to persuade one of the large powers to adopt policies which are economically neutral or favourable to us if it is believed that to do so would weaken its position in the ideological conflict, or would prevent it from maintaining its national power and prestige.
The interrelationship of economics and politics at the international level and how New Zealand is affected is perhaps shown fairly clearly in current international trade problems.

In the years since the war quite remarkable progress has been made in expanding international trade and improving international economic cooperation. Much of this success can be attributed to the G.A.T.T. Based on the principles of multilateralism and non-discrimination the G.A.T.T. has achieved much of what it set out to do—to free trade from the restrictive effects of bilateral discrimination, quotas and arbitrary regulations and to assure to exporters access to markets on known, stable and reasonable terms. And it has also provided a valuable forum for the resolution of conflicts of national economic interest. Nevertheless some grave weaknesses have become increasingly apparent. I shall mention only two. First, although the Agreement has been very successful in the application of its rules to trade in manufactured goods, these same rules have been virtually inoperative for several important agricultural products. Most governments have pursued agricultural policies which have made it impossible for them to honour their obligations not to impose prohibitive tariffs and/or quantitative restrictions. New Zealand like many others has been seriously affected by this and many of the market concessions which we have paid for in tariff reductions have simply not emerged.

The agricultural problem has been argued about for years in the G.A.T.T. and further discussions have just taken place in Geneva. But so far no really satisfactory solution seems in sight. New Zealand could afford not to worry too much about agricultural protection up to the late 1950s. But then it became obvious that the U.K. market would not be able to take our increasing output at satisfactory prices. The existence of agricultural protection in other European countries and in North America took on new and alarming significance, since it meant that unless moderated we would find great difficulty in the future of securing markets for this additional output. The second problem, the growth of regional economic unions such as the E.E.C., plus the defensive creation of the European Free Trade Association and the Latin American Free Trade Area has its chief significance for our trade because these developments intensify the agricultural problem. They have made it much more difficult to attack protectionism and as things now stand have virtually eliminated any chance that we might have had of developing sufficient alternative markets for our butter, cheese, and to a lesser extent beef on the European Continent. Again it is not solely a question of protecting domestic agricultural interests. Political and also technological factors are deeply involved. If, over the past ten years, European agricultural productivity had remained static or had risen only slowly then I think our troubles with protectionism would have been very much less and the prospects for the future much brighter. But output of dairy produce, beef, cereals, poultry and most other things has expanded considerably and productivity has gone up sharply, and consumption has not kept pace. This is especially true in dairy produce. For dairy produce F.A.O. estimates are that over the ten years 1960-1970 production will rise in Europe by 33 per cent, but consumption by only 22 per cent. Thus the prospect is for increasing surpluses. Most of these increases have occurred and will occur in France which looks to the E.E.C. as an outlet for its surplus farm production. And this is now a cardinal point in French policy in the E.E.C. The French insist that E.E.C. agricultural policy should be such that all Community demands shall be met from Community sources, and imports allowed only to fill any gaps. General de Gaulle has made this point very forcibly. In his press conference on 14 January he said: “It is obvious that agriculture is an essential element in the whole of our national activity. We cannot conceive and will not conceive of a
Common Market in which French agriculture would not find outlets to the extent of its production. And we agree further that of the Six we are the country on which this necessity is imposed in the most imperative manner." A most uncompromising statement which makes it clear that for France a community agricultural policy satisfactory to France is a condition of her continued support and membership of the E.E.C. Without France the E.E.C. would not long survive. The French know this and so do the other Five, which is why right from the time the Treaty of Rome negotiations started some six or seven years ago France has been able to force the others to agree to her demands. For it has to be remembered all the time that the ultimate purpose of the E.E.C. is political not economic. It was intended to be an instrument for the political unification of Europe: and that ideal still exercises strong sway on the minds of European policy-makers and is why they are prepared to go to considerable lengths to appease the French and why also any attack on European agricultural protection is so frequently regarded as an attack upon the fundamental political concepts of the Community itself.

There are of course many in European circles who have the gravest doubts that the Community's best interests are served by maintaining a highly protective agricultural system. But it is what General de Gaulle thinks that counts. What New Zealand might think and how New Zealand is affected is simply irrelevant.

The reactions of the United Kingdom and others to the establishment of the E.E.C. have even greater significance for New Zealand. Again economics don't have much to do with it, but politics do. At first the United Kingdom saw the E.E.C. primarily in economic terms. They saw that in trade with E.E.C. countries they would be at a serious competitive disadvantage in what had become one of their fastest growing markets. The idea of a European Free Trade Area was intended to deal with this problem. Subsequently after this move failed the British began to realise more clearly that the E.E.C. was a political creation with serious political implications. The decision to enter negotiations for membership of the Community was related less to Britain's economic interests than to her political position in Western Europe, in Nato and the Western group of powers as a whole. This fact emerges very clearly from a study of the course of the negotiations: indeed the almost hysterical insistence on the need to join the E.E.C., if anything weakened the British bargaining position in Brussels. Lord Home was reported at one stage to have said that they "had been preparing for this (joining the E.E.C.) for 800 years." Perhaps he was rather overstating British capacity for political foresight but it did indicate the deadly seriousness of British policy. It seemed quite clear that they were not prepared to sit idly by and allow the emergence in Europe of a political and economic union bigger than the United States, with almost as much power, and dominated by either France or Germany or both. Such a creation could be influenced only from the inside, by the British being in a position to take part in its decisions, and to bring to its deliberations a sense of unity and contact with the world beyond Europe. Apart from Europe, it was argued, the British would find themselves in a political and economic backwater, bypassed by the Americans, with an out-of-date and stagnant economy and no longer able to maintain its central position in the Commonwealth and Sterling Area. Membership of the E.E.C. was considered vital to Britain's whole future. And they showed this in the negotiations by their willingness to make very substantial concessions to the Six on all the points on which the British had originally sought satisfaction. Even the French appeared taken aback by the lengths to which the British seemed prepared to go. It was said at the end that de Gaulle stepped in, not because the negotiations had not been successful but because they looked like
succeeding, and I am sure that has some truth. But the real conces-
sions came from the British not from the Six. For New Zealand, the
deal which seemed to be emerging on agriculture at the end could not
be regarded as anywhere near satisfactory in terms of our future
export requirements. But had the negotiations successfully concluded
we could not have done anything about it. Given that the British
assessment of their own political interests in the world was correct,
and this is a matter open to question, neither New Zealand nor the
Commonwealth were in a position to offer any alternative equally
satisfactory to the British. Their essential objective was membership
of the Community and, I understand it still is. Suggestions about
closer economic and political links with the Commonwealth, even if
they made sense, are quite beside the point. We have yet to see the
full repercussions of the creation of the E.E.C. Although Britain's
negotiations with the Six have failed it seems apparent that the
British are in a process of adjusting their policies, especially in the
agricultural sphere, for the time when negotiations with the Six can
begin again. I am sure it will not be long before we have a request
to agree to quantitative restrictions on meat imports; although at
the present time this would be related more to a desire to reduce
heavy agricultural subsidy expenditure without putting inefficient
British meat producers out of business. In the E.F.T.A., moves to
accelerate the process of tariff reduction and economic integration
have already resulted in the removal of the butter preference to New
Zealand which forms part of the 1958 Trade Agreement obligations.
This is perhaps one of the few instances where New Zealand suddenly
found itself with some bargaining power. If the Government had
not agreed the British would have been forced to break the 1958
Agreement in order to secure Danish acceptance of tariff acceleration
in E.F.T.A. Thus New Zealand was able to secure some useful short-
term advantages for butter in trade terms. But we have not seen
the end of the process. The further tariff reduction goes in the
E.F.T.A. the greater will be the pressure from Denmark and others
to secure trading advantages in the United Kingdom which must
affect us.

In these comments on New Zealand's position in the world and
the problems we face in trying to expand our export income in future
years I have tried to indicate some of the reasons why our individual
ability to bargain for adequate terms of access is weak and to show
also how political aspirations of the large powers deeply affect our
economic prospects. We are small, and at the mercy of the policies
of others. We cannot make world economic policy. We can only react
to the policies of others and make the best of it. This seems trite
and rather obvious and it would hardly need stressing except that
too often one sees comments—in the editorial columns for instance—
about how New Zealand should "stand firm" or should insist on her
rights. One can only successfully insist on one's rights if one has
the necessary might. That is a viable policy for a country in a posi-
tion to determine policy, but I am afraid it seldom leads anywhere
in our case. Our international economic strategy must start from a
different point—it has to be the strategy of a price taker not that
of a price maker—to borrow some economist's jargon.

In the first place we have to recognise that protection of domestic
agriculture by means other than tariffs is an ineradicable feature of
modern economic organisations. The examination of agricultural
policies which has been carried out in G.A.T.T. in recent years has
shown that all countries including New Zealand protect and support
agriculture to a greater or lesser degree. The present G.A.T.T. rules
on agricultural trade, which would suit New Zealand well, have
remained inoperable because the great majority of countries are not
prepared to enforce them. The abandonment or reduction of protec-
tion involves highly sensitive political issues in the domestic affairs of most countries.

It seems to me therefore that the wiser and more realistic course for New Zealand is not to insist on the abandonment of agricultural protection but to accept the fact that in the foreseeable future international trade in agriculture requires a different set of G.A.T.T. rules from industrial products. And our policy should be directed towards devising a system which while allowing certain special measures of protection also places more effective restraints on national policies and permits a minimum degree of international trade to develop on stable and known terms. It seems to me preferable to have a less liberal code of conduct which can be enforced than to have a more liberal one which cannot.

For most agricultural products broadly similar general principles could no doubt apply but some of the major products entering world trade would need special rules because of significant differences in the conditions of production, consumption and demand, and for some products a chronic tendency for surpluses to emerge. For example in the case of meat or fruit demand tends to be fairly elastic or responsive to changes in incomes and any new rules governing trade in these products should not need to depart very far from the existing provisions of G.A.T.T. But special measures certainly seem to be necessary in the case of cereals or dairy produce where even now substantial surpluses are being produced. And dairy production is probably the most politically sensitive of all agricultural commodities. For this product, the only realistic answer to the present situation and its prospective development in the next decade is some form of international commodity arrangement. Such an agreement would need to fall into two main parts. First, arrangements designed to guarantee that a certain amount of trade at agreed minimum prices can be conducted between dairy produce exporters and the countries of Europe and North America and in the second part, arrangements to stimulate consumption of milk and milk products in the developing countries to deal with the surpluses which would exist. Such an arrangement is technically feasible and even though it would require a fairly high degree of regulation and organisation of world trade in dairy produce it seems to me the only way of meeting the threat to our future posed by the agricultural policies of the E.E.C. and others. Actually, as you may be aware, the subject of a world dairy produce arrangement even of an interim nature is being discussed at the current meeting of the International Federation of Agricultural Producers in Dublin and the subject is also being discussed at the present meeting of the G.A.T.T. in Geneva.

On a more general level, and although spectacular results cannot be expected it seems to me wise to maintain whatever pressure we can against agricultural protectionism as a whole. But we need allies in this and must seek them in other countries who are affected as we are to a greater or lesser degree. Such countries are the United States, Australia, Canada, Argentine and Uruguay. The United States in particular has very considerable interests in agricultural trade with Europe and is able to bring much greater bargaining power and pressure than we can. Discussions between these countries about the way in which the problem of world agricultural trade can be dealt with took place in Washington, a few weeks ago. For those who are more concerned with principles than realities these may seem a strange company of bedfellows for us, having regard to the record on imports of dairy produce. But if we refuse to work with anybody unless they are as pure as we think we are then I am afraid we should find ourselves very much alone and completely powerless. In any case satisfactory world arrangements on dairy produce would remove a major source of disagreement with the United States in
economic affairs. We must remember that for other products the United States provides a very important market for our agricultural exports. The United States Administration has shown itself very much more aware of the international effects of its agricultural policies and has displayed a much greater readiness to do something about them than have most other countries.

In speaking about our trade problems I have had in mind principally the existence of quantitative restrictions. These do not apply to all our exports; there is a wide range of commodities for which in general the only measure of protection is a tariff. In our preoccupation with the problem of access for our major products we should not overlook the fact that for individual New Zealand exporters and in the future, New Zealand as a whole, it will be increasingly desirable to secure better access terms for industrial and processed products. The efforts now being made in the G.A.T.T. especially by the United States to secure a substantial reduction of world tariffs are worthy of our full support, both for the benefits that can accrue to some of our exporters and the benefits that a lowering of our tariffs can bring to us through improvements in the New Zealand industrial pattern. If we do not take part in the present round of negotiations for an across-the-board cut in tariffs, I think we might well find ourselves failing to secure some important benefits—not only in Europe and the United States but also in Japan. To make a reduction of agricultural protection by others a condition of our participation in the tariff cutting exercise as we seem to have done, gives inadequate weight to these points and reflects in my view an unrealistic assessment of New Zealand’s true bargaining position.
PLANNING FOR PROFIT

J. D. Stewart, Senior Lecturer in Farm Management,
Lincoln College.

Last November and December, 130 farmers in Mid-Canterbury were asked whether the maximization of profits was an important motive affecting the farm management decisions they made. Forty-five per cent said it was very important, 53 per cent said it was moderately important, and 2 per cent said it was unimportant. These are not very precise facts, because “very” and “moderately” are not very precise words. Indeed it is difficult for anyone to be clear in formulating their objectives, let alone farmers, whose farm is both their business and their home. Farmers manage their farms according to interacting objectives, which may include profit maximization, building up the value of the farm asset, minimization of risk, or maximization of economic security. In the latter category reduction of indebtedness, or dispersal of assets to minimize taxation and estate duties are often important. Non-economic objectives such as education of children, and the achievement of a desired way of life commensurate with a certain level of disposable income, often impinge directly on farm management.

Despite the seeming complexity of the goals, it is my experience that farmers seeking management advice are normally able to define their objectives in a reasonably precise way. Indeed it is not possible to proceed with management planning unless they can. Similarly it is necessary to think out clearly the relationship between income taxation and management objectives, as it is generally thought that the incidence of taxation has an effect on the decisions farmers make. I often feel that farmers do not react as positively to the disincentive of taxation as they imagine they do.

In the Mid-Canterbury survey referred to, 127 farmers were asked whether the level and incidence of taxation affected the decisions they made about the management of their farms. Fifty per cent considered that it had no effect, while 14 per cent said that it had a positively disincentive effect on their level of production. Also while 7 per cent indicated that their development plans had been curtailed because of taxation, 17 per cent felt that their development plans had been stimulated. They were ploughing a maximum amount of allowable expenditure back into their farms.

Again this information is not as precise as we hope to obtain in further research. For it is clear that the volume of investment on farms is a function of the disposable income after tax, and while 50 per cent of the farmers indicated that they do not react in a positive way to taxation, nevertheless their level of reinvestment undoubtedly would be higher if their taxes were lower.

This paper has been introduced in this way, in order to emphasise that the discussion of farm management planning which follows, is not made in a vacuum. It is fully understood that it is necessary to be conscious of the economic, human and institutional factors around which the farmer is making management decisions; in particular to be conscious of varying objectives, incentives and disincentives. Having made this reservation, it is reasonable to proceed on the basis that we are principally concerned with management planning which is aimed at high income.
The Basic Principle of Costs

An important element of the farm business, when consideration is being given to management planning, is the nature, level and incidence of farm costs. It is important to distinguish between those costs which are fixed in the short run, no matter what the level or nature of production is, and those costs which can be directly assigned to items of production, and which vary proportionately with the level of production. The former are called fixed or overhead costs, the latter variable or direct costs. All farmers are conscious of the importance of their overheads, although in my experience they are often not clear as to what they are. They include interest and debt servicing, rent, rates and insurance, maintenance of farm improvements and plant, fixed wages including those of the occupier. In the short term these costs will not be affected by management decisions. The short term excludes decisions which alter the structure of overhead costs, such decisions being the acquisition of further capital by borrowing, the purchase of new plant, or changing the fixed labour complement. Decisions of this nature result in a new level and structure of overhead costs, and are of course crucial elements of farm management.

With some classes of farming it is possible to give guides as to what are reasonable levels of overhead costs. For example on North Island hill country sheep farms some farm management advisers regard £10/- per ewe as being the maximum reasonable level of debt charges. A level of indebtedness resulting in higher changes would be regarded as excessive to the capacity of the farm to meet all other costs, and at the same time make progress by reducing debt or developing the farm.

Thus it may be occasionally necessary to pay attention to the structure of the overheads, and to other related matters of financial organization, such as the level of liquid funds, before planning of the physical organization of the farm can proceed. However in this paper attention will be given only to those farm management decisions which affect, and are affected by variable costs, such as seed and fertiliser, cultivation, shearing, crutching and dipping, casual labour and harvesting costs. The important point is that where fixed costs may be temporarily disregarded, it is possible to examine proposed adjustments to farm organization by taking into account the direct costs only.

Partial Analysis

For example if we wish to consider increasing wheat acreage, where this would involve reduction in sheep numbers, then all that is necessary where adjustment can be made without altering the overheads, is to calculate the following:

1. Increase in revenue from additional wheat plus decrease in costs resulting from less sheep.
2. Increase in costs from additional wheat plus loss in revenue resulting from less sheep.

If the first sum exceeds the second then the adjustment is profitable, providing all other factors such as fertility and risk are taken into account. These are the kind of partial budgets which farmers often do on the backs of tobacco packets, but as a systematic technique for analysing production alternatives it has probably not been as widely used in farm management advisory work as it could have been.

Hesitation in the use of partial budgeting arises from the uncertainty surrounding some of the principal figures in the analysis. These are price and yield uncertainties, and such problems as conversion rates; for example, how many fat lamb ewes in place of one
acre of wheat? But the analysis does not have to stop at one set of coefficients. Once the basic arithmetic is done, it is relatively simple to examine a range of possibilities in the principal variables before coming to a decision.

A Lincoln College farm management class recently undertook a simple analysis of alternative stock policies on a Banks Peninsula property running about 1,000 ewes, buying replacement two-tooths and fattening all the down-cross lambs. The problem was whether to buy Border-Romney first-cross ewes or Romneys. The farmer had had experience with the half-breds, and found that their mouths were deteriorating rapidly as from six-tooths on his country. The critical variables in this study would be (a) the lambing percentage, (b) the lamb performance, (c) the cost of the replacement two-tooths, (d) the wastage rate in ewes, (e) the value of the cast-for-age ewes, (f) the value of the wool per head. It would be quite possible to examine the effect of variation in any number of these variables, but presentation of the results becomes very complex when more than two are varied simultaneously.

In the following table, which is used merely as an illustration for a particular farm, and not as a case for or against Border Leicester crosses, fixed coefficients were adopted for all the variables except carrying capacity. This was allowed to vary from 880 to 920 for the Border cross ewes with the Romneys at 1000. In one case the net price of fat lambs from the cross-bred flock was taken at 4/- per head better than those from the Romney flock, to give an indication of the effect of possible better lamb performance.

### Partial Analysis of Border-Romneys versus Romneys

<table>
<thead>
<tr>
<th>Banks Peninsula Fattening Farm</th>
<th>Border-Romney</th>
<th>Romney</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Carrying capacity</td>
<td>920</td>
<td>920</td>
</tr>
<tr>
<td>Lambing percentage</td>
<td>125</td>
<td>125</td>
</tr>
<tr>
<td>Net value fat lambs</td>
<td>40/-</td>
<td>44/-</td>
</tr>
<tr>
<td>Cost replacement two-tooths</td>
<td>85/-</td>
<td>85/-</td>
</tr>
<tr>
<td>Cast for age at</td>
<td>4yr.</td>
<td>4yr.</td>
</tr>
<tr>
<td>Value C.F.A. ewes</td>
<td>20/-</td>
<td>20/-</td>
</tr>
<tr>
<td>Gross value fleece</td>
<td>36/-</td>
<td>36/-</td>
</tr>
<tr>
<td>Gross revenue on Sheep A/c. (£)</td>
<td>4214</td>
<td>4444</td>
</tr>
<tr>
<td>Direct costs on Sheep A/c. (£)</td>
<td>1287</td>
<td>1287</td>
</tr>
<tr>
<td>Gross Margin on Sheep A/c. (£)</td>
<td>2927</td>
<td>3157</td>
</tr>
</tbody>
</table>

The purpose of this table is merely to demonstrate that it is a relatively simple matter to explore the effect on financial results of a range of possibilities in the important elements of a partial budget. These results can then form the basis of a more rational farm management decision. In this case the farmer would have a probable range in outcome of from minus £250 to plus £100 when the basis is the performance of the Romney flock. He probably would not regard these as being differences which would justify a change in policy, although he would have to judge this in relation to the differences in net profit rather than gross margin.

### Gross Margins

The term gross margin used in the previous section refers to the margin which a unit (say an acre) of any enterprise is expected to produce in excess of the direct costs. It follows that this margin is the contribution which the enterprise is expected to make to meeting the fixed costs and producing a profit.
In the next table an example is given of gross margin calculation for a wheat crop on medium land is given. The expected wheat yield is 50 bushels.

### Gross Margin for Wheat
(ex peas or rape)

<table>
<thead>
<tr>
<th>Gross Revenue per acre.</th>
<th>50 bushels at 13/6</th>
<th>£33 15 0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct Costs per acre</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cultivation, 5 hours at 3/-</td>
<td></td>
<td>15 0</td>
</tr>
<tr>
<td>Seed, 1.5 bushels at 22/6</td>
<td></td>
<td>1 14 0</td>
</tr>
<tr>
<td>Spray, material 28/-, spraying 15/-</td>
<td></td>
<td>2 3 0</td>
</tr>
<tr>
<td>Harvesting, contract 1/3 bushel</td>
<td></td>
<td>3 3 0</td>
</tr>
<tr>
<td>Cartage, 17 sacks 20 miles</td>
<td></td>
<td>1 13 0</td>
</tr>
<tr>
<td>Sacks, 17 at 1/- loss</td>
<td></td>
<td>17 0</td>
</tr>
<tr>
<td>Levy, 4/9 per 50 bushels</td>
<td></td>
<td>5 0</td>
</tr>
<tr>
<td>Sundry, raking and burning</td>
<td></td>
<td>3 0</td>
</tr>
</tbody>
</table>

**Gross Margin per acre**

As expected yields vary, the gross margins will vary more than proportionately, for apart from harvesting costs, the direct costs per acre are constant. This is shown in the following figures.

### Gross Margins for Wheat
(with variations in yield)

<table>
<thead>
<tr>
<th>Yield (Bushels per acre)</th>
<th>Gross Revenue</th>
<th>Direct Costs</th>
<th>Gross Margin</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>40 10 0</td>
<td>11 15 0</td>
<td>28 15 0</td>
</tr>
<tr>
<td>50</td>
<td>33 15 0</td>
<td>10 13 0</td>
<td>23 2 0</td>
</tr>
<tr>
<td>40</td>
<td>27 0 0</td>
<td>9 12 0</td>
<td>17 8 0</td>
</tr>
<tr>
<td>30</td>
<td>20 5 0</td>
<td>8 9 0</td>
<td>11 16 0</td>
</tr>
<tr>
<td>20</td>
<td>13 10 0</td>
<td>8 1 0</td>
<td>5 9 0</td>
</tr>
</tbody>
</table>

Where there is a wide range of alternative enterprises on a farm, and even in some cases where the alternatives are restricted, the comparative budgeting process may therefore be streamlined by calculating the gross margins for the alternatives. These are then a logical basis for examining the likely financial outcome of proposed changes.

The following is a series of enterprise gross margin for a mixed cropping and fat lamb unit on medium land. Such a list does not have to include every possibility, but only those in which there is immediate interest. With these established it is then possible to look critically at the existing organisation, and to consider the scope for adjustment which will lead to increased income. The scope for adjustment will be determined by factors such as the availability and organisation of labour, the availability and adequacy of plant, the level or risk and uncertainty, the requirements of good husbandry, and personal preferences. The calculation of the gross margins is not an end in itself, but merely the mechanical part of the planning process. All the other components of management, which cannot be quantified as easily, must be taken into account. But at least there is a rational and systematic basis on which to start.

The discussion so far has led only to suggestions for examining the relative profitability of alternative enterprises, where the criterion is the contribution which the enterprise can make to meeting the fixed costs in the short run, and to net profit. There are a number of ways of building up a most profitable programme from the basic data on gross margins. They vary in their degree of mathematical sophisti-
cation. The most practical way for general farm management work is to examine the possibility of margin adjustments to the existing programme in the light of the calculated grass margins. At the other end of the scale the optimum programme may be programmed mathematically, but this technique is at present being used in connection with basic investigational work, rather than with farm management advisory work in the field. In Britain farm advisory workers are using a system intermediate between these two, with which they build up a programme by selecting enterprises in descending order of gross margin per acre. At each step account is taken of the limitations imposed by labour, plant, husbandry requirements and other constraints. It may be desirable at some points to substitute enterprises which while less profitable per unit of land are more profitable per unit of labour. This method is called programme planning.

### Gross Margins per Acre for Alternative Enterprises

<table>
<thead>
<tr>
<th>Enterprise</th>
<th>Yield</th>
<th>Price</th>
<th>Gross Revenue £</th>
<th>Direct Costs £</th>
<th>Gross Margin £</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potatoes</td>
<td>10 tons</td>
<td>£13 &amp; £23</td>
<td>170</td>
<td>0</td>
<td>123</td>
</tr>
<tr>
<td>Specialist W. Clover</td>
<td>280 lbs</td>
<td>3/-</td>
<td>42</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>Wheat (ex peas)</td>
<td>50 bus.</td>
<td>13/6</td>
<td>33</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Wheat (ex wheat)</td>
<td>45 bus.</td>
<td>13/6</td>
<td>30</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Garden peas</td>
<td>35 bus.</td>
<td>18/-</td>
<td>32</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td>Barley (ex wheat)</td>
<td>60 bus.</td>
<td>8/6</td>
<td>25</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>Field peas</td>
<td>40 bus.</td>
<td>14/-</td>
<td>28</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>Fat lamb flock 2-year ewes</td>
<td>6 ewes per acre spring-summer</td>
<td>110 per cent</td>
<td>38/-</td>
<td>10lbs at 3/2 net</td>
<td>£15</td>
</tr>
</tbody>
</table>

The best method for formulating a farm programme will vary according to the nature of the farming system, the scope for adjustment, the structure of farm costs, and of course the availability and reliability of the necessary data. But finally the degree of success of any farm programme will depend more upon the efficiency with which it is implemented, than upon the way in which it is worked out.

There are farmers who, despite the fact that their farms are not reaching a reasonably high level of success, with their indebtedness disturbingly high, who are sceptical about the value of any form of budgeting and financial control. The general kind of criticism is that "budgets never work out anyway." This is usually true. A farm is not a bakery, immune to weather, wool auctions, Smithfield prices, and yellow dwarf virus. A budget however should not be regarded as an inflexible statement of a farm programme with the corresponding income and expenditure. It should be regarded as a flexible method of financial control, adjustable in relation to deviations from expected costs and returns. It is the only reasonable basis for planning development outlays such as fertiliser, fencing and clearing, in situations where there are limited funds for development. It is doubly important where a development programme requires balanced expenditure on, for example, clearing, fertiliser, fencing and extra stock. Development programmes have been known to go astray through lack of balance in the physical and financial planning, resulting in the initial investment not being exploited and even being wasted.
There is nothing novel about the case I am trying to make for planning and budgeting control of this kind. It has been the basis of farm management teaching and advisory work at Lincoln for over 30 years. It has been widely used by those Government departments involved in the settlement and establishment of returned servicemen, and civilian settlers. The success of Farm Improvement Clubs is partly attributable to this kind of approach to farm management. It is now encouraging to find the Department of Agriculture's farm advisory work being turned in this direction. According to a recent Departmental publication—"The Farm as a Business," Department of Agriculture, Dunedin 1962. P. 77—"budgeting has been removed from the field of mere academic interest and is fast achieving recognition as an important practical tool in the implementation of balanced and planned farm management programmes." It is reasonable to point out, with due respect, that budgets have hardly ever been regarded as merely academically interesting elsewhere.

The preceding discussion assumes that there is a need for some kind of management and financial planning on farms. It is a remarkable tribute to the judgement, tuition and insight of many farmers that they have achieved high levels of success in farm management without any of this. They may even regard it as nonsense. But more remarkable is the fact that many farmers with real problems of farm organisation and finance, act belatedly in seeking assistance, and in instituting the degree of financial control which is imperative. This kind of advice has been available at Lincoln College for over 30 years. It is now being extended by Farm Improvement Clubs, and the Department of Agriculture is moving in the same direction. Finally, I wish to emphasise that it is not only farmers in financial difficulty who benefit by careful management planning. It is a matter of interest that successful and established farmers find it sharpens their thinking, and develops a keener insight into the management process.
Much is said and written about marketing agricultural products from the industry and national angles, but little from the viewpoint of the individual farmer. Even amongst farmers there is a tendency to rather neglect the business of marketing. Perhaps this is because production matters have greater appeal to many people; or it may be that some do not realise that the individual farmer really does have a marketing as well as a production problem. The actual extent of this marketing problem varies, of course, with the type of farming. Thus we find that the dairy farmer, with his largely self-contained stock economy and his industry organised marketing, has reduced the personal buying and selling problem to negligible proportions. The sheepfarmer, on the other hand, leads a much more individualistic life and, consequently buying and selling ability assumes considerable importance in determining the size of the farm profit or loss. For this reason I propose to deal with the subject more especially from the sheep farmer's angle covering first some basic considerations and then leading into a more general discussion. Because of the breadth of the subject and the limitations on time, I shall confine the discussion to trading in livestock and more especially from the selling rather than the buying angles.

Basic Considerations

At the outset it is perhaps necessary to emphasize some of the more basic requirements for efficiency in buying and selling livestock. First there is the importance of sound general farming knowledge coupled with up-to-date information on markets. Unless a person has these qualifications, it is difficult for him to determine the requirements when buying or to understand the needs of the buyers when selling. Stock and also other farm inputs, are bought in relation to the needs of the particular farm, including but by no means confined to the size of the purse. They are sold with a view to maximizing the return to the seller but this is possibly only if the purchaser's requirements are understood, be he another farmer seeking breeding ewes or, perhaps, an agent buying fat stock for the local trade.

When buying, the aim may be to reduce the price to the lowest possible figure or, in selling, to extract the highest price but, in either case, it is first necessary to value the stock, or other goods under consideration. Valuation, in itself, is first a physical problem, dependent on the ability to judge the quality of the livestock, and whether they are suitable for the purpose required in accordance with their visual attributes and any production figures available. Secondly, this judgment must be translated into monetary terms. In this respect there are useful theoretical approaches but, in the final analysis, it is necessary to rely on comparative market value; hence the need to understand and keep in touch with markets. In this connection, while radio and newspaper reports on livestock sales have their uses, as also do the verbal reports of agents and others, it is essential, personally, to attend a sale or two, in order actually to see similar class stock sold and so be in a position to value.

Another basic consideration concerning buying and selling is the personal nature of the transactions. When we sell, or buy, we deal directly with people outside the farm—fellow farmers, stock agents, fat stock buyers and others. Thus relationships with the public in general and with certain firms and individuals in particular, are of
importance. It follows, too, that in handling business of this kind, applied psychology and also ethics have a part to play, as well as husbandry and economics. Today in all business firms and public organisations, much importance is attached to public relations and, where the size of the organisation warrants it, specialist officers charged with fostering public relations, are appointed to the management team. It is true, of course, that there is no exact analogy between a business and a farm, nevertheless the question of individual farmer relationships with the public merits attention. Especially is this important where the farmer is operating in a highly competitive field such as stud stock breeding. But even in the case of the “ordinary” farm a reputation built up over the years for efficiency, honesty and integrity represents a considerable asset which pays off in cash as well as being rewarding in other ways.

It is of especial importance to establish sound business relationships with the firms and individuals with whom one deals. More will be said of this later and it is sufficient now to observe that sound business relationships are not established merely on the basis of personal friendship and mutual esteem, important as these may be. In the economic jungle in which farmers operate today, sound business relationships evolve and endure only where there is tangible interdependence between the entities. Reciprocal business and the approach of “you help me and I’ll help you” seems to be the key which unlocks many doors. Thus, for example, the service we get from the stock firm depends very largely on the proportion of our business we give that firm, as well as the manner in which transactions are handled and the compatibility of the personalities involved. Similarly we cannot expect any special consideration from our fat stock buyer in circumstances where he and his firm hold all the trump cards, if we have not been fair and reasonable to him in other circumstances where we have had the upper hand. I appreciate, of course, that in these matters the practical problem is to determine what is fair and reasonable.

The final point which I feel should be made at this stage is the need for faith in people when engaged in buying and selling. There must always be an element of uncertainty in marketing activity and to approach it with suspicion as to the motives and integrity of others can make the whole thing somewhat of a nightmare instead of a challenge and, perhaps, a satisfying experience. This is not to say, of course, that faith can be exercised in a wholly unqualified way.

In the remainder of this paper I propose to deal with more specific points concerning the preparation of livestock for sale, negotiating sales and purchases and, finally, the question of relationships with firms.

Preparation and Presentation of Livestock for Sale

In general terms the idea in farming is to produce suitable products, in sufficient quantity and to sell them to best advantage. The preparation of stock and other produce for sale is therefore just as important to the sheepfarmer as it is to the businessman who attractively grades and packages his goods, dresses his window and arranges his shop shelves to present his wares to best advantage. The same principles do, in fact, apply irrespective of the actual goods to be sold. As a basis for discussion, the aims may be said to be, to prepare goods to be sold in relation to buyers’ requirements, to maximize what may be called “eye appeal” and always to sell “true to label” or description.

Buyers seek sound, disease-free, productive stock and pay accordingly; they cannot afford to do otherwise. Consider the case of a fat-lamb farmer seeking good five-year-old breeding ewe replacements.
This year he would have to pay (at Feilding) some 40/- or 45/- as against the 25/- he might average for his own cast ewes sent to the works. The net replacement cost per ewe then is 15/- to 20/-. But if he is fortunate enough to obtain a breeding life of two years out of his purchases, then the cost is reduced to about 10/- per year for every ewe in the flock. With costs such as these, it becomes important to obtain replacements which will produce both lambs and wool and last as many seasons as possible. Dry ewes consequently are a liability and so too are ewes with bad udders. Similarly buyers will react against any broken or low-mouthed ewes in an otherwise sound mob. Any suggestion of footrot will also put purchasers off, for apart from the economic consequence of this disease, footrotting is by no means the most popular job on the farm.

To most purchasers, evenness in a line of stock is an important feature, consequently any drafting up towards this end that can be effected is likely to be advantageous. In this respect it is helpful to use the analogy of nails or staples. We would be inclined to take a peculiar view of our hardware merchant if he offered to sell us mixed nails or staples. Even at a substantial reduction in price per pound, most farmers would not be interested in such a proposition. Similarly the buyer of stock seeks a line for a particular purpose, not for several purposes at the same time, and he therefore looks for uniformity in his purchase and pays accordingly.

Where the size of the line permits it, drafting should be practised for such factors as breeds, age, size, condition, wool type and, of course, mouths in aged ewes. Procedures such as these need no elaboration but one point can be made. In drafting stock for sale it is common practice to run off tail end, small and poor conditioned animals. This is sound but a line can still be spoiled by leaving in a small number of outstandingly good individuals which, rather than adding to the value of the line will give it an impression of unevenness and also show up the others as being smaller and poorer than they really are. This sort of situation is common in the case of store wether lambs where even a few early or otherwise big lambs will detract from the value of the line as a whole.

An important feature when selling cattle is temperament. Quiet cattle in addition to being easier to handle, settle down sooner in their new environment and invariably fatten earlier. Thus, especially where cattle are bred under extensive conditions, it often pays to take steps to quieten them at an early stage of their lives. In this respect hay feeding of weaners in their first winter is especially useful. Where this is not practicable, then it is necessary to give the cattle special handling to quieten them. This is best done at the weaner stage when they should be mustered from time to time to accustom them to being handled with dogs, to seeing men on foot and to being confined to yards. Later, if selling on the farm, make a point of walking in amongst the cattle and demonstrating their quietness to the buyer. Buyers seek quiet cattle and I should think, judging from the appearance of the fences in these parts, that South Island farmers may well pay an extra special premium for this quality.

It is true that most buyers are strongly influenced by their first impressions of a line of livestock. Thus “eye appeal,” which may or may not be related to productive factors, is important. Well “got up” lines attract attention and invariably sell better than stock of equal quality poorly presented. This is, perhaps, best illustrated by the case of the well known dealer who prospered for many years in the cow country of Taranaki. This gentleman, like many others of his kind, had a small farm close to the local selling centre. He dealt almost exclusively in dairy cows over the winter months, buying the roughest looking individuals but always provided that they were Jerseys of good colour. These he covered and fed well for a few days
before bringing them in and preparing them for resale. Coats were carefully groomed, necks and tails trimmed and horns and hoofs oiled and polished almost to Royal Show standard. Invariably, by this procedure, which cost very little, the dealer was able to clear several pounds a head on resale and this at a time when dairy cows were worth a lot less than today. The same principle should be applied in preparing sheep for sale but, except with stud sheep, perhaps not quite to the same degree. Such things as brands and raddle marks are unsightly and may lead to loss of buyers’ confidence. All lines should be neatly dagged or crutched as necessary and it is most essential, where possible, to yard sheep fresh off pasture with the minimum of delay before sale. Lambs especially will “fade” if yarded for long in hot weather. When preparing run cattle for sale less can be done but empty bellies and mud-stained coats detract from appearance and depress the price.

No discussion on preparing store stock for sale, however cursory, can omit reference to “condition” as a selling feature. Condition will, in fact, influence even the most experienced stockman. One might even go so far as to say that condition is the greatest single factor contributing towards what is generally accepted as quality in sheep and cattle, be they stud animals or ordinary grade lines of stock. This is, perhaps, understandable in the case of stock being purchased for fattening purposes, but more difficult to follow with breeding stock. It has always seemed to me to be somewhat of a paradox that fat-lamb farmers should almost universally state they do not want fat breeding ewes yet consistently pay more for them. This I take as further evidence that there is often considerable difference between what farmers say and what they do. But it is also my observation that whatever farmers say, that which they do, if general practice, nearly always has some logic to it. I conclude therefore that condition in breeding ewes is an economically worthwhile factor. No doubt it is possible to have aged ewes too fat but good conditioned ewes will produce more lambs and more wool and invariably sell better. In the case of two-tooth ewes I doubt very much if it is possible to get them too fat under normal farm conditions.

The final observation which I wish to make with reference to preparing stock for sale is that they must be “true to label.” That is to say, they must be the age and class described. There are, of course, some legal responsibilities in this respect but, more important, a vendor has his reputation and relationships with the buying public to consider.

**Negotiating Sales and Purchases**

Every year many thousands of sheep and cattle are sold by means of private or paddock sales where there is direct negotiation between vendor and purchaser with the agent acting as intermediary in some cases. Protracted deliberations are common on these occasions and the point at issue may only be 3d per head in the price. Criticism is sometimes levelled at farmers for this time consuming and seemingly unbusinesslike procedure. However, it is helpful to remember that with 1,000 sheep in the line under offer, a difference of 3d a head represents 12/10/-.

This may take an hour to achieve but there are few jobs on the farm that will give a return in any way approaching this figure, so why hurry?

It is not my purpose to advocate any particular approach to the business of negotiation. In point of fact there are as many different styles as there are different personalities and it would seem that the matter is as much a contest of wills as that of particular skills or strategies. In any case it seldom pays to have any absolutely fixed ideas on how to handle a deal since the approach has often to be varied.
according to the man being dealt with or the situation which develops during the negotiation. It is especially helpful to know something of the man you are dealing with and how he operates. Some like to play the game on a relatively straightforward basis, others to use every ruse and counter-ruse known in order to get the better of the deal. The opposing party knowing this should modify his strategy accordingly. This is particularly important for the vendor since it is he who has the opportunity to “set the stage” for a satisfactory deal when preparing the stock for sale and in fixing his price. Some vendors use what may be termed the dignified inflexible approach. This is one where the price and terms of sale are quoted and the vendor absolutely refuses to haggle in any way. The method meets with success in some cases, but it requires very careful valuation and the stock under offer must be good. In general it is too inflexible and eliminates many purchasers who like to haggle or who feel, on principle, that they must make a point of some kind even if the price is a fair one and the stock ideally suited to their own requirements.

The opposite approach is to quote a price well above market valuation in order to provide flexibility for subsequent concession if needed to effect a sale. One aspect of this is that the price can always be reduced but once quoted it cannot be raised. For this reason this is the strategy that is used to a greater or lesser degree by the majority of vendors of stock. It does have the virtue of giving scope to allow the purchaser to make this point perhaps when the vendor reduces his price 3d a head to 6d above his valuation. However, if the price asked is too high, there is difficulty in getting any buyers to look at the stock. Or, if it is a regular buyer, he may, quite correctly, refuse to negotiate on the basis that the price difference is too great. Thus a stalemate may develop and a good buyer be lost. As a general guide a price for negotiation should not be more than 5 per cent above market valuation.

Another strategy used by some vendors is deliberately to leave a few small or inferior sorts in an otherwise well drafted line. These serve a double function in providing a negotiating point and also in showing up the others to advantage. Other negotiating points include responsibility for payment of stock firm’s commissions or the transport or droving arrangements. Settlement may also sometimes be effected by the vendor agreeing to hold the stock for a period to suit the buyer’s convenience.

In price negotiation, professional buyers especially often use the strategy of offering the vendor a good price—perhaps even above the figure quoted—conditional on a substantial reduction being given on a tail end proportion of the mob. The aim being, of course, to obtain the whole line at an average below that originally quoted. Obviously this technique calls for quick and accurate mental arithmetic on the part of both seller and purchaser but the fact that buyers are quite often successful in using it is not necessarily an indication of slower mental reactions of vendors. The real explanation is more often the fact that maximizing the average price obtained is rather less important to some farmers than that of obtaining a sufficiently good price for the main line to enable them to hold their own with the neighbours. It seems that it has long been established, in most farming communities, that the price for the tail end need not be disclosed and must certainly never be asked for by others.

Strategies aside, when selling anything, it is necessary to remember the first principle of salesmanship, that a vendor must “sell himself” in order to sell his wares. Buyers clearly react to personalities by stretching a point for a vendor who impresses them, but react against the other kind. A confident, good-humoured and cooperative approach is likely to go down better than a sour take-them-or-leave-
them attitude. It is also helpful to provide background information on the line of stock offered for sale, to highlight their good features and to otherwise promote the sale, but it does not pay to argue with the buyer as to his requirements. The axiom that the buyer is always right has some application but this does not, of course, extend to the price although even here, the buyer has the final say in whether or not he will take them. Another point in selling is that criticism of a competitor's sheep or cattle in order to sell one's own is exceptionally bad form which seldom goes down with buyers. When buying, on the other hand, care must be taken not to antagonise a vendor by some ill-advised remark about his stock or his farm, as obviously such a state of affairs is not conducive to a satisfactory deal.

Relationships with Firms

Farmers have dealings with many business firms, more especially stock and produce firms and meat operating concerns but also lending institutions, motor and machinery firms and many others. Good relationships with these firms are advantageous. This should need little emphasis in the case of motor firms in these days of shortage of new motor cars of popular makes. Earlier I made the point that the basis of really sound business relationships is the tangible one of economic interdependence. It follows, therefore, that the service obtained from the motor firm with the right franchise, is related to the support the client gives that firm. Obviously it is easier to press a claim for a vehicle if it can be shown that say £250 a year is contributed to the firm's welfare in petrol, oil, repairs and car servicing, instead of scattering this business elsewhere on more stoney ground.

The same principle applies with stock firms. It is a fact that firms and farmers exist for their mutual benefit and the farmer, equally as much as his firm, must give careful consideration to the relationship between them if he is to get best results. Everyone is aware of the kinds of services normally provided by our Stock and Station Agencies but there are some rather special ways a firm can help a farmer. These include such things as finding a buyer for cattle at the onset of drought when everyone wishes to sell; disposing of grain or seed when the supply is heavy; letting a client in on a special order of "above schedule" fat cattle; providing especially valuable market information; obtaining preference for rams or bulls from a certain breeder; finding grazing or supplying credit or goods when there is not enough to go around.

With these kinds of things in mind the question arises: does it pay a farmer to put all his business through one firm or to spread it around several? Stud breeders have little option but to distribute the sales of their stock through several firms as this is the only way to get access to the maximum number of buyers, whether selling by auction or on the farm. In the case of other farms, however, I firmly believe that it pays to deal through only one firm, insofar, of course, as this firm provides the necessary facilities and service.

Some farming families have business relationships with firms extending back for several generations. I believe this to be a good thing and certainly something which should not be thrown overboard lightly. At the same time the relationship cannot be allowed to rest merely on the basis of the long association. Again, irrespective of the length of the association, a farmer should not try to off-load the responsibility for his marketing entirely to the firm and its agents. Some attempt this but it doesn't work. The final responsibility for any phase of farm management lies with the farmer and the results are about proportionate to the degree in which this responsibility is accepted and acted on. Besides, firms are comprised of people with
the same kinds of strengths and weaknesses we all have; from time to time some encouragement is needed. Thus a farmer must keep up with the markets and other happenings and make sure he gets the service. Set a good price on the stock to be sold, be around the sales and be seen. Finally, if not satisfied you are getting service proportional to the amount of business you put through the firm, let the agent, and if need be the manager, know about it.

Acknowledgements

Information and ideas in this address have come from many sources but in particular from discussions with Mr J. T. McCaw of Wright, Stephenson and Co. Ltd., and Mr J. N. Hodgson, Senior Lecturer in Farm Management, Massey University College.
The property known as Waipuna was first taken up by Samuel Meggit Mackley my great-grandfather in 1862. Arriving in New Zealand in 1857 Samuel Mackley was a witness to the signing of the deed of purchase of Westland in 1860 when he first laid claim to Waipuna, the first farm in the province. Samuel Mackley was first attracted to the province by gold and stayed to farm. The sale of butter, meat and chaff to miners on their way to Westland goldfields provided the first most important income. At the time of Samuel Mackley's death in 1911 the property carried 1800 sheep and 300 head of cattle. From 1911 the estate was managed, in the latter years, solely by a son of the original owner who died in 1946 at the age of 74. I came to Waipuna as manager for the estate in 1948 and purchased the property in February, 1959.

In 1946 the "Waipuna" property was valued for death duty purposes at approximately £14,500, the valuer reporting that there were no sheep-proof fences on the property and that the stock could wander where they liked. The property required a considerable amount of money spent on it to bring it up to date in buildings, fences and grass before any increase could be expected in carrying capacity of stock. In past years no attempt had been made to put back into the land any of the profits from it with the result that the property had depreciated. At this time the property was carrying 800 sheep and 250 cattle.

In 1946 about 300 acres were growing brown-top and fog, the remainder of the area was not capable of wintering stock. By 1959 approximately 1200 acres were in good pasture and a further 50 acres in swedes. This area wintered 2230 Romney ewes, 1235 Romney ewe hoggets and 90 rams, a total of 3555 sheep; 428 Aberdeen Angus cows and heifers, 55 Aberdeen Angus 18-month heifers, 70 Aberdeen Angus heifer calves and 14 Aberdeen Angus bulls, a total of 567 cattle. The wool clip had increased from 19 bales in 1946 to 140 bales in 1959, the clip totalling 46,700 pounds.

The Waipuna property comprises approximately 2172 acres freehold, 246 acres leasehold, 200 acres T.G.L. (all on the south side of the Grey River) and 745 acres freehold and 160 acres leasehold (all on the north side of the Grey River), a total of 3500 acres. The property is situated seven miles from Ikamatua railway station and 35 miles from Greymouth by tar-sealed road within five miles of the property. It is supplied with both electric power and telephone.

Freight charges to Ikamatua station are £1 per ton on lime ex Ross and £2/7/6 per ton on super ex Hornby. Cost of sending an H. or J. wagon to Addington is £13/2/6.

On the south side the country comprises two main terraces and lower flats running down to the Grey River. The terraces are mainly gravels eroded by glaciers from hard rocks to the east, granite in particular, but also ancient greywackes. On the north side the country is predominantly river flat in its native state. Soil type ranges from fine sandy loam of recent origin on the bottom flats to stony sandy loam yellow-brown earths, strongly leached, on most of the terraces.
Rainfall averages about 60 inches per year. Severe frosts are experienced during the winter and very occasional snow falls on the property.

The property is well landscaped with native shelter belts and fringes the State Forest Reserves. The lower flats are watered from the Grey River and permanent springs, while the terraced flats are watered by several creeks, one of which is permanent and could be easily linked. Present indications are that the Grey River is not eroding but is deepening its channel and is further controlled by rock outcrops.

The river flows through the property almost east to west giving a northerly aspect to the terraces.

Today development has reached a stage where the property is going into the winter carrying 5300 breeding ewes, 3600 ewe hoggets, 400 rams, wethers, etc., a total of 9300 sheep. In addition 350 Aberdeen Angus breeding cows and heifers, 65 18-month heifers, 367 calves and eight bulls. Wool clip for the year totalled 117,000 pounds. Lambs totalling 4500 are sold fat to the works. Of the lambs carried 2300 were brought in.

Since taking over the property all ewes have been cast as four-year-olds. This year 1600 four-year ewes and 1100 cast two-tooths were sold at the station saleyards. In addition 150 steer calves and 30 cull cows were sold and 227 store steer calves were bought in to graze with the sheep. This is the first year in which all heifer calves have been retained. In future years more steer calves will also be retained.

In April-May 1959 we overdilled 720 acres of danthonia country with 8lb mixture of ryegrass and clovers, and 2cwt of D.D.T. super. Results were such that we purchased more in-lamb ewes to increase stock by 1000 ewes. In the spring 50 acres were sown to lucerne, 100 acres were sown to swedes, 60 acres in rape and grass, a further 60 acres were sown to oats and barley preparatory to further lucerne. That autumn a further 1000 ewes were purchased in Southland and the ewe flock increased to over 4000.

In the past calves had been sold at Addington; however, since 1959 all calves have been sold in the station yards.

In the 1960-61 season we sowed 200 acres to rape and grass of which 100 acres had been in swedes. The 60 acres in oats and barley were sown to lucerne. A further 140 acres were sown to swedes and 190 acres on the north side of the river were ploughed from the native to rape-grass and another 50 acres were giant disced from gorse and sown to rye-corn and temporary pasture. We purchased 2000 ewes in Southland to give a net increase of 1000 in the ewe flock. In 1961-62 140 acres in swedes were sown to rape and grass and 170 acres were sown from native to rape and grass. In addition a further 120 acres were giant disced from gorse to swedes. Sheep increased overall by 1000, the main increases being in ewe hoggets.

In 1962-63 the 120 acres in swedes because of the gorse regrowth problem were resown in swedes, 380 acres were ploughed and sown to rape and grass. Sheep are estimated to have increased a further 800, a further 75 heifer calves being retained and 227 steer calves purchased.

Satisfactory yields have been obtained from swedes and chou mollier on this virgin ground.

Analysis from Department of Agriculture show pH values ranging from 5 on the unimproved country to 6.3 on the lucerne. Heavy applications of up to two tons of lime per acre and four hundredweight of super are required to grow good crops of swedes and establish good grass on this country. Quantities applied each year have been governed by returns from stock and have never been as high as desired.
even although expenditure for these items including spreading was £6,556 in 1961-62.

Phosphate figures range from 2 to 14 and it has been proved that without heavy application of potash, lucerne will not thrive for long. Once the phosphate reaches a certain level in all pastures, a dressing of potash would be most desirable. It has been found necessary to incorporate boron to grow swedes successfully, and on some areas where we have encountered grass staggers we have been applying keserite. It appears that with heavier stocking and more production, higher quantities of cobalt could be successful.

We have 2360 acres of fair to good pasture compared with 1200 acres in 1959. The balance of the property is still in swamp, dredge tailings, scrub and bush, etc. This land is now carrying over five ewe equivalents to the acre and this figure can be raised by heavier topdressing and re-establishing the older pastures and by establishing more lucerne and lucerne-cocksfoot mixtures.

Applications of super have averaged 190 tons for each of the past four years. With our experience with lucerne we are now swing- ing to potassic D.D.T. super as it has been found without potash we cannot retain the vigour in our pastures and without D.D.T. we may as well not sow any.

Grass seed mixtures sown now are made up of 7lb P.P. ryegrass, 4lb H1 ryegrass, 2lb white clover, 4lb Mont. red clover, 1lb crested dogstail and timothy or cocksfoot depending on price.

In the spring of 1959 the first 50 acres of lucerne was established running from river flat to three terraces to give a cross section of how it would thrive. It was sown in November, topped at the end of January and 2000 bales of hay were cut by the end of February. The residue was grazed. By August sweet vernal and browntop had taken control and it was almost impossible to find lucerne plants. It was sprayed with 5lb of Dowpon per acre and topdressed with potassic super. It showed a steady improvement in vigour and each cut was increasing in quantity. It has since had heavy applications of 5cwt of 66 potassic super per annum. Under present management the first cut is grazed, the second and third cuts to hay and the fourth into silage. This 50 acres is now yielding 3000 bales per cut. The growth rate this year was measured at 27 inches in 30 days. It is noticed that the lucerne on the river flats grows faster and has a thicker stalk and much greater bulk and in six weeks it has been higher than the bonnet of the Landrover. As we proceed higher on the terraces it becomes finer in the stalk. One of the difficulties is to harvest it often enough and with wind and rain it lodges severely. In November 1960 a further 60 acres were sown in lucerne with similar results and there appears to have been a partial inoculation failure which caused the stand to thin out, but it is showing a fair quantity of volunteer ryegrass which is adding bulk to the hay and is making a useful grazing proposition as well. Last spring I had almost all the ewes and lambs on the property on this 110 acres for three weeks. To accommodate this hay and anticipated future crops we have storage capacity for in excess of 20,000 bales. We are noticing pasture is growing better wherever quantities of lucerne have been fed out.
Costs of development are difficult to analyse but I have estimated these to be:

<table>
<thead>
<tr>
<th>First Year</th>
<th>Per acre £ s. d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial dozing, windrowing, logs tracking</td>
<td>10 0 0</td>
</tr>
<tr>
<td>Ploughing (¼-acre per hour) 35/- per hour</td>
<td>2 10 0</td>
</tr>
<tr>
<td>Three discings</td>
<td>1 5 0</td>
</tr>
<tr>
<td>Picking stones and sticks</td>
<td>1 0 0</td>
</tr>
<tr>
<td>Ridging</td>
<td>11 0</td>
</tr>
<tr>
<td>Harrowing</td>
<td>7 6</td>
</tr>
<tr>
<td>Lime, 2 tons</td>
<td>6 0 0</td>
</tr>
<tr>
<td>Super, 4 hundredweight</td>
<td>3 0 0</td>
</tr>
<tr>
<td>Seeds, swedes, chou mollier</td>
<td>4 0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>£24 17 6</strong></td>
</tr>
</tbody>
</table>

I consider this cost more than offset by the resultant crop of swedes and chou mollier for wintering stock.

<table>
<thead>
<tr>
<th>Second Year</th>
<th>Per acre £ s. d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ploughing</td>
<td>2 0 0</td>
</tr>
<tr>
<td>Cultivation as before</td>
<td>3 3 6</td>
</tr>
<tr>
<td>Lime, 1 ton</td>
<td>3 0 0</td>
</tr>
<tr>
<td>Super, 3 hundredweight</td>
<td>2 5 0</td>
</tr>
<tr>
<td>Heavy rolling and drilling</td>
<td>1 0 0</td>
</tr>
<tr>
<td>Grass and rape seed</td>
<td>1 7 6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>£12 16 0</strong></td>
</tr>
</tbody>
</table>

The resultant rape crop is used for fattening the lambs which again pays the establishment costs. The bulk of this land has been worked and left in large blocks. Use has been made of natural boundaries. With larger stock numbers bigger blocks can be utilised.

Stock

In the ewe flock only Romney rams are used on Romney ewes, all Romney ewe lambs being shorn as lambs and retained. These are culled and sold with the four-years in the annual sale on the property. All sheep on the property are shorn in June and July each year and again in January when all lambs are weaned. The wether lambs are then, together with bought lambs, drafted at regular intervals and sold on the property to the freezing works. All ewes are innoculated with quadruple vaccine. Through the winter they are drafted for condition. The heavy lambers are regularly selected from the main mob for lambing which starts about the 20th of August with the bulk in mid-September. The ewes and lambs are then set stocked where they are dropped with the exception of last season when they had a spell on the lucerne. Lucerne hay and swedes are the main diet through the winter with the lucerne hay playing an ever-increasing portion of the ration.

Through the autumn lambs are dosed regularly. We feel that with the double shearing removing half a fleece prior to lambing is easier on an animal than removing a full fleece. It obviates the need for constant shepherding and increases the thriftiness of the stock generally. Through double shearing normally we expect to lose only 30 ewes between shearing and after lambing. Each shearing the hogget and ewe flock are averaging 6lb per sheep.
All cattle are Aberdeen Angus using A.A. bulls. These are spread through the sheep or used as in this year to control the rape, to eat the inferior hay and to clean up the swedes.

For the first 12 months after purchase we had one permanent boy and casual labour apart from shearers. Since July 1960 an additional two boys have been employed permanently making four labour units in all. With the exception of this year when the shearing contractors did the floor work the station staff have done all the shed work, including the wool table and baling wool.

At the time of purchase the plant which was valued at £750, was very old and inadequate. Even although two diesel tractors have been purchased making three in all and over £2700 has been spent on the farm plant, this plant is still inadequate. The most useful items purchased have been electric and gas welders, front-end loader, disc drill and additional shearing plant to give six stands.

Buildings on the property apart from one large hayshed were well past their useful life in 1959. Since then the big hayshed has been extended and two further haysheds constructed, together with a new dwelling. The future programme must provide for a new woolshed, various sets of yards and houses for two or more married couples.

Most of these improvements are aimed at to facilitate the handling of ever-increasing stock numbers.

Over the last few years we have concentrated more on grass than fencing and much of the old fencing has just been kept standing. This year we expect to erect three miles of new fencing and this rate will have to be maintained as much of the older fencing now has a very limited life.

Reason for the success is one word, “Lucerne,” and to make this possible heavy applications of lime, super, potash, cobalt and copper are required.

Natural fertility on this land was nil, but with correct manure and cultivation coupled with stocking, good pastures can be established on all terraces at Waipuna—even the dredge tailings, peat swamps and pakaki.

The results achieved have exceeded even my own past expectations, especially considering the falling prices, increasing costs and lack of capital when I started. With the exception of the building of the dwelling for which additional loan finance has been arranged, the increase in stock, plant additions, mortgage repayment plan and developmental expenditure have been financed from revenue.

I wish to acknowledge the early grounding given me by my late father and mother and the tremendous help, assistance and encouragement from Mr J. A. McAlister in particular, also help and advice from Messrs H. R. Williams, B. deC. Thomson, our local Farm Advisory Officer, Mr J. M. Lockhart, the staff and Mr M. M. Scott for help in preparing the facts and figures for this paper, and last but not least my wife who has also had a hand in catching the “tiger by the tail.”

31
Waipuna Station: Stock at 30th June

<table>
<thead>
<tr>
<th>Year</th>
<th>Sheep</th>
<th>Cattle</th>
<th>Ewe Equivalents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1963</td>
<td>9,400</td>
<td>772</td>
<td>12,434</td>
</tr>
<tr>
<td>1962</td>
<td>8,407</td>
<td>516</td>
<td>11,169</td>
</tr>
<tr>
<td>1961</td>
<td>7,403</td>
<td>525</td>
<td>10,013</td>
</tr>
<tr>
<td>1960</td>
<td>6,358</td>
<td>502</td>
<td>8,930</td>
</tr>
<tr>
<td>1959</td>
<td>4,809</td>
<td>489</td>
<td>7,379</td>
</tr>
<tr>
<td>1958</td>
<td>3,554</td>
<td>565</td>
<td>5,814</td>
</tr>
<tr>
<td>1957</td>
<td>3,550</td>
<td>609</td>
<td>5,986</td>
</tr>
<tr>
<td>1956</td>
<td>3,124</td>
<td>700</td>
<td>5,924</td>
</tr>
<tr>
<td>1955</td>
<td>2,756</td>
<td>822</td>
<td>6,044</td>
</tr>
<tr>
<td>1954</td>
<td>2,516</td>
<td>456</td>
<td>4,340</td>
</tr>
<tr>
<td>1953</td>
<td>2,083</td>
<td>359</td>
<td>3,519</td>
</tr>
<tr>
<td>1952</td>
<td>1,727</td>
<td>483</td>
<td>3,659</td>
</tr>
<tr>
<td>1951</td>
<td>1,571</td>
<td>450</td>
<td>3,371</td>
</tr>
<tr>
<td>1950</td>
<td>1,325</td>
<td>352</td>
<td>2,733</td>
</tr>
</tbody>
</table>

II. THE DEVELOPMENT OF A SHEEP FARM

E. C. Berry, Atarau, North Westland.

In giving you the history of our farm, I want to state that there are many farms today equally as good or better and brought into production out of similar virgin areas. I have neighbours who have done and are still doing good work in bringing into production similar areas of land, and the result is a credit to them.

Thousands of acres of beech terraces can be found in the north of Westland. During the last few years, many areas have been tackled, but there is ample scope to double the production. While the boom period of gold dredging was on, together with coal mining and saw-milling, many landowners lived on the property but obtained their crust by outside employment. To use a double-barrelled expression, the land was mined on the surface and under the surface. That era has now passed and today the landscape is becoming greener, not with bush, gorse, blackberry and bracken-fern, but with pasture. So now I will give you a short summary of the trials, tribulations and results of my block.

The property is situated 28 miles north of Greymouth in the Grey Valley and was purchased in June, 1942. It consisted of 609 acres of which approximately 180 acres were terrace, balance river-flats and islands. All stock was taken over and it comprised 220 sheep, 60 cattle and three horses. The terrace wasn't fenced and there were no clearings whatsoever. It was heavily timbered with red birch of which most were dead and many were four or five feet in diameter. Gorse, blackberries and fern covered the whole area to the road edge. The County Council road passes through the terrace land for a distance of one mile. There are three gulches at intervals so they make a natural fence line for subdivision. These gulleys were used for the disposal of timber during bulldozing, but they present a very untidy appearance. The terrace is approximately 20 feet above the river flat so the banks were useful for the disposal of logs and for a natural fence.

The river flat was gorse-covered with the exception of about 40 acres. There were only two paddocks. One, which the previous owners called their fattening paddock, was lost by erosion within two
years. Ironically the day that the sale was completed an old-man flood broke the bank about a mile upstream and for a few years most of the river flats were flooded during rains. An embankment was erected and the cost was on to my two neighbours and myself.

The homestead was a lean-to type and mostly in bad state of repair. The property was owned by two bachelors, so we had a good old fireplace which was six feet wide.

Only £400 was available, so with the existing State Advances' mortgage and financial arrangement for the stock, flooding, stock losses, a war on and a family of three boys, the future was not bright. Three draught-horses were purchased and they plugged away pulling old man gorse. Small areas were cleared, ploughed and swedes were grown. I remember in 1945 applying for an allocation of fertiliser, this commodity being rationed at the time. My ration was 10 hundred-weight. In 1948 a spade-lugged 15-30 McCormick tractor was bought. This purchase was the beginning of a new era. Bush and bog discs and heavy harrows were the answer. With this big blundering blunder-bus pulling six-a-side bush and bog scalloped discs, the gorse was chopped up, burnt, ground-harrowed, limed and sown in swedes. Next year another area was handled the same way, while the area in swedes the previous year was sown either in temporary grass or soft-turnips. In the third year of working the ground was sown in permanent pasture. This three-year cycle has been carried out right through the developing programme. In 1949, being financially embarrassed and losing land and stock the river flats, I looked to the wilderness on the terrace. A bulldozer was engaged on an area of about 12 acres. Next year another area was commenced. The three-year cycle of working was carried out before sowing in grass.

In 1949 the district was one step nearer civilization when we were linked to the Ahaura automatic exchange, and in 1952 we took a further step forward by having the power reticulated through the district.

After eight years, my wife having brought up four boys under hardship conditions in an old house situated about ten chains off the road, also after years of listening to river water close to the home, we decided to build a home on the terrace. A carpenter and his boy (I was the boy) built a good home of some 1800 square feet in area. Next an implement and wool-shed, sheep yards and stock yards were built. The old wool-shed on the fiat was a low lean-to type, the farthest corner of the roof was only four feet from the grating.

An amusing incident in the spring of our first year, worth relating, was when the sheep were scattered over the whole area of the river flat amongst the gorse. Then came docking time. One of the previous owners was still with us. On being asked where and what yards were used for docking, he replied, "That's easy; you follow me out tomorrow and we will dock the lambs." When I arrived out he had small areas chopped out of big blackberry bushes and twenty or thirty sheep were driven in and the lambs were caught. After the first lot were dealt with we moved on a bit further and repeated the performance.

At 15½ years our eldest son left secondary school. Wanting to farm the mechanical way, something better than a spade-lugged tractor, or draught horses, was required. Finance not being available through the ordinary channels, an approach was made to the Marginal Land Committee. Strangely enough this was turned down, the reason given being that the terrace were not even in the Marginal area at that time and therefore did not warrant the wastage of their money or my own.

About that time public bodies under the leadership of the Progress League, were pressing the Government to give some assistance to
industry and farming. The scheme to help the farmers was that the Government would provide the heavy machinery and do the initial breaking in of the rough country and the repayment was on a sliding scale over a period of years; but this negotiation never bore fruit.

The property was visited by members of the Progress League, Borough Council, County Council, Federated Farmers, Catchment Board and the Department of Agriculture. A few weeks later a visit was made by the Right Honourable Keith Holyoake and the late Mr Gillespie along with the Progress League and other local bodies. Later the Marginal Land Committee, North Island, visited the area and were followed by Mr Innes of the Land Utilization Division. Finally a group from Lincoln College inspected the small area that had been cultivated. The net result was that finance was arranged through the State Advances Corporation for the purchase of a D2 Caterpillar bulldozer, the loan being secured by a mortgage on the property. After bulldozing the first block, it was found that the tractor had to go out and earn its keep on other farms.

The general pattern of breaking in is as follows:
- Bulldozing logs and all rubbish off the area and levelling.
- Sleighing all small timber, roots, etc., off the area.
- Double cut discing with massive 30-inch discs.
- Tandem discing or double cut with 24-inch bush and bog.
- Liming with approximately one ton per acre.
- Harrowing with heavy harrows.
- And finally, depending on the time of the year, sowing soft turnips or Italian rye grass.

The second year the area is double cut with bush and bog discs and prepared for swedes. One ton of lime is applied.

The third year the ground is prepared for sowing in permanent pasture with another application of one ton of lime.

The general pattern of breaking in is as follows:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Per acre £ s. d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulldozing</td>
<td>9 0 0</td>
</tr>
<tr>
<td>Sleighing wood, rubbish</td>
<td>2 0 0</td>
</tr>
<tr>
<td>Massive discing</td>
<td>3 0 0</td>
</tr>
<tr>
<td>Discing and harrowing</td>
<td>1 10 0</td>
</tr>
<tr>
<td>Liming (subject to L.T.A.)</td>
<td>3 0 0</td>
</tr>
<tr>
<td>Super</td>
<td>2 0 0</td>
</tr>
<tr>
<td>Seed</td>
<td>1 15 0</td>
</tr>
<tr>
<td>Temporary fencing (netting)</td>
<td>2 0 0</td>
</tr>
<tr>
<td><strong>Total cost</strong></td>
<td><strong>£24 5 0</strong></td>
</tr>
</tbody>
</table>

The second year's costs are much the same except the bulldozing is not included. The bulldozing is carried out to road edge and a temporary fence of netting and stakes is erected. The second year the temporary fence is pulled down and the ground worked to the edge of the road and the fence is erected again. The permanent fence is erected the third year when the ground is sown in permanent pasture.

For the seed mixture 25 lb are sown per acre through a seed box on a Cambridge roller.
The mixture, using certified seed, is as follows:

16lb Perennial ryegrass.
4lb H1.
8lb cocksfoot
3lb Montgomery red
3lb white clover
1lb timothy.

2½ cwt of Cobaltised Serpentine manure is sown per acre.

The resulting pasture will smother any growth of young gorse. It will be found that sowing down before the fertility is built up, bracken fern and gorse will take charge. By three workings and two catch crops and finally a good strike of grass with a concentration of stock, no further worries till suddenly the Porina grub shows up. It is usual practice to sow D.D.T. Serpentine the year following sowing down. A weed which is becoming prevalent is Californian thistle. In the past the thistle has been mown, but spraying will have to be carried out in the future. The terrace country is lacking in cobalt, so Cobaltised Serpentine is applied. Cobaltised licks are put out in the winter and spring. A lick mixture is made on the property comprising salt, molasses, calcium dust, cobalt and a few odds and ends which are a trade secret. This is placed out in the paddocks in shallow troughs. It is found that the terrace ground, unlike the river-flats which are alluvial, hold a good pasture during the long dry spells in the summer.

Now we will see how much this would cost:

Over the three years of breaking in and raising the fertility the cost has been in the vicinity of £45 per acre. To offset this high cost, two winter crops have been grown, and we know the value of swedes in the wintertime. I estimate the net cost of the pasture after taking into account the benefits received from the two years' catch crops at £25 per acre, which presents a much better picture than indicated by the Marginal Land Committee.

About 1200 to 1500 bales of hay are cut each year. Twenty to 25 acres of swedes are grown each year. About 80 calves and 1200 sheep are fed on the swedes in the winter time.

I mentioned earlier the farm comprised 609 acres. Earlier in the 1940s, a freehold section was almost completely lost and, having a mile of river frontage, erosion has been widespread. There would be approximately 150 acres in grass on the terrace and about 230 acres on the flat; the balance being riverbed, gorse, gullies and bush.

Outside the paddocks 35 breeding cows, along with young cattle, are run. The ewes are turned out in the rough in mid-May for about a month before being brought in on swedes. The stock comprises 200 cattle and 1200 sheep, plus half a dozen horses. The stock sold off the property this year comprised 13 trucks of fat lambs plus cull ewes, 10 trucks of fat cattle, also 39 bales of wool. Having only 35 calves bred on the property, more are purchased in the autumn. The heifers are sold at 20 months as baby beef and the steers held over to two-year-old.

Casual labour is employed at shearing and haymaking time. One son is on the farm, but two are in a contracting business and the youngest one is still at school. There has been a lot of hard work put into the place, but it has been developed to the stage where it is an economic unit and to my mind has been worth while.
III. THE DEVELOPMENT OF A WEST COAST DAIRY FARM

C. H. McLellan, Roto Manu.

This is a short description of the development of a partly improved piece of land to the stage where it can be referred to as a dairy farm with at least some element of accuracy.

The farm was taken up at the end of 1945 by one who after following a clerical career decided that, post bellum, the attraction of a life on the land was irresistible.

The location is Roto Manu which is 30 miles inland south-east of Greymouth. Rainfall is roughly 80 inches per annum which is certainly generous enough for dairying. Frosts in winter would be roughly ten to 15 degrees, sometimes heavier. Altitude, surprisingly, is only 400 feet above sea level.

Roto Manu is an area of approximately 6000 acres. It is an ancient ice sheet plain covered with an overlay of mica schist soils—quite naturally fertile. It is typical of areas all over the Coast including Kokatahi and Kowhiterangi which are well known dairying areas near Hokitika. This soil type in Westland and Grey Counties would total 54,000 acres.

The area of the farm is 175 acres. It is right on the edge of the plain and extends on to the foot of Mt. Alexander. Fifty acres are more or less level. Thirty acres are slightly rising towards the hill. This 80-acre piece is all fine schisty soil varying in colour—some yellow, some brown. There is a big variation within paddocks but it is all essentially the same soil with mica schist and greywacke as the base. It is moderately acid. The balance of 95 acres is on a roughish sidling with a varying slope of an average inclination of 13 to 15 degrees. This is very lumpy and stony, obviously formed by slump action as the steep glacial valley side collapsed after the ice melted. Three deeply cut creeks spread out fanwise through this to the mountain. Soil here appears to be mica schist and moraine debris with plenty of big stones probably all erratics as the adjoining hill has no big stones apparent on it.

Having acquired this piece of country, the first thing was to increase production by any means. Superphosphate was rationed, but by sustained representation my original quote of 30 hundredweight was raised to what in effect I needed or could afford. Thus from 1946 to 1951 my time was spent on pasture improvement by means of the application of as much lime and super as I could put on (at one ton lime and two hundredweight super to the acre) with a new paddock sown down every autumn. This was all concentrated on the 50-acre portion which had been cleared and grassed years before my advent and had been used as a run-off for a neighbouring property. Fortunately the fencing was quite reasonable and effective so that apart from a certain amount of subdivision I had no worries in that direction. In 1951 I decided I could afford to have some land clearing done; this was confined to the 30-acre patch of gently rising ground which was very lumpy, covered with tall rushes and fern, also with logs and stumps from a bush burn some 20 years prior to this. This was very successful, the contractor doing all the bulldozing with a 60 h.p. crawler and blade while the snigging of logs, cleaning up, cultivating and sowing was done by myself with the occasional help of a good neighbour. This was sown with one ton of lime and three hundredweight of super to the acre. This was a great acquisition to the grazing on the farm. It was sown in the autumn and was in full production by the summer.
Subsequently areas on the rougher portion were broken in. In all 25 acres were cleared and grassed. Not exactly first class grazing but good and sweet for dry and young stock making a welcome change from the rough grazing on the old hillside burn with its fairly general broken fern cover which was the cause of a number of deaths from fern poisoning. The new chum learns this by experience. The fencing of these hillside areas was constructed to confine and control the few sheep as well as the young stock being reared. At this stage it can be seen that there were 80 acres of reasonably good dairying pasture plus 25 acres of sidling in fairly good pasture, with the remaining rough area of 70 acres.

In 1958 it was decided to clear as much of the remaining area as possible with a large tractor which was in the district (T.D. 24). Nearly 50 acres were bulldozed, roughly cleaned off, disc’d and sown down. This is now fairly good pasture, with the exception of about 12 acres which is very steep and stony (large ones) so that to date these 12 acres are grazed mainly by the sheep. Lime has not yet been applied to this 12-acre piece and the contrast with the other area is most marked. There was considerable earth moving and filling on this area and although it is good grazing it still has room for a big fertility build up. That is the story of pasture development and clearing carried out to date. The remaining 20 acres of rough hillside which is too steep for a tractor is being cleared by hand and burnt as opportunity offers.

The costs of this land clearing may be of interest. Strangely enough, considering the different machines used for initial clearing (T.D. 9, T.D. 14, and T.D. 24) the price per acre did not vary much. Fifty-five acres of reasonable country done with the smaller machines averaged out at approximately £10 per acre while the 50 acres of very rough country done by the T.D. 24 cost £8.

A fair summary of costs would be:

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulldozing and clearing</td>
<td>£ 9 0 0</td>
</tr>
<tr>
<td>Lime and manure</td>
<td>£ 4 10 0</td>
</tr>
<tr>
<td>Fencing</td>
<td>£ 6 0 0</td>
</tr>
<tr>
<td>Tractor running</td>
<td>£ 15 0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>£20 5 0</strong></td>
</tr>
</tbody>
</table>

I consider this quite a reasonable cost on this class of country.

Now just a brief look at the management. All pastures are top-dressed with two hundredweight of super annually, with lime often enough to bring the maintenance up to five hundredweight per acre per year. The mower is used frequently, in fact after each grazing of a paddock by the milking cows, rolled up with a Cambridge roller if it is cut up at all with damp weather. The electric fence has been a boon in controlling grazing especially in the spring and autumn. Fifteen to twenty acres are usually taken for hay with a yield of 1200 to 1500 bales. As a point of interest this has been baled by a contractor for the last eight years and I have not lost a bale due to weather yet. (This could be a famous last word.) Two or three trucks of lucerne hay are usually bought in from Canterbury. Ten to twelve acres are usually taken for silage in the spring (November) with quite a satisfactory yield considering that it is saved in a wedge in the paddock. Eight to twelve acres are sown down each December to a 50-50 mixture of swedes and chou mollier. This is a very valuable crop in the winter and is break fed to the milking cows from July on. Depending
on the season, 30 to 40 acres of good rye dominant pasture are saved in the autumn (March on) to be break fed to the milkers from June on. This usually keeps them going into July before they have any hay.

The paddock ploughed down from swedes and chou is sown down to grass, with one ton lime and two and a half hundredweight super per acre. The grass seed mixture I use is:

- 15lb Cert. H1 Rye.
- 2lb Cert. white clover.
- 2lb Cert. Montgomery red clover.
- 1½lb Cert. crested dogstail.

I have used this mixture for many years and find it very satisfactory. Wheel tractors are used for all work on the farm. A 30 h.p. Ferguson diesel is the mainstay. A 36 h.p. petrol tractor on steel wheels for rough work and work on the sidling, while a small tractor with mid-mounted mower is used for pasture control and hay mowing.

Freight on lime is £1/15/- per ton from Ross while freight on superphosphate is £2 per ton ex Hornby to Roto Manu station. This is three miles from the farm and cartage is by farm trailer.

In 1948 the property carried 30 milking cows with 12 head of young stock, plus 20 old ewes to keep the ragwort down. Butterfat production was 6000lb. In 1962, 60 cows were carried with 30 head of young and dry stock, plus 40 ewes. Butterfat production was 18,500lb.

The farm consists now of 14 paddocks on the easy country block of 80 acres carrying in size from three acres to eight acres. Owing to the physical difficulties imposed by the deeply cut creeks it has not been possible to use a good through race. The sidling block is divided into seven paddocks with good tight sheep-proof fences varying in size from four acres to 16 acres. This area is ideal for running the dry stock and 40 ewes. Milking cows were grazed on this area from time to time also.

Pedigree Friesian bulls have been used since 1950, these being obtained from leading breeders in Canterbury and Southland. Since 1961 an artificial insemination service in the summer has been available.

The property with a town supply quota in good proportion to its production (Greymouth is supplied) is now quite a good productive unit. Milk is picked up at farm gate by a contractor.

During the developmental period labour was employed on two occasions of 12 months each. It has always been possible to secure casual labour for milkings, etc., on those occasions when the absence of the owner was imperative.

In conclusion I should like to point out that this farm is nothing out of the ordinary. It is typical of very many dairy farms on this type of country. The herd average production is not high but it is reasonable considering that the greater portion of it is milked through the winter, which in our locality can be quite harsh and wet. There is a lot of work to be done to bring the farm completely up to scratch. My son is with me now and we hope to do this in the next few years, as well as substantially increasing production.

Q.: What is the Government valuation of land at Rotomanu?
Mr McLellan: There is a variation—ours is about £30 per acre.
Q.: What are the possibilities on higher terraces where soil is severely leached?
Mr Ferguson: The aerial photo does show some high terraces on my places. The higher country is 80,000 to 90,000 years old. It is farmable land, but it is swampy. If we can kill moss and rushes the water will run off. I feel that the pakihi lands are farmable given the capital, but you can't get it from Margin Lands Board.

Mr Berry: It is not a job for a man with no capital. The Government is doing a good job at Bell Hill on the pakihi swamps. There are many thousands of acres of land like that. Once the Government has blazed the trail others will follow.

Mr Wallace: Bell Hill is old Red Beech country. In 1915 the Government wrote "Impossible" across it. The main thing is to farm it until it will fatten stock.

Q.: Does Mr Ferguson intend continuing his development at his present escalated rate?

Mr Ferguson: For the last two years we have been trying to consolidate, but that is hard to do once you have the nitrogen cycle working in your favour. Next year we will put on more cattle to ease the labour problem. With an extra 500 tons of super we will need more stock. We have a lot yet to do: 100 acres needs draining, and a new shed and various sets of yards to be built. We can double the output of the improved 2,300 acres just by topdressing without the other 1,000 acres. In short I can't stop—I'm a civil servant—farming around taxation.

Q.: What is the unimproved value of this country?

Mr Ferguson: The unimproved value is £10 per acre. But a lot of this is not worth £10. I contend that undeveloped country in bush has no value—but a lot of this country has been cleared once—therefore this £10 per acre is the figure.

Mr McLellan: In my case the unimproved value is about £3.
STOCKING RATES ON CANTERBURY SHEEP FARMS

J. D. J. Scott, Ruakura Animal Research Station, and S. D. Walker, Winchmore Irrigation Research Station.

The amount of meat and wool produced per acre depends on three major factors: the quantity of feed grown; the proportion of this feed which is actually consumed by animals; and the efficiency with which the feed eaten is converted into animal products.

Stocking rate or the number of stock carried per acre affects all three of these factors but particularly the second—the proportion of feed actually consumed by animals. In numerous experiments, and farm and district studies, stocking rate has been shown to have a profound influence on production per acre. Heavier stocking rates on South Island sheep properties for instance have undoubtedly been one of the major factors responsible for the very large increase in meat and wool production seen during recent years. In the period from 1956 to 1960 sheep numbers in both the Canterbury land district and the South Island as a whole increased by 15 per cent. This increase was mainly achieved by carrying more stock on existing occupied land and represented therefore a marked rise in stocking rate, particularly as the area devoted to wheat growing increased substantially during the same period. The subject is thus a most important one, particularly when it is considered that the amount of virgin land available for future production is relatively small and that further vital increases in output must come from existing farms on which more stock must be carried. As there seems to be ample scope on many properties for increasing stock numbers even further, a review of the subject may not be untimely.

Our intention today is to describe briefly experiments in which sheep have been stocked at different rates; to attempt to explain why the particular results were obtained; to recall experiences at Winchmore under high stocking rates; and to put forward some suggestions about stocking rates for Canterbury conditions.

The best known and most frequently quoted experiment on this subject is that of Miss D. E. K. Walker, conducted at Ruakura about 10 years ago. For three successive years three comparable farmlets, each of 50 acres, were stocked with different numbers of sheep and cattle. All were run as self-contained units. One farm wintered four ewes per acre and one cattle beast for every three acres—a common stocking procedure on Waikato lamb farms. The cattle were bought in as weaners and fattened at two to two and a half years of age. Another wintered six ewes per acre and cattle of the two-, three- and four-year-old type were purchased in spring and fattened by the following autumn—again one cattle beast was carried on every three acres during this period. The third farm was stocked at the rate of eight ewes per acre—no cattle were run on this unit. Romney ewes purchased as five and a half-year-olds and kept for one year, were used. Average results for the three years are shown in tables 1, 2 and 3. The same trend appeared in all years. It will be seen that as sheep stocking rates increased lamb weights and wool weights declined but total production or production per acre increased. When beef production is included it will be noted (Table 3) that the meat produced per acre was much the same on each unit. Proportionate death rates of ewes and lambs were similar on all farms.

No experiment, particularly ones of this type, can be free from criticism, and in this case one can validly argue that the results might
have been somewhat different had the experiment been conducted over a lengthier period when any effects on pasture production would have become more apparent and had the ewes been retained for more than one year. Despite these criticisms, however, the results of this experiment still strongly suggest that as stocking rates increase within reasonable limits, per head production declines but per acre production increases.

Mr Ian Lucas, also at Ruakura, stocked ewes with their lambs during the period from lambing till weaning at the rates of six, eight, 10 and 12 ewes per acre. He, too, found that individual lamb weights decreased as stocking rates were increased, and he also found that per acre productivity increased until 10 ewes/acre were run but declined at the 12/acre level (Table 4). This work was carried out during one season only.

At Invermay Mr Robin Scott has been running ewes at the rates of three and a half and six per acre on areas topdressed at high and low levels. This experiment is still in progress but results to date indicate that the per acre productivity is much higher at the high rate of stocking.

The first year’s experience indicated that three and a half ewes/acre was too light a rate for valid comparison and lamb weight gains were greater (by 2½lb) on the heavily stocked area. Over the past season its stocking rate was increased by 4.2 ewes/acre. This resulted in a degree of pasture control typical of that seen on understocked farms. Individual lamb weight gains were similar under both stocking rates in the past season. In this experiment swedes were fed ad lib to both groups of ewes in the winter of the first year but in the second year a restriction was placed on the intake of swedes by the heavily stocked ewes.

Other experiments on stocking rates have been carried out with dairy cattle at Ruakura and in Taranaki. In addition numerous experiments with both sheep and cattle have been undertaken overseas. Almost all have shown similar results to those already quoted and have pointed to the dominant role that stocking rate plays in influencing per acre production.

Looking at this evidence as a whole it does seem that as the stocking rate of ewes and lambs is increased above a level where competition between animals for suitable feed is achieved, individual lamb and wool weights decline but total output increases until a ceiling level is reached beyond which further increases in stocking rate depress total yield.

Explanation of results

Why should this be so? The reasons have by no means been fully elucidated but it does appear that lamb and wool weights are depressed primarily because the individual ewes and lambs are partially underfed. However, because greater numbers are carried a bigger proportion of the feed grown is actually consumed and this is probably the major reason why heavily stocked areas produce more per acre than lightly stocked ones. At Massey Mr E. A. Clarke and colleagues estimated, from grazing trials, that where grazing pressure is a little over 100 per cent for the low production period of the year, it may, in a good growing season, fall well below 30 per cent in the succeeding three months and not exceed 50 per cent before the summer dry spell. Obviously on lightly stocked areas where animals are well fed during winter there will be a tremendous surplus of feed during the spring months. Where more stock are carried more of the spring growth, which constitutes a high proportion of the annual yield of pasture, will be utilised. Dr Wallace estimated from dairy cattle experiments at Ruahura that about 46 per cent more digestible
nutrients were consumed per acre when stocking rates were increased from almost one to one and a half cows per acre.

The efficiency with which feed is converted to meat and wool is also influenced by level of nutrition and thus presumably by stocking rate. When sheep are fed at progressively higher levels their output increases but larger and larger increments of food nutrients become necessary for each additional unit of output—this is an expression of the well-known law of diminishing returns. At lower levels of intake, such as those obtaining under high rates of stocking, conversion of feed to meat and wool is reasonably efficient because the animals are lighter and have lower maintenance requirements. Such animals also use a higher proportion of the feed they eat for productive purposes than do well fed animals.

It should also be mentioned that stocking rate has a number of other effects on such matters as the quantity and quality of pasture produced and the amount of pugging. Our knowledge of these effects is far from complete and it would be dangerous to dogmatise on what happens under different stocking rates in a wide range of environments. Mr. A. G. Campbell's work with dairy cows at Ruakura suggests that similar quantities of pasture are produced under high (1.3 cows/acre) and lower (1 cow/acre) stocking rates. On hill country sheep pastures a high rate of stocking commonly results in better control of secondary growth than does a lower level. At the Te Awa hill country experimental area of Grasslands Division, Department of Scientific and Industrial Research, there is in progress an experiment which most graphically shows how pastures can deteriorate if the stocking rate is too low. Mr. E. Suckling there has comparable areas side by side which are being stocked at the rates of three, four, five and six ewes/acre. On the three ewe/acre plot the ewes are subsisting on a closely grazed patchwork of pasture while a high proportion of the area is covered by an unpalatable ungrazed stand of browntop. On the four ewe/acre area the amount of similar browntop is less and on the five and six ewe areas a vigorous and well controlled sward is apparent.

There are some reasons to believe, however, that if severe overstocking and overgrazing are practised for sustained periods, pasture production will decline.

The feed available for heavier stocked animals may be of higher quality than under low rates of stocking; but under the latter system there is more scope for selective grazing. The precise effects of stocking rate on feed quality have yet to be determined.

Experiences at Winchmore

At this stage we would like to comment on experiences at Winchmore where ewes and lambs have been stocked at relatively high rates for a number of years under both dryland and irrigated conditions.

No strict comparison of stocking rates has been carried out but attempts have been made to develop systems of grazing management at stocking levels which give good utilisation of feed and high production of meat per acre.

Under irrigation self-contained units have been stocked continuously for several years at rates of six to seven and a half mixed aged fat lamb ewes per acre. Wool production has averaged over 10lb per head; lambing percentages have been 110 to 120 per cent and lamb weights about 31lb. Ewe and lamb death rates have been about normal for the district.

The heaviest stocking rates at Winchmore have led to some invasion by weed grasses, suggesting that pastures so grazed might need renewing after 10 to 15 years.
Under dryland conditions stocking rates of up to four ewes per acre have been maintained with only a very slight decline in production per ewe at the highest level.

In addition winter feeding trials have shown that, provided the level of feeding is high enough to avoid pregnancy toxaemia, wool growth, lamb mortality and lamb thrift are but little depressed by restricted feeding. Under high stocking rates the level of nutrition during the winter is inevitably lower but, only when pre-lambing feeding is limited severely, is the loss of production per head great enough to outweigh the advantages accruing from the extra numbers. To avoid this, we aim on Winchmore to save at least one and a half bales of hay per ewe and to close some 40 to 50 per cent of the pasture for autumn-saved grass. These feeds are then rationed strictly to ensure adequate feeding when the ewes' needs are greatest in the weeks before lambing.

Suggestions for Canterbury

What suggestions can be made about stocking rates for South Island and particularly Canterbury fat lamb and downlands farms?

The first point is that we believe the principle involved—that higher production per head is obtained under low stocking rates but fuller utilisation of feed and greater total production is obtained under higher rates—still holds under these conditions although the absolute levels of stocking may be different. We do not suggest, for instance, that all fat lamb farms could and should carry eight ewes per acre. However, it is highly probable that one and a half ewes per acre will yield more than one per acre if the latter are reasonably fully fed and that four per acre will outyield three if again the three are well fed most seasons.

On hill country where wool is the main source of income and where store rather than fat stock are put off there is perhaps a slightly greater margin for error when increasing stocking rates in that wool production is likely to increase until relatively very high stocking rates are run and store stock do not have to reach a defined standard before sale. It seems desirable to aim at a level of stocking which results in reasonably full utilisation of feed in most seasons. One does not, however, want to stock so high that breeding animals must be sold in adverse seasons on what is usually an unfavourable market.

For fat lamb properties there are of course the alternatives in production of crops and lambs. Land can be well utilised under low absolute stocking rates if spring sown crops are grown or if grass and clover seed is produced. We realise, too, that very dry seasons can impose severe difficulties in lamb fattening. When considering the grazing area, however, it seems desirable to stock at a level which permits ewes to be wintered in reasonable condition and lambs to be killed as fats in most years rather than to keep stock numbers very low so that one won't be caught out in a very poor year.

The type of property on which there is a good chance of increasing production by increasing stock numbers is one which there is a large surplus of feed in the spring and autumn months, where the stock are well fed and in good condition throughout the year and where the wool clip and lambing percentage is high. Conversely on properties where feed is in short supply even in the growthy periods, where stock are normally in store condition and production per head is only moderate there is much less likelihood that increased stock numbers will result in more total production.

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Conclusion

In conclusion we would like to make a number of miscellaneous points which have a bearing on this matter of stocking rates.

The high stocking rate—full utilisation type of farming will have little appeal to those who like to have their stock in prime condition throughout the year and who like to obtain heavy, good quality fleeces and high lamb weights. Production per head and general appearance of stock does suffer somewhat under high stocking rates.

The surest way of capitalising on additional money spent on items like fertilisers, drainage and irrigation aimed at growing more grass is to increase stock numbers. Where stock are already well fed further costly improvements in feed production are likely to bear little dividend unless more stock are run.

Under a high stocking system of farming much greater care must be exercised in adjusting feed supplies and stock requirements than where stocking rates are low. In sheep nutrition the aim should be to feed young stock well at least until towards the end of winter and to feed ewes well prior to tupping and from about three weeks before lambing until weaning. At other times their intake can be restricted without undue penalty and indeed must be restricted under high stocking rates if sufficient feed is to be available at the more important times. The conservation of surplus feed as hay or silage and/or the growing of crops and autumn saving of pasture are essential techniques for successful farming at maximum carrying capacity.

High stocking rates can aggravate problems where soils are very wet during winter. Under these conditions it is seldom possible to carry the same number of stock as on drier soils but still one should aim at wintering the maximum number of stock practicable so that a reasonable proportion of the spring growth will be utilised.

In individual cases it may not be profitable to carry additional stock because extra labour or other facilities would be needed. In such circumstances it may be possible to carry additional cattle which have a low labour demand.

Finally it is a sound idea when increasing stock numbers to make haste slowly in order to avoid any unforeseen difficulties and to become accustomed through experience to any changes which may be needed in grazing and feeding procedures.

**TABLE 1**

<table>
<thead>
<tr>
<th>Ewes per acre</th>
<th>No. lambs fattened</th>
<th>Carcass weight pounds</th>
<th>Grading percentage</th>
<th>No. store lambs</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>589</td>
<td>34.5</td>
<td>68</td>
<td>13</td>
</tr>
<tr>
<td>6</td>
<td>939</td>
<td>33.3</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1172</td>
<td>31.6</td>
<td>44</td>
<td>53</td>
</tr>
</tbody>
</table>

**TABLE 2**

<table>
<thead>
<tr>
<th>Ewes per acre</th>
<th>Ewe fleece weight</th>
<th>Ewe wool per acre</th>
<th>Lamb wool per acre</th>
<th>Total wool per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>4</td>
<td>42</td>
<td>1</td>
<td>43</td>
</tr>
<tr>
<td>6</td>
<td>6.2</td>
<td>58</td>
<td>3</td>
<td>61</td>
</tr>
<tr>
<td>8</td>
<td>8.4</td>
<td>72</td>
<td>8</td>
<td>80</td>
</tr>
</tbody>
</table>
### TABLE 3
Mean Meat Production (Pounds per Acre Per Annum)

<table>
<thead>
<tr>
<th>Ewes per acre</th>
<th>4</th>
<th>6</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lamb</td>
<td>142</td>
<td>215</td>
<td>254</td>
</tr>
<tr>
<td>Beef</td>
<td>117</td>
<td>44</td>
<td>—</td>
</tr>
<tr>
<td>Total</td>
<td>259</td>
<td>259</td>
<td>254</td>
</tr>
</tbody>
</table>

### TABLE 4

<table>
<thead>
<tr>
<th>Stocking Rate</th>
<th>Lamb L.W./Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>4733</td>
</tr>
<tr>
<td>8</td>
<td>5551</td>
</tr>
<tr>
<td>10</td>
<td>6439</td>
</tr>
<tr>
<td>12</td>
<td>6214</td>
</tr>
</tbody>
</table>
I find it difficult to decide just where to commence a paper of this nature, but all things must have a beginning and I choose a point at which I was a very small boy with no interest in the economics of farming, but with a fair measure of enthusiasm for anything of an exciting nature which took place about the farm, and this included watching somebody manipulating an early model crawler tractor. I was interested for no other reason than that it was somewhat of a novelty at that time, and took the rest as a matter of course. Now, some 30 years later, I realise that that somebody on the tractor was attempting to take the first step in a programme of tussock grassland improvement, and but for the objectionable nature of the country, would have been at least partially successful. However, that was not to be, it required the passage of more than 20 years and probably the effects of a world war before that first step became feasible, and economically worth while. I mention the effects of the war simply because it is doubtful whether the aeroplane would have become an agricultural machine as early as it did had it not been for the hastened development in aerial knowledge and the initiative of certain pilots who were not content, after the war, to give up flying. I wonder how many New Zealanders ever stop to consider the debt which we owe these people.

The area of approximately 1700 acres on which it has proved possible to achieve a measure of success with the use of aircraft, seeds and superphosphate would have lent itself to surface cultivation, had it not been for excessive quantities of surface, or almost surface rock, a shallow topsoil, and a very open gravel or sandy subsoil. In other words the contours are for the most part fairly easy, the altitude runs up to 1900 feet and the average rainfall is about 30 inches. It was on these rocks that the plough of 30 years ago foundered, and I now feel that had that not happened, the scheme may only have been in part successful due to the inability of this land to hold moisture when stripped of its protective tussock cover.

Having succeeded, at least to my own satisfaction, in finding a starting point I will now proceed to give you the story of the development of this area so far as it has gone. I want to make it quite clear that you must not interpret this as a super success story; first I have a strange feeling of indifference to success stories as such, and the greatest admiration for those who are prepared to tell a hard-luck story on an occasion such as this; secondly the venture has only been successful to the point of being apparently economic, and thirdly dozens of others have achieved much more than we have done and have had to expend a good deal more energy to do so.

My object in accepting the invitation to present this paper was to show how a scheme of this nature can fit into the management and overall improvement of a tussock grassland property, and later I want to broaden my talk on that basis. Perhaps the idea would work on your place, but remember that it is a case of "horses for courses" and that the techniques which have suited us may need some revision to suit you. This is well illustrated by the 15 advisory officers quoted in the most recent issue of Tussock Grasslands Review. Their opinions are basically similar but vary according to climate and environment.

To give an even better picture of the nature of the area concerned I might say that it was just about as hungry as the sheep which were asked to stay on it, and was used only as a holding paddock at shearm
ing and dipping, and for part of tупping. Cattle wouldn't have it on at any price. Yet in spite of this, my father, to whom incidentally is due all the credit for setting the wheels in motion, always held the belief that something worthwhile could be done. It was during his meanderings about the North Island as a member of the Commission of Enquiry into the sheep farming industry in 1948-49, that he was struck by the results being obtained on country equally as "tough." At that point the seeds were sown, metaphorically on the spot, and literally very shortly afterwards. He had always believed in the now pretty well-proven fact that it was essential to establish legumes before much, if any, success could be achieved in the introduction of better grasses. In fact we had proved it to ourselves at some cost, by scattering hundreds of pounds of cocksfoot and dogstail about by aeroplane, mixed of course with clover seed, but no fertiliser. Only now, after some 10 years, are we starting to see something for the grass seed which has been sown.

Having already been bitten by the "seed alone" affair just referred to, we set about mixing a brew of red clover, white clover and a per acre ration of super which I am afraid, has escaped my memory, and put it, by bulk topdresser, on an easily accessible few acres that were fairly typical of the whole area. This was carried out in the spring, I think October, of 1950, and by February, 1951, there was little doubt in our minds that at long last a means had been found by which this country could be made to grow something which at least looked pretty attractive.

In the spring of the following year we agreed that the next step was to find out the optimum rate at which to sow the super, so we took another small patch of about 10 acres, divided it into three strips, and applied rates of one, two and three hundredweight per acre. Briefly the result was that the two and three hundredweight dressings were very similar, but the one hundredweight strip was quite inferior to the other two. (You'll appreciate the then mighty subtle reason for this as we go along!)

While we were waiting for the results from this trial another interesting factor entered into the picture. Mustering the block became a very simple procedure, as all the sheep congregated on the small block done the previous year. At this stage the block had developed a bit of an Australian flavour—rush out to the water hole, or in this case the "tucker box," and cop the lot.

However, we had now reached the point where pounds, shillings and pence had to play a major part, and as I'm not much of a gambler at heart, and my father even less so, some serious thought became necessary in deciding just how much we would, or should, risk on our first major job. Most of you who are wool growers will remember 1951—if you didn't strike the last sale—with a good deal of pleasure, and needless to say it was that boom in wool prices which made it relatively easy for us to reach a decision. Having also to help us the knowledge that stock would thrash too small a block, we undertook to treat an area of almost 700 acres in the spring of 1952. By the autumn of 1953 the transformation was quite astounding and where my good friends of the Department of Agriculture at that time, Messrs John Hereus and John Tothill had estimated approximately 60 per cent of bare ground between tussocks, we had, over a fair portion of the area, the nucleus of a good clover sward. Here also some very interesting factors started to appear. The first was the most obvious upsurge in the palatability of the existing species, particularly sweet vernal, and I might say that even now, I still look upon sweet vernal as a pretty useful grass in an association of this nature. Other plants also appeared to respond in a like manner, while some rather undesirable plants began to disappear. The other
pleasing feature was the rapidly increasing vigour of the tussock and its change from a sickly-looking grey-brown colour to a much more robust plant with a blue-green tinge.

In these two factors we had the answer to a problem that had caused us some concern, that of providing an all clover diet and its effect upon stock health.

I don't intend to weary you now with the areas treated from year to year, but having reached the stage where some measure of success was obvious, I will enumerate the various other side issues which cropped up from time to time. In that way I will try to present the rest of the story.

1. Almost overnight we had an area of several hundred acres of good grazing which was hitherto virtually useless, but we had no more stock on the place than had been comfortably carried for many years. In fact we didn't really need the grazing! All that happened in that first year was that we produced an awful lot of clover seed, the hill flock had a much better spin both at shearing and dipping time, and the ewes, instead of spending several unhappy weeks with little more than the scenery to enthuse over, were tupped in comparatively comfort.

The moral here of course is that it's all very fine to spend a lot of money in growing a lot of feed, but there's not much future in it if there aren't enough revenue-producing mouths to eat it. We were not very happy about the idea of buying in, which would have required a good deal more cash, so decided on a policy, common in the political field at the present time, that of "easy does it." We agreed to build up gradually on our existing flock at the risk of wasting some feed over a period of years, and this in fact was what we did.

2. This problem was one rather closely related to No. 1, as we had to decide whether sheep alone, or along with the few cattle on the place at the time, would do a satisfactory job, or whether the accent should be placed on cattle. Here it seemed that a fairly high rate of stocking with cattle would assist in spreading the seed and building up fertility. Unfortunately, some years before we had chosen to go out of breeding cows and you will appreciate, as we did, that cows are quite a help if you want to increase the herd. Consequently we bought 50 two-year-old heifers, at that time I think worth about £24, and set them to work. At this stage there was no suggestion of their not wanting to stay on the block, and we have certainly not had reason to regret this choice of procedure. Perhaps to keep everything in its correct order I should say now that in the winter of 1953 we were carrying 160 head of adult cattle, while at the present time we have 360 adult cattle plus this season's 135 calves. Most of the dry cattle are kept to two-year-old and sold in the spring. Some buying and selling has taken place over the years according to circumstances, as although we did not want to buy sheep, trading in cattle is a much more flexible business, as they can be put off at practically any time of the year if the occasion warrants it.

3. Next came the question of how often it would be necessary to apply maintenance dressings. Obviously enough, there had to come a time when that something which had to be supplied to stimulate clover growth would largely disappear, either by leaching or being absorbed by the plants. I think that perhaps in this case it was due to the fact that any lesser interval than three years would have made the economics of the project rather suspect, that we agreed on that time. And this leads me to the most important consideration of all.

4. Did the venture as far as it had gone give some indication of proving economically sound? Here then I shall give you as many of the reasons as I can for our affirmative answer. First the per acre cost of establishment and maintenance had to be fairly accurately assessed and the figures I quote are taken from those recorded at the
time, and of course are related to costs and market values applicable during that period. Unhappily the margin between costs and gross proceeds has narrowed quite considerably over the years, but this tendency has been to some extent compensated for by the steadily increasing volume of production.

The following was the estimated initial cost of treating one acre:

<table>
<thead>
<tr>
<th>Item</th>
<th>£ s. d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2cwt superphosphate</td>
<td>1 2 0</td>
</tr>
<tr>
<td>Cartage and railage on same</td>
<td>7 6</td>
</tr>
<tr>
<td>3lb white clover at 3/- per lb</td>
<td>9 0</td>
</tr>
<tr>
<td>Red clover, cocksfoot and dogstail (small quantities)</td>
<td>6 0</td>
</tr>
<tr>
<td>Flying charges</td>
<td>8 0</td>
</tr>
<tr>
<td>On the farm labour and incidentals</td>
<td>1 6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>£2 14 0</strong></td>
</tr>
</tbody>
</table>

In some years we were able to use seeds produced on the place and this naturally helped reduce the cash cost on those occasions. We tried to use good quality seed in all sowings and I believe that this is most important; so much so that I would suspect that in some cases, of which I've heard, where results have been disappointing, the reason has been an attempt to economise by purchasing cheap seeds. After all, you don't get a very good crop of anything if you don't sow sufficient viable seed.

It now remained to assess potential increases in carrying capacity. This was done on what has proved to be a conservative basis, i.e. half a breeding ewe per acre and a cattle beast to about 15 acres.

This then was the picture:

<table>
<thead>
<tr>
<th>Item</th>
<th>s. d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Half value of wool from one breeding ewe</td>
<td>16 0</td>
</tr>
<tr>
<td>Half value of one lamb</td>
<td>12 0</td>
</tr>
<tr>
<td>Estimated return from cattle</td>
<td>10 0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>£1 18 0</strong></td>
</tr>
</tbody>
</table>

As each acre was only to be treated every third year, this meant a total return for the period of £5/14/-, leaving a credit balance of £3, or £1 per acre per year. In addition to this we could foresee other advantages of which I will say more a little later. Before I move on to No. 5, however, I'd like to anticipate a question which is almost sure to arise if I don't provide the answer first. What effect has all this had on your labour costs throughout the year? The staff has not had to be increased and I think that any additional work created by the necessity to handle extra stock is counterbalanced by easier stock management on the run as a whole.

5. Molybdenum. Much was being made at this time of the part that could be played by molybdenum for establishing clovers. Several people suggested that it could well be the same with us, so I promptly proceeded to put the cart before the horse and treat as a block with molybenised super, then later to have some soil tests taken. These revealed that we had many times more molybdenum than normally required already existing in the soil. There was no way of knowing at that time whether the molybdenum existed in available form, but at least there were no visible signs of any improvement in clover.
establishment where molybdenum was applied. Further hoggets win­
tered on the block next winter did extremely poorly.

Only one short comment here: it was always a mystery to me why, up to that time, the Department of Agriculture had always been so very cautious in advocating the indiscriminate use of many trace elements (and rightly so), and yet did not appear to apply the same philosophy to molybdenum.

6. Now we come to another very important and perhaps even controversial consideration—that of subdivision. I say controversial because I believe that subdivision should follow the development of tussock grassland and not precede it, while I know that others disagree. Let's be practical! How much more revenue does a farmer get out of a 100-acre paddock if he divides it into four 25-acre paddocks? A little more I will admit, but it's relative to the class of land. The better the land the more advantageous the subdivision. Therefore I contend that if you wait a little while and don't succumb too readily to the overtures of those who advocate a whole lot of sub­
division, the fencing will eventually be paid for out of revenue and will not be an additional burden at a time when finance is required for other purposes. I consider a good shepherd to be a useful substitute for a fence in a case like this and a good deal cheaper! However, if you do a big enough area of similar country in the first place, and stock accordingly, you will find that the distribution of stock will look after itself. We have broken down the area in question from two blocks of 1300 and 400 acres to four by making three blocks of the bigger area, and that is where it stands today—after ten years! This has required three and three-quarter miles of fencing and was erected by permanent labour. We shouldn't lose sight of the fact that fencing is a capital item, while super, seeds and the application of same are chargeable against income.

7. Under this heading I want to reveal the factor about which I have been a little secretive up till now. You'll remember my refer­ence to the reason for one hundredweight of super being quite inferior to either two or three hundredweight. It also passed unnoticed that in fact three was probably a little better than two. You would also note my reference to “that something” which stimulated clover growth. “That something” happened to be sulphur. What actually occurred was that in the one hundredweight rate of super we were applying only 12½ pounds of sulphur, in the two hundredweight 25 pounds and in the three hundredweight, 37½ pounds. For several years we had been using a fair ration of phosphate which wasn't required. Although several departmental officers had found, over a series of trials, that sulphur played a big part in stimulating legume growth in Central Otago, very little was heard of it until about 1959 when several experimental plots were laid down on properties where aerial topdressing had been in progress for some years. It is not for me to elaborate on these results as I don't pretend to be a soil scientist or a research officer, but I have a few slides for you to view shortly which will give you some idea of the effects of adding elemental sulphur to superphosphate. You will see at the same time that super alone gives no response whatsoever, but a blending of the two in our particular case is better than sulphur alone. From this inform­ation, and thanks very largely to the energy and enthusiasm of Mr Terry Ludecke, Tussock Grasslands Research Officer of the Depart­ment of Agriculture, Alexandra, we soon found that we could cut our sowing from two hundredweight of superphosphate to one and a half hundredweight of sulphurised super (400lb to the ton). Some places I understand could use straight sulphur, but due to the possi­bility of explosion when spread from an aircraft the maximum per­missible quantity is 500lb per ton of super. This discovery has done
several things to stall off the "rising cost problem" mentioned earlier. It has cut transport costs by 25 per cent and application costs by almost as much. It has opened up the possibility of more than a three-year interval between dressings and it gives one greater confidence to know that the research people are now at least abreast of if not ahead of the work being done by the farmer himself.

Several other things are being studied at the present moment such as the relationship between sulphur and phosphate, the effects of different forms of sulphur, the persistency of improved tussock country under certain conditions of grazing and the optimum method of introducing grasses.

8. This is the final problem on which I want to speak for a moment. Our run flock has been, since about 1934, a merino flock and it became a question of the wisdom of making a change to a heavier breed to make the best possible use of the changed conditions. The decision was not a difficult one, as although I have the highest regard for the Merino sheep, I believe that it has certain limitations under improved grazing conditions, and definite limitations when it comes to disposing of surplus. I hasten to add, however, that as the remainder of our ewe country is fairly easy and not high, all under 3000 feet, the change of breed idea was not complicated by this issue. I purposely have not mentioned the breed to which we have changed as I don't want to be an advertising agency for that any more than I want to do anything to belittle the Merino breed, which has done, and is still doing so much for so many.

Now I should like to enumerate some of the advantages which have accrued on a run basis. I will set these out in the briefest possible form and will be happy to answer questions later if I am able.

(a) The shearing tally in 1953-54 was 5002 and in 1961-62 7185. We were down a little on that this year due to a loss in wethers from keas. I have already given you the cattle position. This is not all directly due to development work, but the greater part of it is.

(b) About 1800 of the original total are run as a separate flock on about 700 acres of farm paddocks and this has not substantially altered, the increase in the main to the hill flock on the remainder of the 19,000 acres.

(c) With the vastly improved feed conditions on the lower altitude country, the higher country, i.e. the wether and hogget blocks which run up to 5300 feet, can be spelled for longer periods and at times when spelling is most advantageous.

(d) Again due to improved feed conditions we have been able to pre-lamb shear the ewes which in turn produces the following benefits:

1. Much better quality wool, comparatively free of discolouration, dust and the cotted and tender fibres so prevalent in later shorn ewes.
2. Higher lambing percentages due in the main to the tendency for the ewe to lamb in a sheltered place and the relative ease with which the lamb can take its first drink.
3. Very much better lambs by weaning time, as they do not have to survive long drives from their blocks at shearing, stand about dusty or muddy yards while the ewes are being shorn, or run the risk of mum going off the milk from a chill, rough treatment, or shortage of feed.

From time to time I have been asked what I would do given the opportunity to start again under similar conditions, but assuming that the plough could be used. I have no hesitation in saying that I would do the same again unless the land was very much better and the
fertility already built up by fairly heavy stocking rates. The microclimate provided by the tussock and other native species, I think should be retained for as long as possible. When you launch out on an agricultural programme you tackle a job with a high cost structure, particularly if you have first to buy machinery. You can do a fairly efficient job with an aeroplane or a sod-seeder. You can bring in the plough when in a few years time, you have built up the fertility, particularly the nitrogen content, and built up your own financial resources. Finally, tackle an area that you can handle and maintain—not one that will hasten you to the grave nor one of market garden proportions—there's not much future in either.

Most of you who own or lease some tussock country have an area that you could go to work on if you haven't already done so. (Assuming of course that in our present-day economy finance can be provided.) My advice is, make a start, you'll be surprised at the pleasure you get out of it, and above all at the effect you could have upon the thinking of those who feel that much of our native country is suffering at the hands of unscrupulous individuals who want to take the last blade of grass off it before they pass on. If I exaggerate it is only to draw attention to the fact that some do appear to have that feeling.

Some of you may think you're too old at 55 to make a start, in ten years time you'll be 65. To quote that eminent American psychologist, Dr Murray Banks, how old will you be in ten years time if you don't start? Should you get a different answer we had better call him in.

The runholder has on his shoulders a most serious responsibility as the custodian of a vast area of this island, he is charged with the task of leaving it in a better condition, from a soil and water conservation viewpoint, than that in which he found it. I am sure it can be done without stretching the purse strings to bursting point. The devastating effect of the rabbit on so much of this country is gradually disappearing (and God forbid that it should ever return). The land owner is becoming ever more conscious of improved managerial practices and most strive to keep abreast of the times. The firestick is not indiscriminately used where it is not pertinent to do so. A more secure land tenure has emerged over the past one and a half decades which must be preserved at all costs, and above all, the energy of youth is ever entering the scene to accelerate modern techniques. All in all I believe that a general rehabilitation of our occupied tussock grasslands is well under way, and will continue, providing everybody concerned is prepared to be tolerant of a process which must at all costs be slow. I don't believe that the runholder can do the job on his own any more than I believe that the soil scientist or research officer can do it by pre-supposing the answers to a host of problems which must surely require prolonged and intense investigation before hasty and costly action is taken.

I am quite satisfied, however, that by continued cooperation between the two; by a careful study of such things as whether the thatched roof and earth sweeping effects of overgrown snowgrass and tussock is a lesser contributing factor to soil erosion than the effects of limited burning; by the strictest vigilance on the part of runholders and rabbit boards that this pest does not again get out of control or be replaced by too many sheep, and by some revised thinking on the part of those who are, perhaps unwittingly, killing the incentive to set about development work in their effort to obtain the highest possible unimproved values on the land and thus bring about substantially increased rating, rentals and death duties. By due attention to these and other relevant factors, our tussock grassland could well provide an increasing contribution to this country's economy.

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Q.: Do you think it would be advisable to close up part of the high country?

Answer: I believe we should avoid taking it out of production altogether, where it is possible; but if it is necessary it should be done. With the greater production of the lower areas then, this means that the higher country can be given longer spells.

Q.: Have you any problem with inoculation of clover or smothering of the sward by tussock?

A.: We do not have to worry about inoculation, but trial plots by the Department of Agriculture ten years ago have given some good results.

Smothering—this is just starting to have an effect due to increased tussock growth brought about by higher fertility. It will be eaten off by cattle before this winter. We try not to burn off because of destroying the microclimate so valuable to the clover and other more delicate plants.

Q.: Have you had any trouble with grass grubs?

A.: Yes. It is reaching serious proportions where rainfall is heavy, though self-seeded clover has helped to fill in the grass. We wanted to put on D.D.T., but with aerial topdressing it is hard to get really accurate dressings.
REDUCING THE COSTS OF RUN COUNTRY FENCING

J. G. Hughes, Tussock Grasslands and Mountain Lands Institute.

Whatever use of our high country lands is made—be it for water, wool or meat, we cannot afford, either financially or physically, to let stock roam at will. In another age, there were boundary keepers—solitary men, the ruins of whose huts we see today. Then wire came and wire was cheaper than men, so five wires and iron standards took their place. Quite rapidly at first, the runs were subdivided but for a long time after that, for one reason or another, few fences were built.

Now, suddenly, within the last ten years, a change has come. We find those fences which were there when we were born are not enough. Like it or not we see extensive grazing being less and less the common way of de-pasturing our flocks. And we put up new fences. Fences to make smaller blocks on improved land (whereon we need from time to time large numbers of grazing animals to enable full use to be made of it); fences to help us husband grass on the valuable winter country; fences to give young plants a spell from grazing so they can increase their vigour; fences to keep stock off those lands where all animals do harm and fences to keep stock on faces where they never chose to graze before. So we need new fences for these and many other reasons and still to replace the old ones which have fallen down.

In these days, too, the stress upon a fence is greater. More often now it has to be built elsewhere than on the best line, but rather in a place which cannot be avoided if the fence is to serve its purpose well. Stock which may be kept on blocks for shorter periods in greater numbers have more reason to test the weakness of their fold and young or untrained cattle may be grazed. Therefore the fences must at least be as good as—and more often better than—those built by our fathers.

All this has come about—and our costs have risen, 23 per cent for the high-country man in the last ten years, we are told. It is in fact perverse that the rise in sheep farmers' incomes of a few years ago which did much to encourage them to consider changes in their management, changes which could rarely be made without money spent on fencing, has now fallen away, leaving them often with the will but no longer quite the means.

Fences are still being built, however, and the prudent sheep-farmer sees them as a wise investment. Wise, that is, if well planned and even more so if part of a carefully-thought-out policy to better the grazing of his stock.

Money can be readily wasted on fences, however. It can be wasted on wrong materials, on weak material, on poor quality material, on too little material and just as easily by too much material or material which is stronger than need be.

The features of a site, of course, and the purpose for which a fence is built do in the end control the type of fence but within these limits real savings can be made by the careful planner and buyer; the buyer who is aware of the strengths and shortcomings of all the many products which are on the market.

I would stress again the words “the careful planner,” for here is a simple source of saving in cost which depends upon the farmer
alone. No criticism of a high markup cost can defend lack of common sense nor can paring of a penny between two brands of wire make up for careless disregard of all the factors which make this fence last and that fence fail. It is not the place here to repeat the many points to remember when siting a fence, and in fact the final line must be the result of long and careful study of the alternatives, but it is enough to say that for each new fence he plans to build, the farmer must keep the maintenance, as well as the capital cost, in the forefront of his mind.

I called this paper "reducing costs"—I would insist that reducing the need for maintenance is at least as important as keeping the first cost low. Thus the three constant weights of cost against which you must balance every consideration when weighing the items of a fence are these: It must be

(i) Stock proof now and in the future.
(ii) Low in maintenance.
(iii) Reasonable in first cost consistent with longest life.

We will now consider the alternatives.

Basically, the materials can be divided into wire and what, for want of a better word, I will call uprights—that is posts, standards, or droppers.

WIRE

We will discuss wire first and here I point out that the cost figures used from now on are average ones and therefore subject to some variation.

Comparison of Cost

No. 8 wire (the common size) costs £80 ton or 3/2 chain.
No. 9 wire costs £81 10/- ton or 2/7 chain—7d less.
No. 12½ gauge high tensile costs £95 ton or 105 chain and therefore 1/9 chain less than No. 8.

These differences may not sound very large when quoted in pence but if you multiply each by six as in a six wire fence, the No. 9 saves 3/6 chain or £14 mile over the No. 8 and the 12½ gauge 10/6 chain or £42 mile over No. 8!

There is certainly a strength drop of about one quarter from No. 8 to No. 9 and No. 9 having less bulk requires slightly more constant attention to keep it taut, cuts out more quickly with frequent fires through it, and rusts more rapidly when buried in soil or vegetation as often happens to the bottom wires. For these several reasons I have never been a great advocate of fences all of No. 9 wire (although I have seen some which are quite successful). I do, however, recommend that you consider using No. 8 for the bottom two or three wires of a fence and No. 9 for the remainder. With three No. 9 wires in a fence as against all No. 8 there is still a saving of £7 a mile and that is three coils of wire gained at no real cost.

Combinations of 12½ gauge high tensile and No. 8 are rarely seen—fences are usually built as all 12½ gauge or none at all, but because they are not common does not mean they are not practicable. Twelve-and-a-half gauge does have some disadvantages—it is awkward to use, rusts more quickly than normal wire because of its higher carbon content and is prone to snap, particularly at knots, in very cold conditions when under high stress; or due to sudden shock as when a rock bounces through. But against these must be set its one big attraction—its cheapness—£42 a mile cheaper in a six-wire fence—and just as strong in tensile strength as No. 8. And, again, if you use three No. 8 wires at the bottom and three 12½ gauge above then you still save £21 a mile which is the worth of 40 posts or 80 standards. That is not to say that I do not favour fences all of 12½ gauge. They are fully satisfactory on the easier country where cold may not
be so intense, risks of damage less, and the fence more often inspected. It is, of course, the only wire to use with electric fences

**Number of Wires**

In the old days, five wires were enough to check fine-wooled sheep which had such scope in grazing that they rarely encountered fences when on the blocks. "Merino" fences they were called. Higher concentrations and the presence of cattle now mean that fences must be sturdier. The debate is whether six wires are sufficient or seven wires are needed. The arguments for six wires are that sheep, unless pressed, will not jump six or seven wires and so cattle are the deciding factor. If cattle are well handled and know the country, if fresh young stock are not provoked and particularly if the cattle have not had the chance to get the habit of breaking through poor fences, then they also will not jump six or seven wires. Except, that is, for the occasional rogue which will attempt anything and then it is better for it to jump and clear six wires than to make a mess of seven.

Others, of course, insist that if you have cattle you must have seven wires. My recommendation is to use six wires (five plain and one barb) on the hills and seven wires on the flats, in paddocks or at points where stock may gather. One wire less can mean anything from £6 to £13 a mile saved, depending on the gauge used.

**Netting**

The heavy netting fence is a special case by itself and there are so many different gauges and widths available that it is not easy to give you a guide to cost. The manufacturers frequently claim great savings by its use but I would ignore any figure unsupported by details of the plain wire fence and the netting fence being compared. These are the points you must weigh:

**Advantages:**

(i) Stays sheep proof as long as it is erect even if not taut and is thus ideal for river crossings and rough sites.

(ii) Need not follow straight lines—another advantage in rocky places.

(iii) It has good resistance to stock impact.

(iv) Maintenance is less than with a plain wire fence.

(v) Fewer posts or standards need be used—and this is the main—the only real—cost-saving factor. I will be mentioning it again shortly.

The disadvantages are:

(i) Rolls are heavy to carry and awkward to pay out on difficult sites (but it is here it is most useful).

(ii) The wire fabric is, by comparison with plain wires, more easily blocked by slips or rock and the fence carried away and buried.

(iii) Small gauge wires may not last as long where strong corrosion elements are present but this would rarely be the limiting factor in the high country. Some makers use high-tensile wire—which is stronger than it looks.

In my opinion the practical advantages outweigh the disadvantages for most sites; but the big deciding factor is cost.

A seven-wire fence will cost 23/- per chain for wire alone if six No. 8s and a 12 gauge barb are used but this figure is reduced to 18/- if the fence is six wires only and there are two No. 8s at the bottom with three No. 9s and a barb above them. There is the range (18/- to 23/-) a difference of 5/- per chain or £20 per mile. That is worth
remembering for itself but is used here for comparison with heavy netting. The price of this netting varies from 25/- to 42/- per chain according to grade and is thus from 2/- to 18/- a chain dearer than the No. 8 wire fence. In fairness, however, it must be pointed out that the higher-priced types of netting are for special purposes with which plain wires could not cope. But omitting those, a commonly-used size and weight of netting retails at 29/- a chain—"that is, 6/- a chain dearer than the six No. 8 and a barb. If you add the usual barb on top (4/4 a chain) the difference jumps to about 10/-. Thus the netting fence could be dearer than the plain wire fence by 10/- a chain for wire alone.

To break even then, the netting fence must be able to be built with two standards (at 5/- each) per chain less than the plain wire fence. If yet more standards can be left out (say, then, three standards in between each one chain post instead of the usual six) then savings are being made. But in my opinion it is rarely safe to use quite as few as this, particularly on broken hill country, and for all practical purposes the netting fence is thus at least as expensive as the plain wire fence. The criteria for choice then are the advantages and disadvantages given earlier, and from this, the lower maintenance of the netting fence could well be the deciding factor in its favour.

As far as a barbed wire goes, I still believe one is necessary in spite of it costing £4 a mile more than a plain wire. Even if it doesn't warn off cattle (which I believe it does) it keeps the standards or droppers of a fence in place.

So much for wire.

"UPRIGHTS"

Posts

I will deal first with posts. While we hope never to reach the density of posts found in some North Island fences (although I see this happening near Te Anau) still they are essential in run country fences also, and I would say that there are few places where posts can afford to be further than one chain apart. I, too, have seen fences with only one post to the 12 chain strain, but I am quite sure that this is one apparent form of saving where the risks of false economy can be very great. I will be quite firm then in recommending one post per chain—at least. But what is that post to be made of? The choice is still, concrete or wood.

Cost

Steel posts (T-iron, that is, the traditional material) cost from 15/- to 35/- each (depending on size), are long lasting and easily erected but lack resistance to side pressure. It can be expected that the heavier grades of steel post will have an extremely long life—short of severe pressure damage—much longer than the treated post, but at 35/- it costs three times more than its competitor.

Concrete posts (and I would only consider pre-stressed concrete) cost 11/- to 12/- each, are long lasting if well made but again are short on strength. Short that is, compared to the third alternative, wood, which has a bending strength three to four times as great if it is five-inch diameter pine. Untreated native timber posts are still available but their quality is so uncertain that they are a risky buy from merchants. In my opinion, the treated pine or larch post is the only wooden post worth buying and is in fact quite worthy of ranking with the venerable T-iron in high country fencing. It is, of course, less fireworthy than the T-iron although the risk of damage is not increased by the treatment—even with oil-based preservative if followed by some weathering—and it costs more to erect and may be
shorter lived. The "may be" is important because posts treated to the standard required by regulations are expected to last at least 25 years. It is quite possible they will last a good deal longer since none of the treatment plants has been carrying out commercial post production at the preservative loadings now required, to my knowledge, to be able to ground-test their product for much longer than 25 years. Quite understandably the processors will not give guarantees. There are so many variables in wood and ground conditions that it would not be fair to expect them to do so. But they offer at least 25 years average life (and even the lighter T-irons can fail by corrosion on some sites in that time). I am really sceptical of the tales which one hears of treated posts failing after only a few years. I am quite sure they were not commercially treated to the present regulation standard for fence posts.

As regards comparison of pine and larch, treated by either the "greensalt," creosote or pentachorphenol-in-oil methods . . . there seems little to choose between them in quality, longevity and price. For myself however, accepting the treatment standards of the Timber Preservation Authority as giving, by different loadings, comparable preservative values to the fluids used, I prefer the pressure-treated pine to the immersion-treated larch or Oregon. It seems to me that the softwood pine which has preservative forced right throughout it is a safer proposition than the larch which has only an inch or so of sapwood at post-size and thus can be little more than shell-treated. This, of course, is quite satisfactory if the shell stays intact but the larch, with its high percentage of heartwood, checks or cracks readily when drying. It is said that all the checking going to take place will do so while the posts are being air dried and seasoned before treatment. But sometimes, to take an extreme example, I wonder if posts which are air dried at, say, Tapanui and later treated, will not check even further when taken to the very low humidity of Central Otago. The life of the post would then become the life of the heartwood—which is still 10 to 12 years. Perhaps the risk of later checking through the preserved shell in a very dry climate is balanced by the slower rate of decay there. I will leave this by saying that if I am putting in posts I use pressure-treated ones and trust the manufacturer's claims for his preservative are true.

The point of special significance with treated pine or larch posts is their price—9/- to 10/- each—and their great strength. It should be noted that there are smaller (or Grade II) posts with a minimum diameter of 3½ inches also available, costing only 7/- to 8/- but these are less than half as strong as the grade I posts with at least 4½ inch top diameter. They are, however, still half as strong again as a reinforced concrete post.

The T-iron post still has its place but since I am talking about reducing costs I recommend the treated wooden post to you. Have you considered treating your own? The economics of this depend on how much labour you have available and whether there are slack periods in the year for them. Of course, the real point to ponder is whether you can produce posts on the station of a comparable quality and at a comparable price to the commercial post plus transport costs. With skilled and well-equipped labour it would cost you at least 1/6 per post to get them out of the plantation and barked. With unskilled station labour, if costed as an alternative to other work, it could be considerably more but if used for filling in time by salaried employees—little or nothing. The posts would then have to be stacked, preferably under open-sided cover, and air-dried for three months or more depending on the time of the year. Preservative treatment then has to be considered. One firm in Christchurch will "greensalt" pressure-treat your posts for about 3/- each (depending on size) if landed in their yard, but landing them there and carting
them away could cost you 1/- a ton mile. Since there are about 700 posts to the ton, if you lived 50 miles from Christchurch, it would cost about 1/- per post to land them there and 1/- per post to cart them home again after treatment or a total of 5/- per post for cartage and treatment. The rest of your costs for cutting, barking and seasoning would then have to be 5/- each or less for you to break even but it would be a fairly inefficient place that reached this figure. So it is worth considering. There may be a treatment plant closer to you which will give you a similar service.

If you want to treat your own posts there are several alternatives open to you. It is not likely that you would want to install an expensive high-pressure plant capable of handling the up-to-200lb per square inch pressures of commercial units. A small low-pressure (10-15lb) cold fluid plant is available in Australia and the New Zealand Forest Service can supply plans for an 8-10lb plant here. There are two other practicable types of process. One involves heating a tankful of preservative and posts for four hours, then cooling for 16 hours during which time the creosote or other preservative is drawn into the wood. This is the method by which the Forest Service posts you buy are treated. The other system involves cold soaking either the whole dried and seasoned post in a vat of fluid or butt soaking newly-cut green posts. Cold soaking of the dried post, particularly with Pinus varieties is a thoroughly good method of preservation although the wood may absorb insufficient preservative to meet the standards set for commercial posts. The method is somewhat slow since immersion for eight to 48 hours is needed for each batch depending on the kind of tree, with drainage after that. It is, however, cheap and well worth considering if you have the trees and transport rates are high. A 45-gallon drum of creosote costs about £7, or 3/- per gallon, so since you should aim to get 6lb of preservative into a pine post with little or no heartwood and 4lb into a larch or Oregon post with, on the other hand, little sapwood, then preservative cost by this method is 1/6 to 2/6 per post. Other preservatives than creosote are also available. Thus you can reckon to produce posts cut from your own plantation and treated by the cold-soak creosote method for 4/- to 5/- each, wages included. Posts cut, taken to a treatment plant and returned to your property will cost you 5/- plus transport. Either way, if you've got the labour to spare, and the trees, the end result is posts at a very attractive price.

Standards and Droppers

The use of steel or iron standards has become almost a habit in run-country fencing. They have much to commend them and their continued use is supported. As far as price is concerned, there is little to choose between flat standards and Y section standards of the waratah type. I prefer the flat standard of 5/16 inch thickness. It is supremely versatile in difficult country and has twice the thickness of metal of the Y section—therefore, to me, it should last twice as long. Its lower sideways rigidity is not important where there are sufficient posts.

As with spacing posts, stretching out the spacing of standards is false economy. Departure from the regular nine-foot interval with six standards between each one-chain-post can be condoned only on fairly smooth ground where five firm standards at 11ft spacings each with a wire or steel dropper in between could be used. The saving is however, illusory and cannot really be recommended.

In a landscape where post-hole digging is most usually done by hand and the ground is rocky, posts (except the driven steel) cannot be used any more frequently than is needed for strength. Thus the post and batten fence although slightly cheaper in material cost is not suitable.
Consider:
Per Chain, 1 post at 10/- plus 6 standards at 5/- equals 40/-
or 2 posts at 10/- plus 4 standards at 5/- equals 40/-
or 3 posts at 10/- plus 9 droppers (treated wood) at 1/- equals 39/-.  
The system of chain droppers that is used quite widely in the North Island again depends on frequent posts for strength and for reasons already given does not appeal.
Thus, no real way of reducing the need for, and cost of, standards or droppers can be offered.

CONSTRUCTION
Labour
If you use contract labour, calling tenders for a big job can be worthwhile. Again, if the materials for a fence are well laid out on the line and the contractor given fair treatment, a lower construction price can often result. At least, he will, if he is worthy of his trade, give you the best job possible and that can mean reduced maintenance.

Tiedowns
It cannot be too strongly emphasised that savings in materials should not be made at the expense of satisfactory tiedowns. Herein, if the posts are well laid, lies the secret of strength and low maintenance in a fence. Stainless steel for the attachment of standard to anchor is recommended.

Footplates
Steel footplates for supporting iron posts (if used) and standards on soft ground justify their cost by preventing sinking of the fence. Old posts or rocks laid crosswise under the bottom wire are cheaper alternatives where there is little downward pressure.

ELECTRIC FENCES
No discussion about reducing costs of fencing could now ignore the case of the "permanent" electric fence. I have left it to the last because I do not intend to consider it at length. It will indeed cut down your capital costs considerably if you see fit to use it for the following duties:
(i) Temporary fencing.
(ii) Subdivision fencing on flat, rolling or clear-face hill country up to, say, 3000 feet.
(iii) To help in the control of secondary growth.
(iv) To provide semi-permanent fencing where there is an early and extensive need for pasture control in an improvement programme. When finances permit, the fence would be strengthened up and de-electrified, having been designed with this in mind.

In these four functions lies its greatest usefulness if its limitations are respected. If carried outside its range or erected without understanding by an unsympathetic farmer not able nor prepared to give it the extra maintenance it needs, it has more often than not failed—and thereby caused more general condemnation.
On easier country, it will cost you £190 to £240 a mile erected.
On difficult broken country it will cost £260 to £340 a mile erected.
This is a quite remarkable reduction in capital cost from the £470 to £500 per mile of conventional fencing but the much more frequent attention and maintenance required must be remembered and weighed against this credit. It is not a wonder fence in itself to be adopted or discarded for all purposes. Rather is it a most useful complement to conventional fencing.
CONCLUSION

I recommend to you these ways of cutting costs as worth considering:

No. 9 or 12½ gauge wire, alone or in combination with No. 8 can save up to £40 a mile compared to No. 8 alone and this with little or any loss of efficiency.

Seven wires are necessary only where stock congregate—six wires are quite satisfactory elsewhere and save up to £13 mile.

Netting in itself costs more than wire but it usually needs fewer standards to support it. It deserves much wider use if only because of the low level of maintenance required.

Treated posts receive my earnest recommendation. They are strong and reasonably cheap—costing from 5/- to 25/- less than T-iron posts. At a rate of one post to the chain they therefore reduce costs by £20 to £100 per mile—although the range £20 to £50 would be fairer considering the longevity of the heavier grades of steel.

If you can treat your own posts the cost can be reduced to as low as 5/- each.

And, finally, wise planning of the line, careful selection of the right materials and sound construction all contribute to the hidden but nevertheless most important savings of the fence that keeps stock where you put them and needs little attention.
NASSELLA TUSSOCK PANEL DISCUSSION

On the panel were:

Professor A. H. Flay, Associate Professor, Farm Management Department, Lincoln College (chairman).

Mr A. J. Healy, Assistant Director, Botany Division, D.S.I.R., Lincoln.

Mr W. M. Leonard, Senior Scientific Officer, Department of Agriculture, Christchurch.

Mr T. G. Maxwell, chairman North Canterbury Nassella Tussock Board.

Mr H. V. Hinds, Conservator of Forests, N.Z. Forest Service, Christchurch.

Mr G. J. Watt, Commissioner of Crown Lands, Lands and Survey Department, Christchurch.

Each member of the panel (except the chairman) introduced himself with a short talk describing his interest in nassella tussock. This was followed by a panel discussion and questions from the floor.

A. J. Healy

Nassella tussock (serrated or Yass River tussock of Australian States) is a perennial, fibrous-rooted grass, native of Argentina. How it reached Waipara, North Canterbury, is not known, but it is now a serious weed over some hundreds of thousands of acres in North and Mid-Canterbury, Marlborough, Central Otago and North Auckland.

That it had developed into a major weed here was evident by 1940, its troublesome features including:

(i) Harsh, unpalatable, fibrous foliage.
(ii) Capacity to invade, establish and thicken up into dense stands smothering more palatable sward plants.
(iii) Ability to establish and thrive under low rainfall conditions on unploughable, sunny faces and ploughable rolling and terrace country.
(iv) When abundant, causing overgrazing of palatable sward plants.
(v) High seed production—up to 100,000 seeds per mature plant.
(vi) Seed dispersal by many agencies—wind, water, livestock, farm and other machinery, produce and humans.
(vii) Efficient wind dispersal of entire seed heads for distances up to six miles (perhaps more), enabling mass invasion down wind-line.
(viii) Seeds remaining in soil in viable condition for unknown number of years.
(ix) A present known altitudinal range from sea-level to approximately 3,000 ft.
(x) Difficulty of detection owing to similarity in appearance to native hard and silver tussocks.

Its serious nature is recognised and emphasized by legislation—in The Nassella Tussock Act 1946 and The Nassella Tussock (Grass Seed) Regulations 1949, and inclusion as a scheduled weed under the Noxious Weeds Act 1950.

Outside New Zealand, nassella tussock is thoroughly established and a major weed in New South Wales, with lesser infestations in Tasmania and Victoria. It has appeared about wool treatment plants in England and a number of European countries, indicating seed dispersal in fleece wool.
Establishment of the weed is favoured by failure or inability to maintain a dense sward on sunny aspects whether modified native tussock grassland, sown English grass pasture or lucerne crops, predisposing factors being burning, overgrazing, cultivation of too steep slopes with attendant difficulties in re-establishing a dense cover, and too high a proportion of annual grasses, clovers and weeds in the sward.

Similar in appearance to, and likely to be confused with several native tussocks and sedges, nasella tussock is identified by (i) its pale green colour, (ii) tightly-packed, whitish, swollen basal parts, (iii) decorative, open flower heads, purplish and erect when mature, straw-coloured, on long, trailing, easily detached stalks at maturity by the wind, and (iv) seeds one-sixteenth of an inch long, plumb-bob shaped, rough, hairy at base, and with straight, rough bristle (awn) one inch long.

Nassella tussock is a menace—do not trifle with it—appreciate the dangers and the problems—check the identity of any unknown tussocks on your property or in your district.

W. F. Leonard

As you would expect, the Department of Agriculture is involved in the administration of nasella tussock legislation. One of the responsibilities of the Minister of Agriculture, is to implement the Nassella Tussock Act under which the Marlborough and North Canterbury Boards were set up. To advise him, there is a joint committee, made up of representatives of the Departments of Agriculture, Forest Service, Internal Affairs, Lands and Survey, Scientific and Industrial Research, Treasury, Valuation and the Soil Conservation and Rivers Control Councils.

This committee reports to the Minister annually on the activities of the Boards and, before approving payment of each year’s subsidy money, he must be satisfied with the past year’s operations and the programme for the coming year.

The Department of Agriculture administers the Nassella Tussock Grass Seed Regulations which are aimed at preventing the spread of nasella in grass and clover seed. We are also concerned with the Noxious Weeds Act under which many local bodies exercise nasella control.

Besides being represented on the two Nassella Tussock Boards, the Department, through publicity of various kinds, tries to draw attention to the seriousness of the problem, and to educate farmers (and others) in tussock identification. Methods used include radio talks, illustrated lectures, field days, demonstrations, newspaper and Journal articles, shop window displays and show exhibits. In fact, in Northland, slides were shown on cinema screens, after the discovery of nasella there.

An intensive programme of research has yielded the results on which present day large scale control work is based. Until a suitable grass-killing chemical was produced about 10 years ago, hand grubbing and afforestation were the only means of control on non-arable lands.

The technique now known to us as chemical ploughing, had its birth when nasella tussock on hill country was killed, and oversown grasses and clovers established in its place. Research into ways of improving the reliability of spraying and oversowing is constantly going on.

But killing existing tussock and replacing it with pasture is only a step in long term control. The amount of re-infestation from seed
in the soil varies greatly and the length of time over which this will be a problem is still uncertain. Nor do we have much information yet on the extent to which oversown areas will carry stock and still suppress re-infestation. Research into these and other aspects is in progress.

Some re-infestation by nassella seedlings is certain. We therefore attach great importance to work on the selective control of tussock seedlings in pasture. Results obtained so far in this investigation are most encouraging.

Advice arising from research work is passed on to the Nassella Tussock Boards, the Lands and Survey Department and other organisations involved in nassella control.

Where new infestations are found outside the Boards’ districts, advice on control is given, and assistance provided with searching, so that the perimeter of the affected area can be established as soon as possible.

T. G. Maxwell

It is indeed a far cry from Scargill-Omihi Y.F.C. in August, 1939, to the Lincoln College Farmers’ Conference in May, 1963.

The first mention of the possible menace of nassella contained in the minutes of the club was from a meeting held on August 2, 1939, when a letter was read—from whom it does not say—and the club decided to endeavour to arouse local bodies to take action to suppress the tussock.

Arising from these activities, the Nassella Tussock Committee, on which the Y.F.C. was represented, was formed in 1940, and this was in turn replaced by the Combined Counties Nassella Tussock Committee which was authorised and formed in 1943 as a result of an amendment to the Counties Act.

The Board was formed in 1946 comprising two members from each of the four counties, Kowai, Waipara, Cheviot and Amuri, the Field Superintendent, Department of Agriculture, the Field Officer, Land and Survey Department, a member from Botany Division, and in addition the Board had power to co-opt three other members.

Finance is on a subsidised basis. The four Counties contribute £7045 and subsidies are as follows:

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making a total of approximately £58,000

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The North Canterbury Nassella Board has in its area approximately 900,000 acres of which 15,000 to 16,000 acres are moderately to heavily infested and the balance of the area is in many cases lightly infested.

The Board’s staff consists of a secretary-manager, one senior inspector, two inspectors, and 16 rangers; in addition gangs of men up to say 12 in number per gang are employed for eight months of the year to a total strength last year of 150.

Inspectors arrange work on properties where owners are unable to do grubbing for themselves for various reasons, e.g. (1) lack of staff, (2) too heavy infestations, (3) absentee owner, etc., etc.

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The cost to the employer is 6/- per hour and to the Board approximately 6/6 per hour, making a total cost of gang labour in the vicinity of 13/- per hour.

To house these gangs the Board has built hostels at Waipara, Waiau, Cheviot and Hurunui and also has the use of accommodation in the Balmoral forestry camp.

Rangers’ duties are merely to scout over properties and determine the degree of infestation “if any”; also to note if the owner is cooperating or not and report back to the Board.

The Board has reports on all properties ranged. These are considered and where necessary arrangements are made with the owners for work to be carried out. In addition the Board has two spray units which are used for boom spraying gullies and dense patches of tussock to save hand-grubbing work.

The secretary-manager and inspectors arrange contracts for spraying by helicopter or fixed wing aircraft of nucleus areas either for a kill or seed control. The Board is also concerned about the control of rabbits so that nucleus areas kill-sprayed can satisfactorily be oversown and spelled to allow a good cover of grass to suppress nassella seedlings. The Boards' rangers report the finding of nodding thistle to the Counties concerned and generally action is taken.

The Board's expenditure last year was £110,000 and estimates are for a similar sum this year. Recoveries from farmers were approximately £23,000 and although it is impossible to estimate the additional amount expended by private owners on control measures the amount would be considerable.

In conclusion, while carrying out a survey of control work in Australia with Mr W. F. Leonard, Department of Agriculture, Christchurch, at the Board's expense I noted that the Victorian State Government has in operation a system of "Noxious Weeds and Vermin Control." I consider a similar scheme could be very desirable in this country.

G. J. Watt

Being alert to the nature of the problem the Lands and Survey Department resumed possession of some 2,250 acres of leasehold land at Waiau and farming operations commenced in the 1952-53 season. Previously this area had been heavily infested by rabbits and only after their extermination did the full significance of the nassella become apparent. For several years a reasonable measure of seeding control was achieved by intensive or forced grazing by adult steers. Glenbourne proved the guinea-pig for aerial treatment with herbicides in Canterbury and T.C.A. was applied on 425 acres with but limited success. Since the 1958-59 season Dalapon has been used and some 950 acres have been kill-sprayed. Oversowing and topdressing together with judicious stocking has given marked results, but annual follow-up measures by way of seedling control, spraying and hand-grubbing remain a costly item.

About two years ago the North Canterbury Nassella Tussock Board asked the Government to assist by the purchase of privately held lands where the nassella problem had gone beyond the combined resources of the Board and the farmers concerned. Obviously nassella in North Canterbury had become a national problem of no mean magnitude.

The Lands and Survey Department accepted the challenge and between February and July 1962, nearly 22,000 acres were purchased, thanks to the cooperation of the individual farmers.
As the appendix shows the land has been grouped as four farm settlements:

- **Cheddar Valley** . 9,500 acres between Waiau and Parnassus
- **Coringa** . 3,500 ,, at Motunau
- **Tiromoana** . 4,700 ,, at Waipara
- **Washcreek** . 2,200 ,, at Waipara

**Total** . 19,900 acres

Because of the intensity of the problem both Tiromoana and Washcreek were regarded by the Board as nucleus areas and practically no control measures had been carried out.

Two areas excluded from the above have been taken over by the N.Z. Forest Service; 435 acres lies close to the Omihi State Forest and 1,340 acres were excluded from Tiromoana.

The aim is to deal as effectively and expeditiously as possible with the problem with a view to ultimate settlement as sound farming units. Already vast expenditure, combined with the praiseworthy efforts of the contractor, has transformed the landscape on the arable land. A total of 3,400 acres has been cultivated and in the main nassella was growing strongly, but included was some 550 acres of dense gorse and scrub. Of this area 2,860 acres have been grassed. Over 4,000 acres of non-arable land have been kill-sprayed and 12,000 man hours recorded for hand grubbing. Twenty-five miles of tracks have been formed and 19 miles of fencing erected.

It might also be claimed that during the first season spectacular progress has been made in arresting the wind-borne dispersal of nassella seed on the non-arable land but overall a more subtle problem remains.

The vast population of latent but viable seed awaiting a favourable climate for growth is a major source of concern, particularly on non-arable areas where complete ground cover with competitive species is not possible and a perfectly even coverage by aerial operation too much to expect.

The timely intervention and operation of such large scale activity has arrested the loss of production from otherwise fertile and productive land. Recrimination would be pointless and uncalled for, but in conclusion, let me emphasise that the experience in North Canterbury and also in Marlborough should remain an object lesson to New Zealand and possibly beyond. The combined efforts of the farmer, the scientist and the administrator can and must be geared for maximum vigilance in search and rescue operations wherever nassella is likely to appear.

**H. V. Hinds**

In many cases in New Zealand trees have been used for weed control, notably gorse and broom. They were first used to control nassella tussock in a private plantation in 1939.

The Forest Service planted on request 430 acres in Wyllie's Block at Omihi in 1949—an area that had been declared a Nassella Tussock Reserve. It is said that there was a considerable effect in the control of seed dispersal of nassella from about the third year. In many cases nassella was also suppressed, or seed dispersal controlled, by the growth of cocksfoot and other grasses which flourished owing to the release of grazing pressure.
An additional area of 912 acres (Croft's Block), a few miles away, was acquired in 1957. The primary object was to make a more economic forest holding; about 300 acres contains nassella in quantity.

In 1962 about 1,700 acres of the 22,000 acres of badly infested nassella tussock land, acquired by the Lands and Survey Department in North Canterbury, were handed over for afforestation.

The technique proposed for planting the new area will be to kill-spray in the autumn before planting and to give an anti-seeding spray of the areas which will be planted in subsequent years. Trees will be planted closer than in areas with no nassella. Experiments are in progress to see whether the young plantations can be sprayed to kill, or at least control seeding of nassella tussock before the trees close canopy. The results are as yet inconclusive, but there is some indication that spraying under certain conditions will not kill trees; the most resistant appears to be Corsican pine.

Trees in the nassella tussock areas may be difficult to establish as the tussock favours, and becomes dominant, in areas least suited for trees, i.e. on dry northern slopes exposed to the north-westers. A good deal depends on the climate in the spring following planting, but it is considered that trees can be established. On the higher and drier areas Corsican pine will be used, with radiata pine on the lower slopes.

In the 1949 Wyllie's Block at Omihi most of the nassella, especially in the areas where there is complete tree canopy, has been killed. Where rather more light enters, possibly owing to a gap in the spacing, there are some moribund tussocks which appear almost dead. Tussock still grows in the larger gaps but it appears that restriction of light inhibits seeding, and it is only in the larger open areas inside the plantation that seeding occurs; the dispersal of this small quantity of seed is effectively controlled. Some tussock seedlings have appeared in the more heavily thinned areas of radiata pine and some of the old moribund tussocks have shown recovery. It is considered however that lighter thinnings, possibly by poison, can be carried out so that a final crop can be achieved and tussock controlled.

The shortest rotation for saw-timber production will be 40 years for radiata pine. For Corsican pine it will probably be 80 years.

Experiments by the Agriculture Department show that soil from the radiata pine areas at Omihi 14 years after planting still contains viable seed, but it appeared to be less than that from soil taken from outside the plantation.

Professor Flay: You mentioned in your talk that nassella tussock is a native of South America. Is it a bad weed there?

Mr Healey: No. There is very little else for the animals to graze except other species which are even more unpalatable.

Professor Flay: The stock eat it in South America. Why is that?

Mr Healey: We cannot answer this yet. A new environment may change a plant. This may be due to soil or climate and may be due to the fact that it loses some of its competitor plants in a new environment.

Professor Flay: While we can't control nassella by grazing is it quite easy to control on ploughable land?

Mr Healey: It is a problem on ploughable land, but you do have the advantage that you can cultivate which you cannot do on steep country.

Professor Flay: Do you agree with that, Mr Leonard?

Mr Leonard: Cultivation kills nassella readily—it is not a twitch. Removing the existing plants is simple enough, but the problem is to
deal with the millions of seeds in the ground which are likely to re-infest the pasture. On some farms the occupier has to plough every two or three years. This very short rotation makes the economic position dubious.

Professor Flay: Mr Watt, you have cultivated 2,000 acres up there at Waipara, I believe. How are you getting on?

Mr Watt: We have ploughed, cultivated and sown in grass. We assume that this pasture will have to be replaced in two or three years' time unless there is a spray available which will kill nassella seedlings.

Professor Flay: It must cost a lot of money.

Mr Watt: The cost has worked out very well indeed. The cultivation has not been easy. It has included some 500 acres of gorse and nassella tussock scrub but the overall cultivation cost has worked out at £6/15/- per acre.

Professor Flay: But that is only part of the cost. You must be putting seed on it.

Mr Watt: The seeds and the super cost an average of £4/5/-, bringing the total up to £11 per acre.

Professor Flay: £11 per acre—that's not very much, Mr Watt. What's this cheap seed mixture you are using?

Mr Watt: One bushel ryegrass, half a bushel H1 and three pounds white and three pounds red clover. Not an ambitious mixture, but only a temporary one.

Professor Flay: What do you think of this seed mixture, Mr Leonard?

Mr Leonard: We are up against this problem of re-infestation and we have to grow species which are most likely to keep nassella out. Mr Watt is using species which are vigorous and fairly well adapted to dry conditions, but I have a "hobby horse" in preferring Phalaris especially for hill country where the cost of re-sowing presents greater problems.

Professor Flay: Why don't you put these arable areas down in lucerne? Even if the nassella does re-establish you can control it by mowing it two or three times a year. Instead of having to plough up a pasture over two or three years you would be able to leave it down for eight or more years. This would be a big saving.

Mr Leonard: At first sight lucerne would look like the obvious answer, but it has a long dormant period in the winter as you all know. Further, lucerne is not a very competitive plant—it gets infested with all kinds of weeds. Farmers of the Waipara district usually find nassella in the lucerne paddock. However, when we could find a selective spray for nassella seedlings then lucerne would be a good plant because it is less affected by grass sprays.

Professor Flay: I do think there is a real place for lucerne in these "nor-wester" areas. After all, it produces something like a third to a half more dry matter per year than normal pasture. Don't you think there is a place for lucerne, Mr Watt? I suppose you don't like it. Is that just Mr Leonard's advice?

Mr Watt: As usual Professor Flay has just hit the nail on the head. We looked to Mr Leonard for our advice. We have been going for only a year but with experience we may vary the programme a bit.

Mr Leonard: But of course there will be a plan for lucerne after the preliminary stages are past.

Professor Flay: Well, that deals with arable land, you can control it by frequent ploughing. What about the hill country?
are you doing about those steep faces where there are odd scattered plants of nassella, Mr Maxwell?

Mr Maxwell: Well, we have got a great deal of experience with grubbing. The Board has a tremendous task grubbing out these odd tussocks and we have sixteen rangers whose duty it is to comb over the country to find out how much and where the tussock is before we go to work on it. They also knock out the odd tussock if it is not too hot! They do a good job under difficult conditions. The maximum area each ranger can comb is about 30,000 acres. We have 900,000 acres in our district which means we really ought to have about 30 rangers instead of 16. For some reason or other some farmers are very reluctant to do anything about their tussock so rangers have to put more time in on some properties than on others which adds to our problems. Then we employ big gangs of men to grub out the tussock, working on the principle that one tussock grubbed out as soon as he shows his head is the best way of control.

Professor Flay: How much does this grubbing cost? Do these farmers spend much money on grubbing nassella?

Mr Maxwell: It is hard to estimate how much the average farmer would spend in terms of his own labour to keep their properties clean. I suppose 40 or 50 days would cover the job, which amounts to about £80 to £100 per year in wages.

Professor Flay: That is just another rate.

Mr Maxwell: The thing to remember about this tussock is that many farmers have been grubbing the odd tussock out, but their properties have been re-infested from these bad areas which the Government has now taken over. The seeds blow for six miles at least. The Banks Peninsula farmers think that it blows for sixty miles. As long as the Government is prepared to control the seeding on these blocks by pouring on Dalapon then there is a great hope and we will succeed. But if seed is allowed to blow 'willy-nilly' all over the land, which farmers and the Board are grubbing it won't be long before the farmers will say, 'I have had enough of this. I am going to stop.'

Professor Flay: What happens when you grub a plant out, Mr Maxwell. Don't you make a nice little seed bed for other nassella seeds to establish in its place?

Mr Maxwell: No, they don't. Nassella's a silly plant. It is probably the easiest thing to kill. Knock it out on a hot day and come back in half an hour and it is lying absolutely dead. The only time that it will regenerate is after heavy rain. If you leave the tussock to seed the funny thing is that the seed doesn't seem to come up on your place.

Professor Flay: But if you scratch the surface by grubbing why doesn't the Nassella seed come up there. Even if the seed doesn't come from your farm it will have come from your neighbour's place.

Mr Maxwell: No. You don't seem to get seedlings coming in unless there is a lot of nassella seed blowing around from neighbouring properties.

Professor Flay: Is Mr Maxwell telling the truth about these seedlings, Mr Healy?

Mr Healy: Well, they do sometimes; but if the seed is blowing around nassella will come up anywhere.

Professor Flay: Well, we have got the nassella under control in the scattered patches. What about these densely infested areas in some of these gullies? What are we going to do about these, Mr Leonard?
Mr Leonard: Until we got on to chemical spraying, nothing could be done with this country except plant trees. The story is to kill the nassella with Dalapon. The dead nassella creates a good environment for oversown grasses and clovers. The job is done from the air, chemical spraying first, followed a couple of months later with seed and super.

Professor Flay: Do you use the same mixture on these hillsides as you do on the flat, Mr Leonard? I suppose you are using some Phalaris?

Mr Leonard: If I’m not, I should be. Usually there is white clover, possibly sub. and two or three grasses including ryegrass and cocksfoot. The ryegrass may not survive on the very exposed faces, but it does all right in the more favourable situations. When we have got more data on Phalaris we will be using a couple of pounds per acre.

Professor Flay: The Lands Department have had experience with this chemical oversowing method. How much does it cost?

Mr Watt: Forty pounds of Dalapon costs £9, the seed and super another £5 and the flying costs are £1/10/-, a total of £15/10/- per acre. That is the cost to the Government because of its scale of operations. The cost to the farmer would be nearer £30 per acre.

Professor Flay: How long will this chemically established pasture last, Mr Leonard? You can’t really compute the full cost unless you know when you will have to do it again.

Mr Leonard: Well, I am regarded as the author of the chemical spraying method, but I hope I am under no illusions as to how long the sown species will last on dry hills. Although we have picked the best species, the conditions are stacked in favour of nassella. Only by careful grazing and doing everything to nurse the sown species along can we extend the period before the pasture needs to be treated. We will also be able to extend the period if we find a chemical spray method which will allow us to kill out seedling nassella. Making a guess, I’d say that, in the absence of grubbing or selective seedling control, these pastures will have to be re-done again in about five years’ time.

Professor Flay: That means to say that the maintenance of one of these pastures is going to cost £3 a year. Mr Healy, how do you feel about it?

Mr Healy: Well, what exercises my mind is that we are oversowing the very species that let the nassella in in the first place, that is with the exception of Mr Leonard’s friend—Phalaris.

Professor Flay: What about the farm management side of looking after the area that has been chemically oversown?

Mr Watt: We have got definite ideas on this. We are going to stock it very lightly and with the emphasis on cattle rather than sheep. This has paid dividends at Glenbourne. We sometimes include Phalaris at two pounds to the acre. However, on one area at Glenbourne Phalaris was too successful! The stock, both cattle and sheep, have not taken to it as readily as the other species.

Professor Flay: In that case it will be smothering out the nassella!

Mr Watt: Well, it might surprise you, Professor Flay, to see a vigorous nassella plant growing right in the midst of rank Phalaris. However, to demonstrate the confidence we have in Mr Leonard, we have given him a sixteen-acre paddock which we have called “The Leonard Phalaris Hobby Horse Park.”
Professor Flay: I am worried about sowing of seed on top of this sprayed nassella. It seems to me a bit chancy under arid North Canterbury conditions. When do you sow and how risky is it?

Mr Leonard: Well, compared with ordinary oversowing on hill country, it is not as chancy. The dead nassella provides very good conditions into which to sow seed. We have figures to show that the moisture-holding capacity of soil under nassella is very much greater than usual. Usually the spraying is done in the summer and the sowing in the early winter. The results are quite reliable. Re-infestation is the big problem. Mr Watt did say that Phalaris was not as palatable as cocksfoot on one area at Glenbourne. I don't think we want a species that is too palatable. This is a disadvantage. Some species are going to be struggling to exist in any case and if you have a slightly unpalatable species then I think this increases its chances of remaining there and doing this job.

Professor Flay: Well, that sounds very encouraging, but I would have thought that tree-planting was the obvious answer. A mat of trees will check anything. I know we cannot forecast the values of trees in thirty or forty years, nor can we forecast the value of sheep products so far ahead. What do you think about controlling the nassella by putting in trees, Mr Hinds?

Mr Hinds: I think I covered the use of trees in my opening statement. Trees are controlling nassella. The results are not perfect—they have limitations—but we have an example of our own—fourteen years' experience—where the results can be seen.

Professor Flay: We are putting a great deal of trust in Mr Leonard and Mr Watt. Would it not be better to spread our risks by diversifying the use of our land? That steep hill country is not much use for sheep you know! What do you think of that Waipara country as a tree proposition, Mr Hinds?

Mr Hinds: I don't think you can neglect trees as a method of control, nor can you neglect any method of control. The people in control of the distribution of land have not given the Forestry Service any great area. It is only eight per cent. I think you should preach to them, Professor Flay, rather than to the Forestry Service.

Professor Flay: No, I want your opinion about these trees at Waipara, Mr Hinds.

Mr Hinds: The Waipara area is not a particularly good one for trees, it is a bit on the dry side; but we think that it is a practicable place for planting trees. If there was no nassella there we would still be interested in some of the land.

Professor Flay: What's the opinion of the Nassella Tussock Board, Mr Maxwell? You can give your own opinion if you like!

Mr Maxwell: The Board does provide a subsidy both for trees and for fencing where the farmer wants to plant trees. We have had trouble on some of these nor-wester country areas when the trees have been slow in striking. The tussock tends to regenerate and seed out. This seed is a menace to surrounding country. If there are no trees on a block at the time we can put the aeroplane across and stop the danger of seeding. But we have not been game to spray a nassella area that has been planted in trees nor have we had the labour to grub the tussock out. Consequently we have been coasting along with the tree idea. However, on the steep, heavily infested areas around Waipara I think it would be desirable to plant trees so long as spraying was continued to stop the nassella seeding until such time as the trees had formed a complete canopy. Trees also have the benefit of breaking nor-westers and therefore increase the moisture status of the neighbouring country giving extra growth over two or three weeks into a dry season.

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Professor Flay: Well, that's the Board's point of view. Would you recommend personally that individual farmers should plant trees with the help of the Board's subsidy?

Mr Maxwell: No, my opinion is that if a man has got two or three acres of badly infested gully then it is better for him to get stuck in on some cold frosty winter's day and over a period of years, by continuous grubbing, he will eventually get to the stage where it is only half an hour's work a year.

Professor Flay: Mr Gerard won't be too pleased with you. He wants wood-lots on farms. Farmers don't seem to be planting trees the way he would like. Anything more on that, Mr Hinds?

Mr Hinds: I think the grubbing problem has been grossly underrated. You can go on for years and years. If you have trees you are growing an asset. They are gradually winning the fight, while possibly you are not with grubbing. Take the parts in Marlborough for instance. Marlborough is less heavily infested than Canterbury and the situation is thought to be quite well under control, but last year their grubbing bill was more than it was the year before. Is that realised in North Canterbury?

Mr Maxwell: I think the North Canterbury Nassella Board are quite well aware of this problem which is facing them, too. I think the reason for this is that the seeds have been blown around over many years from these densely infested areas. They are hard seeds and lie dormant for several years and now they are starting to give trouble.

Professor Flay: Mr Watt, what do you think about trees? Your Department has just handed over 1,700 acres to the Forestry Service.

Mr Watt: Not being of an acquisitive nature, I am very happy to share the spoil with Mr Hinds, even if the ratio is 8 to 92. Provided adequate safeguards are taken both before and after planting, I will welcome Mr Hinds as a neighbour, particularly now that he has announced his good neighbour policy. This problem of grubbing versus trees is one of relativity. Mr Maxwell is to be highly commended for the work he has done on his own property where he has proved that grubbing is effective. But if the nassella gets to a certain stage then I think the economic balance would tip in favour of trees.

Professor Flay: Well trees obviously have a definite place in controlling nassella. I personally like the trees because I don't like grubbing nassella. What do you do, Mr Maxwell, in the case of a farmer like myself, who wouldn't do a thing about nassella. You would send me instructions to grub, you would send your gang around and I wouldn't pay the bills and so on. What would you do to me, Mr Maxwell?

Mr Maxwell: We have had cases like yours before! We do a bit of sabre rattling and the drums roll. Mr Foley writes the odd letter and months drag on. In many cases the tussock appears to be going to seed, and, as a last resort the Board safeguards the national interest and steps in. In some ways the Board and the taxpayer appear to be a "Father Christmas" to some farmers because a considerable sum is spent on some places, not to save that farmer or to help him, but to safeguard the whole district from the seed. We have got the power to serve a notice and force the farmer to do the work to which he has the right of appeal if he likes. If he refuses to pay his account then under the Act we can register this against his title. Now that is not a pleasant thing to do and nobody likes to do it. We have done it only once but I must say that so far as bringing other farmers into line it was one of the best things we ever did.

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Professor Flay: How many are there like me?

Mr Maxwell: Only two or three.

Professor Flay: We have heard the story, Mr Watt, that people in the Nassella North Canterbury area cannot get loans on their farms so they are in a tight spot financially. Would the Marginal Lands Board be interested in helping these people like me who have not got any money but who have changed their attitude towards nassella? I want to get rid of it now, would you give me a Marginal Loan?

Mr Watt: My heart would bleed for you! Owing to the reluctance of other lending institutions the Marginal Lands Board takes a very liberal view of these people in the nassella area. We have granted three loans.

Professor Flay: Does that mean to say that more loans would be granted if people asked for them?

Mr Watt: Well, all I can say is that none have, as yet, been turned down.

Professor Flay: It is nice to know that Mr Watt will look after us if we cannot get money elsewhere, but wouldn't I be better off to sell my land to the Crown, Mr Watt? Would you be interested in buying any more farms?

Mr Watt: I trust it will not be necessary to buy any more farms. I think it is well within the capabilities of the farmers and the Board to control nassella.

Professor Flay: So it is only the nucleus areas which the Lands Department take over and these you have now acquired?

Mr Watt: That is correct.

Professor Flay: I suppose having acquired all these thousands of acres, Mr Watt, you will sooner or later be putting them up for settlement by young farmers?

Mr Watt: That's the long term objective.

Professor Flay: You wouldn't expect to recover all your costs would you?

Mr Watt: I'd like to change places with you and ask you that question! Provided the would-be settlers have enough patience and give us enough time, then I think that the immense costs can be substantially recovered. I am sure we can easily double production by regular oversowing and topdressing on the non-arable areas and on the 6,000 acres of arable land. I am quite convinced that we can increase this from two-thirds of a ewe to the acre to at least three ewes per acre.

Professor Flay: I agree, having inspected the area. This control is a tremendous problem Mr Healy, why don't we just let it go as we did with the gorse?

Mr Healey: This would be committing agricultural suicide. We are going to have the problem with us for a very long time and we have got to live with it because of the long life of the seed.

Professor Flay: What's the position about control in Australia, Mr Leonard?

Mr Leonard: Well, in Australia they have adopted the philosophy of having weeds in the gullies and pasture elsewhere and trying to control nassella with a good farm management just as we do with other weeds. It is not working very well, because nassella seeds so freely and competes so well in dry climates. When Mr Maxwell and I visited Australia we attended a farmers' meeting in a nassella area and the farmers were obviously very dissatisfied with the "live and let
live' policy. They are coming to the conclusion that while you may be able to live with other weeds you can't live with nassella.

Professor Flay: We have made great progress in getting the nassella under control in the nassella districts of North Canterbury and Marlborough as you can see. There is, however, one very important further point. Some seed has spread to other parts of New Zealand. It must not be allowed to spread further. What are you going to do about this, Mr Leonard?

Mr Leonard: Well, the first thing we do is to educate people. They must be able to recognise the plant and realise its dangers. Noxious Weeds inspectors are doing a very fine job in this respect. When an infestation does turn up outside the Board's area, then it is the local body's responsibility, if it is already administering the Noxious Weeds Act, to get busy. So far as the Department of Agriculture is concerned, we have a small mobile team for searching new areas to see how far the infestation has gone. Unfortunately there is only one small team for the whole of New Zealand. This team has helped in the early control work until such time as the local authority gets into gear.

Professor Flay: Following that then, if I have a clean farm in the district and then find that, on a neighbour's place half a mile away there is nassella, what action can I take to see that the seed doesn't spread on to my place?

Mr Healy: Put the heat on the next-door neighbour and get him cracking smartly. If the local body is administering the Noxious Weeds Act I'd get on to them too, to see that they have nassella declared a noxious weed.

Professor Flay: Any comments to make about these areas outside the Board's district, Mr Maxwell?

Mr Maxwell: To me, as a farmer, I am very conscious of the fact that we are getting an increasing number of people going around telling us what to do or showing us how to do it. Now in Victoria Bill Leonard and myself were very impressed with these Pastoral Protection Units which the Victorian Government have brought into being. They have combined the Noxious Weeds and Noxious Animals Act and I feel sure that sooner or later in this country we are going to have to bring our Noxious Weeds Tussock Control and our Rabbit and Vermin Control measures under one administrative heading. We would have Pastoral Protection officers going around and making sure that when nassella shows its head in the upper waters of the Rakaia that it is not allowed to get out of control and outflank the activities of the North Canterbury farmers. At the moment it is giving me very great concern that we are spending £200,000 a year to bring this weed under control in North Canterbury and we are not fully convinced that it is controlled in outside areas.

Professor Flay: Now I would like to throw this discussion open to the floor.

Question: How much seed on a per acre basis does nasella produce?

Mr Healy: The weight of seed from a nassella plant is equivalent to a 27-bushel crop of wheat.

Question: Chemical oversowing was first tried on the Wrekin property at Marlborough. What are the results there?
Mr Leonard: There has been no seed produced on it for the last five or six years and the results have been fairly satisfactory. The technique has been improved slightly since then. However, there is a very considerable annual maintenance grubbing bill on the Wrekin.

Question: What effect has the so-called selective seedling control have on pasture species?

Mr Leonard: This is something that I have high hopes for but it has not reached the stage where I have used it over a sufficient number of years to give guarantees for it. To be successful it must kill out seedling nassella and not harm the other pasture species to any great extent. We cannot recommend it yet.

Question: There is a great difference between the cost of Dalapon for the Lands and Survey Departments to kill their tussock and the prices charged the ordinary farmer. Why is this?

Mr Leonard: The Board and Mr Watt use Delapon in such large quantities that they are able to call tenders. They get it at "bed rock" prices because they take such large amounts. They take it from the ship's side and so there are no storage costs. The firms don't have to provide technical advice. The Board and the Lands Department get that from us instead. This is the reason why they get it at a lower cost.

Question: Should there be control over the movement of stock from nassella areas to combat the spread of seed?

Mr Maxwell: The effectiveness of this quarantine method would have been very successful 20 years ago or even five years ago, but the Board and the Department of Agriculture have now come to the conclusion that, now there is not supposed to be any tussock seeding in the area, then there is no point. There is no need to bring in restrictive regulations of this kind unless you have to.

Question: What is being done about the control of nassella tussock on unoccupied Crown land in the Rakaia Gorge?

Mr Watt: There is a small infestation there on the river bed which is being dealt with effectively in the normal way.

Professor Flay: I would now like you to join with me in showing your appreciation in the usual way to these five gentlemen who have done their jobs magnificently. (Applause.)
## APPENDIX
### SUMMARY OF LANDS AND SURVEY DEPARTMENT'S OPERATIONS ON NASSELLA TUSSOCK BLOCKS IN NORTH CANTERBURY (from March, 1962, to 31 March, 1963).

<table>
<thead>
<tr>
<th>FARM SETTLEMENT</th>
<th>CHEDDAR VALLEY</th>
<th>CORINGA</th>
<th>TIROMOANA</th>
<th>WASH-CREEK</th>
<th>TOTALS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area (acres)</td>
<td>9,556</td>
<td>3,492</td>
<td>4,738</td>
<td>2,142</td>
<td>19,928 acres</td>
<td>Excl. 1,340acs. of Tiromoana, 100acs Washcreek and S.C. Stokes' property of 438acs. purchased on behalf of N.Z. Forest Service. N.T.B.</td>
</tr>
<tr>
<td>Arable (acres)</td>
<td>1,800</td>
<td>1,450</td>
<td>2,200</td>
<td>750</td>
<td>6,200 acres</td>
<td>*N.T.B.</td>
</tr>
<tr>
<td>Kill-spraying (acres)</td>
<td>700</td>
<td>400*</td>
<td>2,500</td>
<td>640</td>
<td>4,240 acres</td>
<td></td>
</tr>
<tr>
<td>Seed control spraying (acres)</td>
<td>—</td>
<td>12*</td>
<td>—</td>
<td>—</td>
<td>12* acres</td>
<td>*N.T.B.</td>
</tr>
<tr>
<td>Seedling spraying</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Grubbing (man hours)</td>
<td>8,100</td>
<td>2,000</td>
<td>800</td>
<td>1,300</td>
<td>12,200 man hrs</td>
<td>N.T.B.</td>
</tr>
<tr>
<td>Oversowing and top-dressing (acres)</td>
<td>2,100</td>
<td>620</td>
<td>—</td>
<td>600</td>
<td>3,320 acres</td>
<td></td>
</tr>
<tr>
<td>Topdressing (acres)</td>
<td>3,400</td>
<td>200</td>
<td>1,000</td>
<td>600</td>
<td>5,200 acres</td>
<td></td>
</tr>
<tr>
<td>Clearing (gorse, scrub, etc.) (acres)</td>
<td>50</td>
<td>500</td>
<td>—</td>
<td>—</td>
<td>550 acres</td>
<td></td>
</tr>
<tr>
<td>Cultivating and sowing (acres)</td>
<td>—</td>
<td>800</td>
<td>1,560</td>
<td>500</td>
<td>2,860 acres</td>
<td></td>
</tr>
<tr>
<td>Roading and tracks (miles)</td>
<td>2</td>
<td>7½</td>
<td>13½</td>
<td>2</td>
<td>25 miles</td>
<td></td>
</tr>
<tr>
<td>Fencing (miles)</td>
<td>1½</td>
<td>4½</td>
<td>5</td>
<td>—</td>
<td>11½ miles</td>
<td></td>
</tr>
<tr>
<td>Electric fencing (mls)</td>
<td>1½</td>
<td>—</td>
<td>4</td>
<td>2½</td>
<td>7½ miles</td>
<td></td>
</tr>
<tr>
<td>Building</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Dwelling, woolshed, men's qtrs</td>
<td></td>
</tr>
</tbody>
</table>

Other: 1 cattle yd 1 sheep yd 1 cattle yd 3 cattle yds and 1 sheep yd

| [Ewes] | 5,520 | 2,710 | 2,646 | 1,414 | 12,200 |
| [Ewe hoggets] | 1,200 | —     | 888   | 550   | 2,618 |
| [Other] | 220   | 107   | 110   | 206   | 643   |
| **Stock** |   |   |   |       |   | **Ratio: 12.56 to 1** |
| Run cows | 400   | 107   | 180   | 44    | 731   |
| Heifers   | 47    | 76    | 83    | —     | 206 |
| Other     | 41    | 51    | 167   | 42    | 301   |
| **Hoggets** |       |       |       |       | 1,238 |

| **Sheep** |       |       |       | 15,551 |   |
| **Cattle** |       |       |       |       | 3,056 |
ANIMAL TREADING AND PASTURES

D. B. Edmond, Senior Scientific Officer, Grasslands Division, D.S.I.R., Palmerston North.

Preliminary

An animal exerts three main influences in pasture—it treads, removes leaves (defoliates) and excretes upon it. In view of past work it is undeniable that removal of leaves and excretion of dung and urine can be of overriding importance in pasture management. In contrast, the effects of treading have been overlooked and underestimated.

This situation was highlighted in the early 1950s on a 30-acre dairy farmlet run by Grasslands Division and Massey Agricultural College. There an attempt was being made to test a calculation made by Dr P. D. Sears, Grasslands Division, which indicated that good pastures under good stocking should produce at least 500 lb butterfat per acre. In fact, despite great care and the development by Sears of the “sacrificial paddock” wintering system, production remained consistent about 350-370 lb B.F./acre/annum. All replacement stock was, however, also carried on this area. The late Mr E. O. C. Hyde was in sympathy with Sears’ hypothesis, but after an independent appraisal of the farmlet conditions he suggested that animal treading was much more important than realised. Research on treading then began at Grasslands Division.

For the sake of completeness an up-to-date version of Sears’ calculation follows:

Highly productive pasture growing 15,000 lb dry herbage/acre/annum can represent 9,000 lb of Starch Equivalent. If 70 per cent of this is actually used by grazing animals then 6,300 lb S.E./acre/annum will be utilised.

A cow of 8 cwt bodyweight needs a total of 4,980 lb S.E./annum for maintenance, production (350 lb B.F.—milk 5 per cent test) and reproduction.

Thus, in theory, the above pasture could carry 1.3 cows and produce 445 lb B.F./acre/annum. If utilisation is 90 per cent efficient it should be possible to produce 570 lb B.F./acre/annum.

This calculation is a theoretical one, based on the best information available. While it does not take into account seasonal effects it does indicate very clearly that farmers waste pasture, and, also, the extent to which efficient utilisation of grass can improve production per acre.

At this point it is worth noting, that with a fuller awareness of treading effects, the Massey Dairy Unit has produced more than 400 lb B.F./acre/annum in two successive years.

Research Technique

Limitations of space prevented the use of cattle with the result that Romney sheep have been used. It was assumed that one of these sheep would walk about 1 ½ miles per day while grazing highly productive pasture, and one acre can measure 1 ½ miles long x 4 ft 9 in wide. Thus, if a sheep walked straight down this long acre once each day, we could, in the fullness of time, say that the pasture had received treading equivalent to that done by one sheep per acre set stocked.

Clearly all that was required was a sample of the long acre (25-50 ft length is used) and an adjustment to width so as to accommodate body overhang on the sides (width used is about 5 ft 4 in). The
rotational grazing approach is used, which helps in the sampling of the pastures. All herbage is removed before the sheep enter the plots in order to prevent them from removing leaves. The deposit of dung and urine is small as the sheep are on any one plot for perhaps 10 minutes each three weeks or so. There it is then—a plot of pasture measuring say 40ft x 54ft, fenced on two sides, grass mown and removed, trodden by moving mobs of sheep up and down, then left to recover and grow.

Research Work

The first need was to measure if experimental treading would cause effects in pasture. To do this a four or five-year-old pasture of short rotation ryegrass and red and white clover was trodden experimentally with sheep, when the soil was moist in early spring. Twenty-eight days later the date of measured recovery growth were:

- Not trodden: 100
- Trodden by four sheep equivalents: 88
- Trodden by eight sheep equivalents: 68
- Trodden by 20 sheep equivalents: 34

Thus a highly productive rye-clover pasture had been damaged by even the lightest treading.

The second need was to discover whether changes in the soil could influence grass growth directly. With the local silt loam soil it was found that compaction, within normal limits, did not influence grass growth—but where structure was destroyed and the soil worked up into a slurry the growth of ryegrass was greatly reduced (probably because soil air became deficient).

Essentially, the results accumulated over the past eight years have supported these earliest findings, but remember that so far only established and highly productive ryegrass-clover pastures have been used in the experimental work.

It has become very clear that both plant and the soil must be considered together if animals are to be fed adequately and profitably.

General Result

Inspection of any trodden pasture reveals torn and bruised leaves and stems, the effect being one of a very severe defoliation. In the summer, under high temperatures, a pasture damaged in this way seems less likely to survive than in the spring, etc. Where the soil is moist and soft, leaves may be buried, plants are more likely to be torn apart and root damage may be extensive. The latter is especially prominent where the soil is wet when trodden. The net result is that treading reduces plant numbers and has the effect of slowing their rate of growth during the early stages of recovery. Pasture thus damaged never catches up with undamaged growth, and the annual production suffers accordingly.

Dry soil is little affected save that the surface soil is pulverised and constitutes a problem when rain washes the dust into unclogged pores. In moist soil, compaction increases and it is possible that exclusion of air will permit the soil water to lubricate the particle faces and thus lead to puddling. Puddling normally occurs in wet soils and is the direct cause of deficiency of soil air in both quantity and quality. Also compacted and puddled soil is not easily penetrated by roots or worms.

The above occur to different degrees, wherever stock graze pasture.

Particular Results

A. A pasture must be physically capable of supporting animal traffic, and as such soil stability is of prime importance. Stability depends on soil type, structure, moisture, fertility, etc., and some pertinent data follows:
Soil Type. Similar ryegrass-white clover pastures on two different soil types about 300 yards apart were trodden experimentally with ten sheep equivalents. The soil was moist and conditions were similar in each situation. Measured regrowth was as follows:

Manawatu fine sandy loam: Not trodden = 100, trodden = 87.
Kairanga silt loam: Not trodden = 100, trodden = 61.
The Manawatu fine sandy loam is a stable soil.

Soil Moisture. Similar 10-year-old perennial ryegrass-clover pastures on Kairanga silt loam experimentally trodden with six sheep equivalents gave regrowth data:

Not trodden = 100, six sheep on moist soil = 81, six sheep on wet soil = 61.
The difference between moist soil and wet soil could have been avoided by delaying the wet soil treadings by only 6-12 hours, when free water could have been drained away.

Soil Structure. Experiments on two adjacent areas of the same soil type but different structure gave the following regrowth data when trodden with the soil moist:

Not trodden = 100, 12 sheep on poor structure = 80, 12 sheep on moderately good structure = 54.

Soil Compaction. The surface soil, as in a gateway, can be compacted until plants can no longer grow in it. Much of this effect can occur in any pasture if it is trodden heavily when the soil is moist. Soil pans have been noted in some places due to animal treading, and these have restricted root growth.

Soil Fertility. Intermingled, similar plots of ryegrass-white clover pastures have been equally trodden at two different levels of fertility. Regrowth data is:

Not trodden = 100, 16 sheep on medium fertility soil = 67, 16 sheep on high fertility soil = 78.
The reduction in yield under high fertility is probably more important because it is greater in quantity. If the high fertility pastures had been trodden more heavily than the rest as normally would be the case, the loss of production would have been the greater.

B. Plants are of great importance in this work, because some have good treading resistance.

Plant Species. Perennial ryegrass has proved to be outstanding in that it is relatively very resistant to treading damage. Short rotation ryegrass was not quite so good, and timothy was possibly the best of the rest (growth a little slow though). *Poa pratensis* (Kentucky bluegrass) withstood treading well, as it grows by underground shoots, but it grew too slowly. Yorkshire fog and cocksfoot were the poorest grasses tested, while white clover was clearly better than red clover and compared well with perennial rye in the summer.

Plant selection. Limited evidence suggested that treading selects out plant populations, which suggests that repeated heavy treading will shift the plant type towards a treading resistant strain.

Plant Height. By mowing a perennial ryegrass-clover pasture to two heights and treading it equally, regrowth measured of ryegrass expressed as percentage of total herbage was:

1 inch height: Not trodden = 62%, 16 sheep = 65%,
Relative total yield = 100.

2 inch height: Not trodden = 63%, 16 sheep = 81%,
Relative total yield = 86.
If we bear in mind that some sheep pastures are always short, it is obvious that the above results apply particularly to the experimental pastures used.

C. Treading effects have altered with season, the greatest effects being in the winter when the soil was wet, while the least effects were in the spring when growth was vigorous. BUT—treading effects were sufficiently large as to be important throughout the year.

Kind of Animal. Sheep have been used throughout this work. In one experiment on a uniform ryegrass-white clover pasture, equivalent sheep and cow grazing was compared. In the short term the cows were the more damaging, but there was clear evidence that in the long term this extra damage would have produced a large effect. Thus, I conclude that the results quoted would have been even more alarming had cows been used.

Other Considerations. In high quality pastures it seems clear that hoof damage must be restricted at all times. On poorer pastures, as are more common, it is possible that hoof damage reduces poorer weed grasses and helps to improve the overall pasture quality. It also seems likely that high quality pastures need some treading to maintain the right species in good proportions. Thus, it is clear that every farmer must judge his own situation for himself.

Practical Extensions. It seems sensible to prevent any idle walking which animals do, and to avoid untimely treading of pastures (wet weather, frosts, etc.) at all times. To date this general idea has been accepted by very few people. However it is fortunate that considerable number of farmers have become more aware of its implications during the winter.

The Massey University College dairy farm supervisor, Mr I. McQueen, accepted the idea and planned the investigation of two different wintering systems. (a) Set stock half the farm and feed hay to appetite. (b) Ration graze half the farm by giving grass for two hours each day, self feed silage to appetite, hold cows in a holding paddock or on a concrete block (when the soil is wet). In one spring the undisturbed recovery growth of the (b) series pastures which had been winter grazed, was 30 to 40 per cent greater than those of the (a) series. In practice the (b) series pastures were grazed two to three times for one grazing of the (a) series, most of the latter being oversown subsequently. Cow weights were similar in both treatments at start and finish. Unfortunately, production records were not kept. It seemed that, in the Manawatu, cows may need to stay on concrete for about 20 days each year. Transference of fertility may prove to be important.

Farmers have secured good results using concrete block systems, examples being:

1. 53 cows and 13,000 lb butterfat without a block. Next season (a poorer one) 58 cows and 15,200 lb butterfat with block.

2. 115 cows on 170 acres plus winter run-off, then after three years use of a concrete block—154 cows on 170 acres without run-off.

Mr C. P. Harris, production officer, N.Z. Milk Board, has stated that where a concrete block system is used, it is usual for cows to be less restless, and even more thrifty; pasture damage is less, pasture management improves; less hay or silage is wasted and less is required; less labour is needed; production and stocking rate increase. As the long term effects of this approach are not known, it should be considered carefully, in the light of the particular circumstances of each farm.
As a conclusion I will restate some of the points made and suggest practices which might be incorporated in a farming system.

Undamaged pasture plants produce more herbage than can damaged plants, and consequently damage must be controlled. Controlled defoliation can have a long term beneficial effect by maintaining plants in a productive, vegetative state. Controlled treading is probably at least as important. However, ryegrass-white clover pastures appear to need some treading so as to grow vigorously and free from weed grasses and other weeds. Thus “zero grazing” of pastures, which also involves damage by tractors, transfer of fertility, etc., seems to be fraught with problems.

Suggestions follow, for use where pastures are of high quality.

1. Daily, admit cows to pasture only for the period necessary for the intake of their requirements. Dr. L. R. Wallace, Ruakura Animal Research Station, has indicated that four to six hours per day is all that may be necessary.

2. Daily, use an electric fence, before and after the animals, around an area calculated to carry sufficient herbage for one day’s feeding.

3. Daily, concentrate unnecessary walking on a concrete block or loafing yard. A holding paddock may be useful if cropping is necessary.

4. When the soil is either very wet or very dry, maintain the cows, as much as possible, on concrete by feeding silage, hay or concentrates.

5. When pasture growth is too great, maintain pasture vigour and quality by making silage at any time of the year.

6. Reduce tractor traffic to a minimum.

7. Select placid animals which walk little as they feed.

The related problems of fertility transfer and of disposal of wastes must be considered. There are many problems connected with animal treading, all of which point to the need for considering treading as an important influence in all pastures.

Chairman: Would Dr Corkill care to comment on the less vigorous growth of cocksfoot progeny when tillers taken from these parent plants that had undergone “treading” treatment, were grown under artificial hot-house conditions?

Dr Corkill: I do not think the differences shown were due entirely to treading. Some change in actual pasture species composition of a pasture can be caused by treading and in time one may get a change within a species. With cross fertilised plants it is possible to obtain wide variations or strain differences within a species and this would affect the growth form. There will, however, probably be differences in the reaction of plants to treading.

Q.: Have you ever tried grass harrows to open up the soil?
A.: No. Some people do this and obtain a response in pasture growth but others obtain no such response.

Q.: Is there any effect of treading on subsequent cultivation?
A.: Yes and no. There is evidence that treading reduced the growth of chou moellier because of pan formation and the farmer not working the soil deeply enough. Other paddocks that did not undergo such treading treatment did not have this pan.

Q.: How wet should the paddock be before I take my cows off?
A.: A farmer should know by experience. You probably know already. If a farmer has not the experience to decide when to take cows to the concrete, then it would pay to seek advice of the Farm Improvement Club advisor. I can’t see how farmers can afford not to be a member of a F.I.C.
SOME METHODS OF AVOIDING TREADING DAMAGE TO PASTURES


On soils not subject to treading damage the results of stock treading in the winter may be beneficial and combined with the consequent heavy dressings of stock residues may actually lead to pasture improvement. This is particularly so with browntop or paspalum dominant swards. But over a large part of the country treading damage is a real problem.

Several grazing techniques are in use to help avoid this pasture damage.

The first of these is extensive grazing where the herd is paddock grazed in large paddocks to avoid a heavy concentration at any one time. This method is adopted in really wet country and is not normally associated with heavy stocking or high production.

The second method, used when break grazing, is to use a back fence so the cows can't return to trample pasture which is already short and vulnerable to damage. If a wet day occurs then the damage is confined to the break being used, but damage may be severe on this small area.

The third method, designed to overcome the above problem, is to give a much larger break on wet days so that when the cows have eaten their requirements there still remains a fair cover of grass which seems to act as a cushion in helping prevent excessive hoof damage. Farmers are diffident of using this method as it seems wasteful of grass at the time, but in the long run actually more grass is utilised from that area. This method is useful only for brief wet spells in an area with soil that normally will carry stock without severe pasture damage.

The fourth method has become popular as a method of wintering in some districts and is known as the "split-herd" system. The herd is divided up into a number of small groups which are set-stocked at about two to the acre in a number of paddocks. This method relies on the fact that a small mob does less wandering and less concentrated trampling, a feature particularly noticeable when feeding out.

If a 100-cow herd is in a five-acre paddock the whole herd comes to the gate when they see or hear the tractor coming, then the whole herd follows the tractor as the feed is thrown out. A large number of hooves is trampling over a relatively small area.

If this herd is now split up so that only 10 cows are left in the five-acre paddock there are only 10 cows to walk to the gate when they hear the tractor, and only 10 to follow the tractor to get their hay and silage.

Using this same rate of stocking: five cows in a two and a half acre paddock have less distance to wander and two cows in a one-acre paddock would have less distance still.

Let us imagine the entire 100-cow herd is split between 50 paddocks each of one acre with two cows in it. Now even if all cows walk in the direction of the tractor when they hear it coming, they can walk only a few yards before they come to a fence. This would reduce the amount of walking and consequently the amount of pasture damage.

If the herd is split into small groups the mob instinct doesn't have a chance to operate. The example of two cows in a one-acre paddock is, of course, an extreme one but it does illustrate the reason for the
benefits of split herd wintering. A larger proportion of the farm is used for wintering but it comes away more quickly afterwards so the need for a large area of saved pasture is reduced.

So much for avoiding pasture damage by the method of grazing alone. Now let us consider some of the devices which are being used to assist in avoiding treading damage to pasture.

Structures to Assist in Avoiding Pasture Damage

We have prided ourselves in this country on our system of dairying which keeps the cows out of doors, on pasture, all the year round. It is true our equable climate which makes this possible is still our greatest asset and is the major factor in our low-cost production.

Why is it then that with prices considerably lower than they have been in the recent past, many thousands of pounds are being spent on structures designed to keep cows off pasture at certain times of the day or year? The cause is probably a combination of the following:

(a) Better knowledge which has enabled us to increase pasture growth so that stock numbers could be increased to the stage that pasture damage is more likely to occur.

(b) Better knowledge which now shows the advantages of these structures in certain conditions.

(c) Lower prices for dairy produce no longer allow us the luxury of imagining that over the whole country conditions are such that we can keep cattle on pastures all day, every day of the year, and still obtain maximum production.

This is not to say that money spent on these structures is always a good investment. It isn't, and in some cases may be money wasted. The building of such a structure must take its place in the list of priorities for work and expenditure.

Pastures should be productive, subdivision and drainage should be adequate and races must be good before thought is given to spending money in this way. "First things first" is a good motto in farming and the successful farmer decides which things are limiting his production and then deals with them in the sequence which will give the greatest increase in production or the greatest increase in net income.

These structures for assisting in overcoming treading damage to pasture have been in use for a comparatively short time in the North Island so new ideas continue to appear. But the different types fall into two main groups.

A. Those used for part of the day to feed supplements to cows in milk.

B. Those used for wintering dry cows. (These, of course, could also be used for feeding cows in milk after calving if needed.)

A. Feeding Cows in Milk

The use and economics of feeding sheds for town milk supply is being dealt with elsewhere on this programme so I will consider only feeding platforms. These can be a great benefit to the farm on a wet country whether it is supplying for town milk or manufacturing, and can be built fairly cheaply. Various types have been built for a cost of £3 to £6 per cow.

If the feed is in a fixed place the cows must come to it, and as they come to the milking shed twice daily, it seems logical to locate the platform near the milking shed or at least on the race leading to it. The herd can then obtain its hay or silage on the way to and from milking.
The reduction in trampling of the pasture is much greater than would be expected from the relatively short time the cows are off it. This is because the cows go back to the paddock contented after a feed and don't rush about the way they do when feeding out is taking place. In addition the tractor is not taken into the paddock and this reduces pasture damage considerably. Some farmers have allowed access to the race through the day so cows can help themselves. I have stressed the reduction in pasture damage and indeed this is the subject being discussed. But experience shows an additional benefit in the considerable saving in supplementary feed when it is fed in racks or troughs. None of it is lost by being blown away, fouled by dung or trampled into the mud.

Consider now the experience of a Papakura farmer with 85 acres of very heavy soil, and a run off for dry stock, milking about 65 cows all year round on town milk supply. He built a 24ft x 80ft slab of concrete on his race and the cost of this together with steel hay feeding racks was £270 or about £4 per cow. As part of this concrete forms a section of the race some of the cost could be legitimately debited to that.

The feeding platform was used in winter in the following way. Pasture was being break-fed to the cows and they were spending an hour both before and after the evening milking at the hay racks, as well as remaining there after morning milking until the middle of the morning. With this routine they were off the pasture for about five hours a day, but if the paddocks were very wet after heavy rain the cows spent even more time on the concrete.

It might be assumed that under such a system the cows would eat vast quantities of hay but this doesn't seem to be the case. Experience has shown that generally less hay is required but as none is wasted the cows obtain more benefit than from the same amount fed in the paddock. In this case it was found that the amount of grass provided governed the quantity of hay eaten each day. In this case it was found that the amount of grass provided governed the quantity of hay eaten each day. So the consumption of hay was used as a simple guide to determine whether the size of the grass break was adequate.

Cleaning of the platform was carried out at 10-day intervals. There was a small increase in milk production during this period. But during this first winter no silage was needed so this was carried over for use later. With the reduction in winter pasture damage more grass was grown the year round and as a result of this and the unused silage, it was found necessary to follow the usual practice on this farm of growing a crop for summer.

Lack of pugging damage through the first winter was marked and the second winter of operation showed even greater benefits. This was particularly a wet winter in the area. The tractor was not on the paddocks from June until nearly October and in the spring no harrowing or rolling of pastures was required to smooth them as had been the case before the feeding platform was built. This wet winter was followed by a dry summer but once again summer crop was not grown and not needed. Dispensing with cropping has resulted in considerable savings in time and money.

Even such a relatively cheap and simple structure soon proved its worth, soon paid for itself and has obviously raised the potential carrying capacity of the farm. It is clear that larger numbers of stock could now be carried before pasture damage again became a major limiting factor. Many similar success stories could be told.

B. Wintering
1. Using a feeding platform.
A simple feeding platform as already described has been used for wintering where the herd was being fed grass and hay. This
herd was wintered in two halves with half the cows spending the morning on the platform where their hay was fed. Their place was taken by the other half of the herd in the afternoon. With this system the cows were off pasture for four hours out of the 24 but even this resulted in a worthwhile benefit. In this case the use of the feeding platform allowed the farmer to dispense with a run-off he had previously found necessary.

2. Using a wintering barn.

Relatively few wintering barns have been used so far but many are being built where conditions warrant it. They are, of course, much more expensive than a simple feeding platform and consist of a loafing barn and feeding yard, this being known as the loose housing system. In this way the cows can be kept completely off pasture for prolonged periods or even for the whole of their dry period.

The problems of providing sufficient supplementary feed at the one place and of cleaning a set-up where the cows are confined for several weeks are, of course, quite large and these factors together with the cost involved mean it is only justified on farms where soil conditions are really bad.

Let's look at the case of one farmer at Wellsford in Northland. Much of his farm consists of soil that is really wet, so that even on a considerable slope it doesn't drain and pugs very badly with excessive stock treading.

The farm is of 205 acres of which 180 are in grass. Less than 100 cows were being run and it seemed that the benefits of increasing the herd size might be nullified by the extra damage larger numbers of stock would cause to the pasture.

At this stage it was decided to adopt a loose housing system based on 30 square feet per cow in the barn and 60 square feet per cow in the feeding yard. The floor in the barn is earth covered by sawdust. The yard was limestone the first season but has since been concreted.

A clamp of silage for self-feeding is made along one edge of the yard.

Cost

Savings in building costs were made by using home-grown timber and a proportion of the corrugated iron was used material already on the farm. In addition about £70 was saved on cartage by using the farm truck.

Actual costs (excluding labour costs) are shown below, the figures in brackets being the estimated costs if all timber and iron had been purchased and if cartage costs had been paid.

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
<th>Estimated Cost</th>
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<tbody>
<tr>
<td>Cost of shed (100ft x 30ft)</td>
<td>£350</td>
<td>(£500)</td>
</tr>
<tr>
<td>Cost of yard (100ft x 70ft)</td>
<td>£600</td>
<td>(£670)</td>
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</table>

£950 (£1170)

Feed

The only feed used is silage and this is self-fed from a clamp 70ft x 20ft x 6ft. While the grass all has to be brought to this central point at silage making time, feeding out is now much easier than previously as it consists merely of pushing the electric fence standards a few inches into the silage each day.

The herd enters the shed when dried off about mid-May and cows remain there until they calve. This means later calvers are in the shed for a long period, some cows having remained there for 11 weeks.

The amount of supplementary feed saved on this farm is practically the same as before the increase in stock numbers which accom-
panied use of the wintering barn. This indicates a saving in supplementary feed of approximately 30 per cent, but it may be more realistic to expect a saving of about 20 per cent as this has been more commonly achieved. The saving is probably due not only to the reduction in waste, but also to the fact that the cows are sheltered from the weather and do not have to exercise hard to obtain their food. Their requirements may thus be lower than if they were wintered out.

Yard Cleaning

A blade on the tractor is used to push the dung over a ramp to form a heap which is carted out in summer. This material is then loaded with a front-end loader and spread with the tractor blade on a paddock to be resown to grass in the autumn.

Moving the electric wire and scraping the yard takes about half an hour each day.

Effects on Stock Numbers and Production

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<th>Cows</th>
<th>Yearlings</th>
<th>Cow Equivalents</th>
<th>Butterfat</th>
</tr>
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<td>Season prior to use of barn</td>
<td>90</td>
<td>25</td>
<td>98</td>
<td>33,000</td>
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<tr>
<td>First year using barn</td>
<td>104</td>
<td>31</td>
<td>114</td>
<td>34,000</td>
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<tr>
<td>Second year using barn</td>
<td>117</td>
<td>56</td>
<td>135</td>
<td>37,000</td>
</tr>
<tr>
<td>Third year using barn</td>
<td>113</td>
<td>60</td>
<td>133</td>
<td>37,000</td>
</tr>
</tbody>
</table>

Not only has butterfat production improved but because of the large number of young stock carried, stocking rate has increased even more than the increase in butterfat production would indicate. It is felt that most of this increased production is due to use of the wintering barn and that without it the present level of production could not have been reached.

For the general pattern of a wintering barn it has been felt that unless the yard area was twice as large as that allowed in the shed and unless soft bedding was provided in the shed, troubles would occur. Such barns have been built for a cost of between £10 and £25 per cow, but these requirements may now be open to question.

Last season one Hauraki Plains farmer wintered his herd in enclosed bays attached one on either side of the hay shed. There was no outside yard, the cows feeding and sleeping in the same area which provided only 20 square feet of bare concrete per cow. Seeing is believing and the success of this pioneer has led to several similar outfits being built for this winter. Their progress will be watched with interest for this design, if further experience confirms that it is satisfactory, would be considerably cheaper than that at present recommended.

Conclusion

The wet heavy nature of some soils renders them liable to treading damage which reduces carrying capacity by reducing pasture growth. Many farmers in these circumstances have in the past raised production by getting the herd away to a run-off for their dry period. All too often this has meant sacrificing another piece of land, the run-off, for the good of the home farm. As well as this, the wettest period of the year generally occurs after calving when the herd is home from the run-off. Many people in these areas have, of course, been unable to obtain a run-off and have had to winter the herd at home anyway.
Structures designed to allow the cows to be kept at home but off pasture are proving highly successful. As a result it is to be hoped that much run-off country will be farmed in a more productive manner in the future.

The use of these structures brings the potential of wet land much nearer to that of soils less liable to treading damage. The degree of the treading problem that faces you will govern the amount of money that can profitably be spent. In some cases a simple structure as a useful insurance against occasional wet spells will suffice. In others a more elaborate and expensive outfit for regular annual use may be required.
EXPERIENCES WITH A FEEDING SHED

J. R. Duncan, Farmer, Lincoln.

In my paper today I intend pointing out the advantages of a feeding shed as I have found them, over a period of years.

Coming to Canterbury from the West Coast we found that milking cows in our first winter of 1944 an ordeal not pleasant to look back on.

We milked 40 cows that winter and to keep up the supply we seemed to have to have fresh cows calving right through.

This meant trading in cows which was a costly practice.

The pugging of the pastures was to such an extent, the grass that did survive was so late in coming away in the spring that the hay yield was very disappointing.

Not having the early spring growth the cows were later coming into their flush of milk. So we had to go on feeding them well into the spring.

The feeding out on these pugged pastures caused a lot of the hay to be tramped in and wasted. Then again we wasted a considerable amount of time covering our cows. We had the muddy udders to contend with—cracked teats and all sorts of troubles.

These problems coupled with the big snow fall of 1945 finally led us to the thought of building a feeding shed for the housing of our cows.

At that time there were very few feeding sheds in Canterbury so information on them was limited.

Nearly all building materials were controlled owing to immediate post-war restriction. Corrugated iron was not procurable and was replacing by locally made Polite.

Eventually in 1946 we made a start deciding on a tie-up shed. It holds 44 cows plus storage of 1000 bales of hay—500 on each side in front of the stalls.

There is a concrete race 9ft 6in wide down the centre giving the cows access to these stalls, which are 7ft by 7ft in area and rise six inches above the race—each stall holds two cows. In the front half of the stall is clay for the ease of the cows standing up and getting up and down—the rear half is concrete.

Originally we had water troughs in each stall but later we replaced them with pressurised drinking bowls.

The hay is fed in ricks with a bin underneath for feeding concentrates and roots or silage if required.

Ventilation is very important and is allowed for by louvres on each side of the building with a ridge vent along the top.

Outside at one end of the shed there is a concrete platform for the storage of manure until weather allows us to spread it out on the paddocks. This shed cost £1,100 when we built it and at that time we were getting only 1/6 a gallon for our milk.

I'll tell you how we use the feeding shed—shedding is started towards the end of May and finishes in early September.

Unless the weather is very rough the cows are only shedded at night. During the day they are fed on fodder beet or silage and very little hay—most of the hay is fed in the shed at night. We also feed a break of autumn-saved pasture when ground condition is suitable.

We find that after coming out of the shed, the cows are inclined to be quite content to just laze about, rather than mill around the paddock—the usual behaviour of cows that are not shedded.

In the first year, cleaning the shed was a big job. We had to shovel the manure into a tip-dray—cart it out—and spread it by
hand on the paddocks. The old farm horse was still used in those days.

This was a most unsatisfactory method so I managed through a machinery firm to import a manure spreader before the following winter.

This machine proved to be a great success—it spread the manure evenly and at any quantity rates we wanted.

With the passing of the years and the introduction of the three-point linkage hydraulic tractors and front-end loaders the cleaning of the shed has become quite an easy job. We use a wide plank fitted to either the front or back of the tractor to push the manure out on to the platform. The time taken to do this, hose down and add some fresh straw to the stalls takes about 20 minutes.

To fill the ricks with just on half a bale of hay for each cow takes a man another 20 minutes.

With this type of shed the cows have to be individually tied up—it has the advantage of allowing each cow, especially heifers who are usually bossed, to get their proper feed.

If expensive grains are used this method allows each cow to get its exact ration. The time taken tying and untying is about a quarter of an hour night and morning.

So, we spend 20 minutes cleaning out, 20 minutes filling ricks and 30 minutes tying and untying, a total of one hour 10 minutes.

I think this compares favourably with the time taken in getting them up from the paddock—the time spent feeding out and the time taken washing dirty teats.

There is, of course, extra time taken up in spreading the manure, but with the front-end loader and mechanized spreader this is done in a few hours each month on a dry day.

The big advantage being that the manure is spread where it is needed most instead of being wasted under the odd tree or alongside gorse hedges.

From the herdsman’s point of view as well as being able to do most of his work in the dry—it is much more congenial to be able to switch on the lights in the shed early in the morning and drive the cows along a concrete race to the milking shed, rather than walk in the dark down a muddy driveway in all weathers to get them from the paddock and hope that you haven’t left any behind.

Again there is a time-saving factor in that the cows from the shed are warm and let their milk down more freely.

We have found that by feeding about three or four pounds of crushed barley it pays very well. It seems to supply the cows with extra energy and may mean better utilisation of their other feed.

Once the cows go into the shed they maintain their production evenly right through the winter and come out in exceptionally good condition. This helps them to increase their production for the rest of the season.

Before we shedded, the cows went down in their milk with each patch of wet weather and lost their condition. By springtime if they had been under very muddy conditions they looked a very sorry lot.

By the time the grass came away, and they picked up a bit of condition again, their production was reduced for the rest of the season.

This is demonstrated in our herd by the fact that the overall production figures for the year before shedding was 30,734 gallons for 40 cows. Whereas for the first year of shedding the same number and most of them being the same cows the production was 35,898 gallons—an increase of 5,164 gallons.

Of the 5,164 gallons increase—2,760 gallons were produced over the winter months of June, July and August—showing an increase of three-quarters of a gallon per cow over that period.
The balance, 2,404 gallons, which was produced over the rest of the season, I think was due to the good condition of the cows and the better pastures through not being pugged.

On today's standards this gallonage for 40 cows seems fairly low but it must be remembered that this was nearly 20 years ago. The quality of the cows used for town supply in Canterbury at that time was a much lower producing cow than they are today. The average for most cows supplying Christchurch then was one and three-quarter gallons a cow a day.

They were mostly grades of a sort ranging from brindles to spotties of all colours.

On this 100-acre farm with the feeding shed system of farming, the building up of better pastures, rearing of better stock—assisted by herd testing, and the introduction of irrigation, the carrying capacity and production has increased year by year. This has allowed us to take advantage of all quota rises.

We now carry 53 cows and our production has almost doubled since the year before we shedded. Our quota at the present time is 158 gallons. All replacements are reared and we make all our own hay except in odd years when a larger regrassing programme forces us to buy some second class hay for the dry stock. Our usual practice has been to take a crop of peas before regrassing.

I will try to explain the profit there would be with a shed built on today's prices.

A shed similar to ours would cost approximately £2,200. Against this would be interest, depreciation, insurance and maintenance of approximately £200.

Taking the same rise as in the first year—an extra three-quarters of a gallon per cow—which I am sure we are still getting, 44 cows used in the winter would produce an extra 3,036 gallons.

Costing it out at today's winter price of say 38d a gallon this extra production would amount to £480. After deducting the charges against the shed the profit on milk alone while shedded would be £280.

There is, of course, extra revenue from the extra milk over the rest of the season—referred to earlier. As this is impossible to estimate I'll leave it out.

There are other general advantages which I'll try to roughly assess.

Assuming that one-eighth of a bale fed outside is trampled in and 1,840 bales were used in the shed. This would mean for the cows to get the same amount we would have to feed 2,100 bales outside—a saving of 260 bales. This, valued at 6/- a bale, is worth £78. Through paddocks not being pugged another 500 bales could be cut—this would be worth about £100. I think this is a conservative estimate. Taking the profit on milk for the three winter months of £280 and adding it to these savings it would amount to £458. In these calculations I have omitted the value of the manure on the pastures and fodder crops.

I feel that in these times when the profit margin in farming is shrinking, the building of a feeding shed is one way of saving the feed cost and assisting in extra production.

Now that above quota milk in the winter is worth only 14d farmers should perhaps consider milking fewer cows in the winter getting three-quarters of a gallon extra in a feeding shed and have a larger spring calving herd. The milk they receive above quota would therefore be produced cheaply in the summer. Feed costs would be reduced by having a shed, and through no pugging damage to pastures, would mean more cows could be carried.

Anyone contemplating building a shed would be well advised to take a careful look at all types of sheds including the loafing barns.
Regardless of the type of shed built it must be remembered that to keep cows clean it must be planned correctly and cleaned thoroughly every day.

From the humane aspect, if cows are expected to produce milk in the winter which is contrary to nature they are entitled to the best possible conditions.

Where a farm is subject to bogging and is devoid of all shelter a feeding shed in my opinion is essential.

I hope that some of the information I have given you will help you in making your decisions.

In my experience I am sure the feeding shed has paid off for us.

Now looking at the overseas trend in dairy farming today, the farmers are shedding their stock all the year around. The land is solely used for the growing of fodder crops which is automatically fed to the stock.

This system could quite easily be adopted in this country in the future.

The only time a feeding shed could become obsolete would be if Mr Hollard's ideas ever eventuated and the city people had to accept reconstituted milk. This, I think, is in the very dim and distant future.

As far as capitalization is concerned, town milk suppliers who consider that the layout of about £2,000 on a feeding shed to use for only three or four months of the year is uneconomical must think that sheep farmers must shut their eyes to economics altogether when they build a wool shed for the same amount of money and use it for only three or four weeks in a year.

Q.: What procedure is used for the feeding of roots in your feeding shed?

Mr Duncan: The roots are fed out on a dry paddock because of cartage difficulties to the shed.

Q.: Is any attempt made to feed animals to their production requirements?

Mr Duncan: All animals are fed at the same rate and when cows refuse feed we remove it.

Q.: Does the incidence of disease, especially T.B., increase under feeding shed, loafing barn or feeding platform conditions?

Mr Duncan: We use tested stock and have found no disease increase in our herd.

Dr C. S. M. Hopkirk: There is no reason for disease proportions to increase under such feeding systems if T.B. and Brucellosis-tested cows are used. Salmonella may occur if sheds are not kept clean.

Mr Clifford: Cows may get stiff and sore lying on concrete and often do not lie down unless sawdust is used to cover concrete. Other farmers have had no trouble in this respect with concrete slabs. This is still being tested.

Q.: Would Mr Duncan use a "tie-up" feeding shed or a loafing barn if he built again?

Mr Duncan: I am not sure. The "tie-up" shed is easy to clean and I am not sure whether cows get dirtier and waste more feed or not in a loafing barn. I don't think there has as yet been a controlled experiment in this respect and must reserve my decision.

Q.: What percentage of the herd lie down at night?

Mr Duncan: I do not know the exact percentage, but there are always some lying down at 10 p.m. and it has been observed that all cows do lie down about 2 a.m. or later.
PRODUCING BEEF FROM DAIRY HERDS

J. C. Gerring, Ruakura Animal Research Station, Hamilton.

Ruakura's interest in this subject, the production of beef from dairy herds began just over ten years ago. It has been maintained ever since. At the outset therefore, I want to outline the basic underlying reasons for this interest before describing the investigations which have been made.

The major objective of the Station's research programme is simply stated. It is to increase the efficiency with which farm animals convert grass to meat, milk, and wool. As a means of converting grass to saleable products our beef industry is operating at a considerable disadvantage compared with any other system of livestock production. In the past farming beef cattle has been justified mainly for their function as implements of weed and pasture control, that is their ability to use feed largely unsuitable for other livestock, and for their low labour requirement. As such their role has been complementary to rather than competitive with lamb and wool production.

With the rapid intensification in our farming methods, resulting in improved pastures and more effective weed control, this secondary function of beef cattle is becoming less important. Beef production is rapidly being forced to assume a more competitive role, and the favourable outlook for beef rather than lamb is likely to accelerate this process. To meet this change everything possible must be done to increase the efficiency of beef production.

Its relative inefficiency is due mainly to four factors, the high overhead cost of the breeding cow, her low calving percentages, her poor milk producing ability, and the time required to raise a steer to slaughter weight.

Overhead Cost

To give a rough indication of the magnitude of this overhead cost the total feed required to produce a steer from conception to consumption, at 1000lb liveweight, is very approximately 12,500lb of hay equivalent. Of this total more than half, 6500lb is required by its mother for maintenance, for pregnancy and for suckling the calf. The remaining 6000lb of hay equivalent is required to take the steer from weaning at 400lb to 1000lb liveweight. This makes no allowance for the cost of rearing the cow from birth to first mating, nor for the fact that few cows produce a steer calf each year. Remember the only purpose for keeping a breeding herd is to produce a calf crop.

In contrast, in our dairy industry the cows are kept primarily for milk and butterfat production. The vast majority are put in calf solely to make them produce milk. The surplus calves, well over a million of them, are born with virtually no overhead cost at all. If a proportion of these could be used for beef production then the calf crop available for this purpose could be substantially and rapidly increased. The Jersey, the predominant dairy breed, is not a good beef-producing animal. It has a poor reputation for fleshing qualities and suffers from the major defect of yellow fat. But by mating these dairy cows to bulls of the more specialised beef breeds, they could be used as incubators for the production of calves with a better beef potential, without any detrimental effect whatever on their ability to produce milk.

This then is the purpose of Ruakura's interest in crossbred beef, to investigate the possibility of exploiting this untapped potential for raising out output of high quality beef.
The Ruakura work has had two main objectives:

(1) To measure the performance of crossbred calves under different methods of rearing and management.

(2) To assess the quality of the carcasses produced and their suitability for our overseas markets.

When this work began in 1953, skim milk was readily available on most dairy farms. Radford (1954) showed that Aberdeen Angus x Jersey calves fed whole milk for a limited period followed by skim milk ad lib, produced prime quality veal carcasses dressing 143 lbs at 18 weeks of age. They averaged just on 2 lb liveweight gain per day for a feed cost equivalent to 10½ pints of whole milk, testing 5 per cent fat. A good type of carcass showing much of the blockiness of the Aberdeen Angus was produced, yielding 70 per cent muscle or lean meat, 8 per cent fat and 20 per cent bone.

From this and other experimental work it is evident that a liveweight gain of 2 lb per day or better is essential for the production of high quality veal. Since the young calf is able to consume a higher intake of digestible nutrients in a liquid rather than a solid form, liveweight gains of this order are more likely to be achieved on a diet composed largely of milk or milk products.

Next the possibility of using Aberdeen Angus x Jersey animals for lightweight beef production was examined (Radford 1954, McMee-kan 1956). One group was early weaned at eight weeks of age and a comparable group at 18 weeks. At weaning both groups were transferred to the sheep farm and run together. They were farmed in conjunction with fat lamb breeding ewes in the normal way.

Growth rate was good for both groups, they gained just over 10 lb per week during their first year and at 15 months of age averaged 730 lb liveweight. They then ran into the long summer drought of 1954-55 and in common with all other cattle, growth rate was poor for this summer and the following winter. A marked recovery the next spring enabled the animals to be slaughtered at 1223 lb average liveweight at an average age of two years four months. Straight Angus cattle grazing on similar pastures at similar sheep stocking rates gave no better results than this over the same period.

Carcass Quality

Representative carcasses were shipped to England as an individual line of chillers and were favourably reported on by an experienced panel of judges. Since today most of our export beef is boned out and shipped in the prepacked form, the cutting value and eating quality of these carcasses will be of considerable interest. For this purpose J. Lyons and Company took over the carcasses and submitted them to their standard palatability and cutting test procedures in comparison with New Zealand baby chilled beef and Argentine chilled beef. In respect of tenderness, juiciness, texture, flavour of lean and colour of fat, the crossbred carcasses compared very well indeed with beef generally regarded as being of the top quality imported at that time into Great Britain.

Comparison Between Different Breeds of Sires

This report was sufficiently encouraging to warrant taking the work a stage further. To this end Walker (1958) set out to test the merits of three different breeds of sires, Aberdeen Angus, Polled Hereford and Shorthorn, when these were mated to Jersey heifers. The resulting crossbred calves were bucket fed twice daily, being fed a total of 16 gallons of whole milk and 84 gallons of skim. They were weaned at eight weeks of age and transferred to the sheep farm where they were handled as beef cattle. Due to feed shortages (during the first autumn and winter) they were sent out for some time
on the Raglan hill country and spent a subsequent period on a block of poor newly developed peat land. In their second year they were more favourably treated and were fit to slaughter just before two years of age.

Table 1 shows some of the liveweight data and includes that for a comparable group of normally suckled straight Aberdeen Angus steers.

<table>
<thead>
<tr>
<th>Breed</th>
<th>Liveweight Data (pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8 weeks</td>
</tr>
<tr>
<td>Aberdeen Angus x Jersey (m.s.)</td>
<td>144</td>
</tr>
<tr>
<td>Hereford x Jersey (m.s.)</td>
<td>146</td>
</tr>
<tr>
<td>Shorthorn x Jersey (m.s.)</td>
<td>144</td>
</tr>
<tr>
<td>Aberdeen Angus (steers)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 shows the carcass weights.

<table>
<thead>
<tr>
<th>Breed</th>
<th>Steers</th>
<th>Heifers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aberdeen Angus x Jersey</td>
<td>508</td>
<td>457</td>
</tr>
<tr>
<td>Hereford x Jersey</td>
<td>504</td>
<td>411</td>
</tr>
<tr>
<td>Shorthorn x Jersey</td>
<td>519</td>
<td>487</td>
</tr>
</tbody>
</table>

These carcasses were frozen for export and shipped to Smithfield for criticism by trade experts. The general consensus of opinion was very favourable. On the question of breed and disregarding sex, voting was heavily in favour of the Hereford x Jersey group, on account of their uniformity of conformation, evenness of finish, and lack of waste.

That good-quality beef, readily acceptable on the British market, can be cheaply produced from our dairy herds, was clearly established by these experiments. Yet the practice has not been adopted to any notable extent despite the availability of beef bull semen through our A.B. service.

In recent weeks we have had some encouraging support for our advocacy from the meat trade. The manager of one of our foremost meat exporting companies, in an address to the Economic Society in Wellington said this:

"One of the most important things for New Zealand to do for the future of its meat industry is to work in every way possible to increase beef production. There are big opportunities for the sale of our high-quality beef, and it is up to us and the New Zealand farming industry to get it produced."

He then went on to say:

"I agree with authorities who point out the possibilities of greater use of crossbred beef and the wastage at present occurring through the killing of more than a million bobby calves a year. Surely a start could be made by saving at least a few of the more suitable types of these calves and growing them up to beef animals."

These statements have been made by an authority on the marketing of your meat, whose job it is to keep in close and continuous touch with the markets of the modern world. I have quoted them, quite deliberately, to counter the prejudices which have been widely held,
amongst farmers, and others, against crossbred beef, on the grounds of poor conformation and carcass quality. Such prejudices completely ignore the dramatic change which has taken place in recent years in the consumers' concept of quality beef. Weight-conscious women and middle-minded men, no longer favour the traditional sirloin with its rich marbling and cream surrounding fat. In consequence there has been a soaring demand for lean meat.

Equally radical developments have recently taken place in the handling of beef at our meat export works. Today almost 80 per cent of our total beef exports are boned out and packaged mainly for export to the United States. About 80 per cent of the total American imports of beef and veal, from all sources, are for manufacturing purposes. Under such conditions our traditional beliefs about the value of conformation and its relationship to carcass quality have largely lost their significance. Present day markets demand a carcass which will yield a maximum of lean tender meat and a minimum of fat waste and bone. Crossbred beef can fill this demand.

As producers we surely cannot afford to ignore the impact of such changes on our methods of production. New Zealand farmers are noted for their initiative, imaginative thinking and ability to improvise. I believe it could be a profitable exercise to bring these faculties to bear towards developing ways and means of producing crossbred veal and beef. Though my thoughts on this subject must be speculative and based mainly on the experience of a few enterprising farmers, they may serve to provoke some discussion. On a dairy farm there are two different measures of efficiency—the utilisation of labour and output from land. On very many farms one, but not both, is being achieved. On those where labour is already fully committed but scope exists for more stock, the slack could readily be taken up by rearing crossbred calves for either veal or beef, or as well-grown weaners for sale to sheep farming colleagues. It is true that skim milk is no longer so readily available, but our calves have not yet forgotten how to feed themselves without any assistance at all. Any self-respecting Jersey cow will yield enough milk in her first 100 days to produce two first quality vealers or three well-grown weaners for subsequent beef production.

At this stage the cow can be brought back into the milking herd, at a time when the replacement calves have been weaned, most of the herd have been mated and much of the silage made. By this time, too, the main herd is taking less time to milk so that a few extra cows could be easily handled. This practice could well result in a more even demand on the labour supply, than exists on many farms today, and at the same time, increase our output per acre.

A rough calculation will show that a realisation of £9/10/- apiece for the vealers or £6/10/- for the stores would give a net return closely approximating that from the sale of the milk. A cow yielding 300 lb of butterfat will produce approximately 45 per cent of this in the first 100 days from calving.

Return from Milking

| 45 per cent of 300 lb = 135 lb butterfat at 3/- | £20 5 0 |
| Less labour cost and shed expenses, etc. 30 per cent | £6 1 6 |
| Net return | £13 3 6 |

Return from Suckling

| Two vealers at £9/10/- | £19 0 0 |
| Less Bobby price | 5 10 0 |
| Net return | £13 10 0 |

95
The production of crossbred beef or veal has a number of features which make it an attractive proposition. Very little extra finance is needed. The raw material, in the form of well over a million calves is bred each year.

The returns for the small additional capital invested and the little extra labour expended are high. It is an enterprise which calls for no major change in farming policy, nor the acquisition of any new skills.

From a national viewpoint the goal is an attractive one. It could make a substantial contribution to that extra £17 million per annum in overseas earnings, which the Institute of Economic Research tells us is necessary to maintain our present standards of living.
WHEAT VARIETIES

L. G. L. Copp, Crop Research Division, D.S.I.R.

Introduction

We have all been concerned about the high incidence of the various diseases in the wheat crops last season—and the effect of the late spring drought, after a very mild winter—which made them even more serious. Dr Harvey Smith will be talking about the diseases—and I will offer some suggestions of ways in which we may possibly avoid similar disease troubles in future years.

We have been well aware for a long time that we are growing too few varieties—and I assure you that we have not needed recent newspaper reports to remind us of the fact. Unfortunately we can not produce new varieties at will. There is a great deal of work involved—and we suffer many disappointments and few successes. The importation of seed of European varieties is not the solution—but I will refer to this later.

Wheat breeding

Every year we make many crosses, between our New Zealand wheats and varieties bred overseas. The crosses are made to combine the good qualities of as many as eight different varieties, in our effort to breed new wheats which are an improvement in yield—or in baking quality—or in disease resistance. Selections from each cross are tested at the Crop Research Division for up to eight years. The progenies of plants selected in the third generation retain their identity throughout the testing period. During this time any line which shows a defect is rejected—and we do not give any line a second chance. In the first few years we reject mainly on characters which would make a variety unsuitable for the farmer—such as susceptibility to “lodging,” “shattering,” or to diseases, or have long straw. Later we reject on low yield, poor milling quality, and inferior baking quality. Because of this rejection at every stage very few of the crosses we make produce lines good enough to be tested in the cooperative field trials. Some of you may have had these trials on your own farms. They are sown by the Farm Advisory Division in the main wheat districts, and one selection may be tested for up to five years. Very few of the lines tested in this way have been good enough in yield, or in milling quality or in baking quality to become named varieties. When there is one, however, it is given a name—but it still takes another two years to increase the seed for commercial sowings. If you add up the times I have mentioned—eight plus five plus two—you will find that it takes about 15 years from the cross to the new variety.

Now, we have been breeding wheat for over 35 years, and during that time six new varieties have been produced: Cross 7, Fife Tuscan, Hilgendorf, Arawa, Aotea, besides two other varieties Tainui and Tairoa by reselection. Since Cross 7 was released we have averaged a new variety each five years.

Objectives

It is possible that we have been setting our sights too high in our endeavour to produce wheats which are a definite improvement. Perhaps we should have been selecting a few additional varieties which were only equal in yield to the standard varieties—and thereby increasing the number of wheats available—with different genetic backgrounds. Remember, however, that although we are breeding wheats for the farm, we also have to satisfy the demands of the miller
and the baker—who both contribute just as much in levies as the farmer towards the cost of the work.

You must realise, of course, that more varieties will mean more work in the production and maintenance of pure seed, and that most of you would not grow a new variety unless we could tell you that it would yield better than the best you have already.

Certification

The New Zealand seed wheat Certification Scheme is—as far as I know—the best in the world, and it has been built up by insistence on purity of type in the nucleus seed which we grow every year. This seed is increased to become the “Mother,” “Pedigree” and “Standard” classes of seed with which you are all familiar. But it is possible that you do not know the general procedure we adopt in the production of the first nucleus seed of a new variety so I will tell you how we went about selecting the first pure seed of Aotea.

Nucleus Seed

The line 313.01, produced in the way I described earlier, was tested in field trials up and down the country for over five years. It was a bulk mixture of the progenies which came from a single plant selected three years after the final cross. The bulk contained a majority of plants resistant to mildew and it seemed to have a fair resistance to several other wheat diseases. It yielded about 22 per cent better than Cross 7 which was then the standard variety. We sowed about 1200 single grains of the bulk and at harvest we rejected over 500 plants because they were obviously low yielding or because they were off-types. We sowed the seed of the remainder in short rows—and at the next harvest again rejected the off-type plants. Now the bulk 313.01 from the results of the baking test was not quite good enough so we reselected on quality—and tested the best selections again in all wheat growing districts. We found that we had made a further improvement in yield. One of these reselections now yielded 25 per cent more than Cross 7 and the baking quality was almost as good as that of Cross 7—and this line, the progeny of one single plant, which was selected in a late generation, became the nucleus seed of the variety Aotea which, in 1960, was sown on 78 per cent of the wheat area in New Zealand.

Resistance to Mildew

This reselection was not resistant to mildew, and although this disease is not very important in most districts it is important in South Canterbury and Ellesmere. Now one of our main projects is the breeding of a mildew-resistant strain of Aotea. And we will be able to add further resistance factors, as each disease becomes important, provided that there is a source of resistance available. We can not do anything yet about BYDV, or “take-all.” It is comparatively easy to add disease resistance to a good variety; but it is much more difficult to produce the good variety. Aotea is a good variety; one which is capable of producing high yields in all districts from Hawke’s Bay to Southland. We are now making the variety still better by adding resistance to diseases.

Stem-rust resistance

We know that the South Island of New Zealand is excellent country for wheat growing. The last season was an exception to the general rule but we can profit by the experience. Breeding for disease resistance can be carried out in several ways. In Canada, Kenya, Australia and many other countries, stem-rust is a constant threat to wheat production and the wheat breeders are flat out trying to keep ahead of new strains of rust which infect new varieties soon after they
are released. Some of these wheat breeders have found that growing a pure stand of rust-resistant wheat is not advisable and that the sowing of a mixture of two or three varieties with rust-resistance drawn from different sources is the best insurance against a rust epidemic. A plant infected with rust of one strain, if it were surrounded by plants resistant to that strain, would not easily infect other susceptible plants in the same crop. The rust infection would be sporadic and an epidemic which would seriously reduce the yield of the crop would not be likely to occur.

A new approach

The same philosophy could be applied to other diseases—even in New Zealand—because we have only two, Aotea and Arawa, which ripen at the same time and they would look rather messy in a crop. But we could make some alteration to our system of producing pure seed of a new variety, so that more of the genetic diversity in the bulk population could be retained.

A hybrid line when it is being tested in yield trials is a bulk of the progeny of a single plant which was selected many years before, in the third generation after the cross. It is really a mixture of a large number of types of plants which are genetically different and have different degrees of susceptibility to various diseases—and of course to other agronomic characters like lodging, shattering, head type and so on. If the hybrid line after several years of trials is shown to be at least equal in yield to Aotea, is good in all the other characters the farmer likes, is good in milling quality, is good in baking quality, and it is decided to release it as a named variety we could use a much greater quantity of the bulk seed for the initial selection of nucleus seed for certification.

Now this is only a suggestion—and it is one which I have not discussed as yet with my colleagues who administer the Wheat Certification Scheme—but it is one which could be used to retain more of the genetic diversity of a hybrid line.

Increase in amount of nucleus seed

We now have the machinery which would handle a much greater number of nucleus lines of a new variety. We could sow about 5,000 single gains of the bulk which would cover about one-twentieth of an acre. At harvest we would reject any plants which were distinctly different from the general type and we would reject any plants which showed obvious signs of disease. We would sow the seed from the remainder of the plants in short rows and reject at harvest further plots which were distinctly different from what we would consider the general type of the new variety. We would probably reduce the material to about 500 to 1000 progenies—which is much greater than the 100 we now maintain. Single plants would be selected from each of the progenies to provide similar plots each year—just the same as we do now. Under this system we would retain many more plants which would look alike but be different genetically. A casual glance at a farmer's field of certified seed would not reveal any tall or short plants or any obvious signs of different types of plants but a closer examination would show some slight differences between neighbouring plants—but this would not cause the farmer much concern.

Reduction in time in testing

Another suggestion we could try, is to reduce the time taken in testing new varieties so that we could provide you farmers with more alternative wheats. Provided that the milling and baking quality of a hybrid line were satisfactory, a new variety could be released much sooner; but you would have to carry out your own tests to see whether
it was suitable to your district. There would be a big risk of good lines not "taking on," and some risk of poor ones getting established, if we did this. One thing we just cannot do is to release more varieties and test them more thoroughly, as one prominent writer has suggested.

**Shortage of Varieties**

You are partly to blame for the shortage of wheat varieties mainly because you take notice of our recommendations. The Department of Agriculture carry out field trials of a possible new variety—and when we are satisfied, and the millers and bakers are satisfied—the variety is released, and then you all cash in on it. Arawa was released in 1955—by 1959 it made up 56 per cent of the milling wheat sold. Aotea released in 1957 amounted to 86 per cent of the milling wheat sold in 1960. Hilgendorf (1961) will be sown on a lot of land this year—and there would have been a much greater area had the seed been obtainable. I feel sure that the premium price was not the only consideration.

If we could produce about half a dozen new wheats all as good as one another and release them in the same year, there would be a considerable advantage to wheat-growing in general, and this would certainly please the plant pathologists. It has been suggested that we could import high-yielding wheats from Europe to help us out of our shortage of varieties, but it is unlikely that these will be successful in New Zealand.

**European Wheats**

At the present time there is no restriction on the growing of any overseas wheat by the farmer. All you have to do is to apply through your merchant for an import licence for a quantity of seed of a particular variety. A limited number of licences will be made available—provided you know the name of the variety and can produce some evidence that this variety might suit your locality.

Most of the European wheats which you are likely to try out are already growing at the Crop Research Division. The majority are much later in ripening than our varieties. Most of them are longer in the straw and they tend to "lodge." Many of the varieties, particularly those from France, "shatter" badly.

If you are really interested in any of these wheats, we would be only too pleased to discuss them with you—and if you would like to come to the Crop Research Division in December—you could see them growing. Some of you have already grown Atle and Hybrid 46—but there are very few crops of these about nowadays—and the same would apply to most of the European varieties. Last season we tried Milfast and Dominator from England, in a small yield trial—but rejected both of them because they were affected seriously by yellow-dwarf virus; they were worse than Aotea. So do not believe that by importing European varieties you can remove the threat of virus.

We have good contacts in Europe, in the States, Canada and Australia and we obtain small quantities of seed of new varieties soon after they are released. We grow them for observation and if they show promise—in yield trials, if they have any character which may be used to improve our own hybrids, we use them for crosses. Unfortunately, all of the imported wheats so far tested, except the rust-resistant Australian wheats in the North Island and Gabo in South Otago have ended up as parents and have never been grown in bulk in a farmer's field.

**Poor Baking Quality**

There is another important defect in these high-yielding European varieties—the baking quality is not good enough for our New Zealand standard. A large proportion of the milling wheat used in England
comes from Canada, and Australian and domestic wheat is used as a "filler" in the grist. Some of the home-grown wheat is used for making biscuits. In New Zealand we have no system for the growing and marketing of biscuit wheats—so we must defer the growing of these varieties until such time as a marketing system has been established. We do not import Canadian wheat—so we have to pay a great deal of attention to the baking quality of the wheat we grow. There is no sense in farmers growing high-yielding but poor quality wheat, if there is only a limited market for it. Even the poultry farmers prefer Hilgendorf wheat when they can get it.

Degeneration of Varieties

There is still another point I must mention. The wheat varieties, maintained by certification procedure I have outlined—do not degenerate. The old Cross 7—and there is still a little of it about—is still the same Cross 7 as it was in 1935. I quite agree that it gets more disease nowadays than it used to—but the reason is this: you farmers have all increased the fertility of your land, and at the same time created a much more suitable environment for the various diseases. The aphids which carry the virus come from your high producing ryegrass paddocks. The Dominion average yield per acre increased from 34 bushels per acre in 1935 to 44 bushels per acre in 1956—but Cross 7 could not take full advantage of the increased fertility, so the stage was set for another variety, Aotea, which could do so. And it seems from the results of last season that it is high time that we bred a replacement for Aotea.

I trust that the few suggestions I have made will show that I am conscious of your disease problems. My next job is to talk my colleagues into agreeing with me—or, at any rate, be willing to discuss the implications of possible changes in methods.
SPRAYING FOR CONTROL OF YELLOW DWARF VIRUS IN WHEAT

Harvey C. Smith, Officer in Charge, Plant Diseases Division, D.S.I.R., Lincoln.

Most farmers have by now heard of yellow dwarf virus and know that it can be a serious disease of wheat. But very few farmers could be certain that they could identify this disease.

This is not surprising because this virus disease is one of the most recently identified virus diseases in the world—and there are only a very few of the twenty plant disease specialists in New Zealand who could give reliable identification.

Although we have recognised yellow dwarf virus on wheat for just on 10 years in New Zealand—we are still finding out very important facts—and that is the main reason for my talk today.

I want to present an accurate, precise account of the important facts—and let you decide whether you should take any action against this disease on your farm.

The basic facts are:

**Symptoms**

Yellow dwarf infects only grasses and cereals. It may cause severe stunting, leaf yellowing, or leaf reddening (on wheat) or blasting of oats, or have no symptoms except shrivelling grain or reducing yield, or even as in perennial ryegrass or cocksfoot have no recognisable signs of infection at all.

**Spread**

This virus is a very tiny “bug” which occurs in the sap of plants, or in the saliva of aphids. It can only be spread by aphids! It cannot be spread in seeds or soil, or fertiliser. You will now be able to understand why so much attention has recently been paid to the cereal aphid. If we can control the aphid then the control of yellow dwarf automatically follows. For that reason I spent a year in Canada studying all the aphid vectors and yellow dwarf virus.

Before I go into details on the recent N.Z. trials on controlling the cereal aphid and virus, I would like to give some basic information on the relative importance of different wheat diseases. I have prepared some graphs which show the relation between different seasons, districts, and varieties to disease.

The first graph (figure 1) shows the acreage, and average yields of wheat in Canterbury and the severity of yellow dwarf virus over the period 1957-8 until the past season 1962-3. The average yield over this period showed a marked increase from 40 bushels per acre in 1957-8 to a record of 51 bushels per acre in 1959-60. This has been ascribed to the increase in acreage of Aotea which outyielded Cross 7 the previous predominant variety by 20 per cent.

The next period, however, shows a decline in average yield from 51 to 42 bushels per acre this past season. It is this decline that has been worrying many men—farmers and agricultural scientists included.

There are several possible reasons for this decline. For example with the increased acreage from 160,000 acres to over 200,000 acres in New Zealand there must be a larger proportion of poor land growing wheat.
However other factors are: poor seasons, or increased disease. There is no doubt that drought had a serious effect in the 1961-2 season but both in 1960-1 and 1962-3 disease was by far the most important cause of lower yields.

From this graph you can see that there appears to be an increasing importance of yellow dwarf virus—three bushels per acre (seven per cent) loss in 1957-8, seven bushels per acre (15 per cent) loss in 1960-1, and eight bushels per acre (20 per cent) loss in 1962-3!

In 1962 as many of you farmers know, the wheat looked wonderful in November and early December but the amount of mildew, leaf rust and yellow dwarf virus showing up in December was already worrying quite a few farmers before January arrived. I therefore decided to do a complete disease survey throughout New Zealand in January and February this year.

The main aim was to find out the relative importance of the main wheat diseases in each district.

The results of this survey are shown in figure 2.

At the top you can see yellow dwarf virus and stem rust. The districts represented from left to right are Marlborough, North and Mid Canterbury, South Canterbury, Otago and Southland.

Both these diseases (stem rust and yellow dwarf) declined in importance from north to south, both being serious in Marlborough but not significant in Southland.

The next section shows leaf rust which was high in all districts. Septoria leaf blotch showed a high incidence in South Canterbury and declined to both north and south.

Powdery mildew, however, appeared more serious in South Canterbury, Otago and Southland than in northern districts.

This result showed clearly that losses from all these diseases were quite serious but different diseases were important in different districts and this is the most obvious reason why new varieties must be tested in all districts before release.
WHEAT DISEASE INCIDENCE 1962-63.
(AOTE A AND ARAWA ONLY)

YELLOW DWARF VIRUS AND
STEM RUST

LEAF RUST

SEPTORIA

POWDERY MILDEW

PER CENT INFECTION
MARLB. NTH. MID CANTY. S.T.H. CANTY. OTAGO SOUTHLAND.
Figure 3 shows the relative susceptibility of our wheat varieties to yellow dwarf virus in relation to very susceptible plants, e.g. Steel oats which are usually 80 per cent infected, to very tolerant plants, e.g. some barley varieties from Abyssinia. The relative figures for the different wheat varieties are:

- Aotea: 61 per cent
- Cross 7 (1961): 51 per cent
- Hilgendorf (1961): 48 per cent
- Arawa: 43 per cent
- 705,01: 43 per cent

Although Arawa looks much better than Aotea in the field there is not very much difference in terms of yield. Seln. 705,01 which is the newest promising wheat selection was quite a lot better than Aotea.

It thus appears that the New Zealand plant breeders have still been making excellent progress in developing tolerant or resistant wheat varieties by their field selection and co-operative trials with the Department of Agriculture.

Figure 4 shows the increases in yield obtained in spray trials with different wheat varieties this past season.

This graph shows that all main wheat varieties give large increases in yield when sprayed, both on autumn sown crops in Canterbury and in the North Island on spring sown crops.
In Canterbury

Five trials on Aotea averaged 14 bushels/acre increase.
Two trials on Arawa averaged 14 bushels/acre increase.
One trial on Hilgendorf (1961) averaged 20 bushels/acre increase.

In the Manawatu

On trial on Mengavi sown in October and sprayed in November averaged 11 bushels/acre increase after spraying with systemic insecticides. One other crop of Aotea sown in September was sprayed but was too far advanced to stop spread of virus and there was no obvious evidence of control.

In the Hawke's Bay

Two trials on Gabo with systemic insecticide applied in granular form at sowing showed increases in yield averaging about nine bushels/acre.

The overall conclusion from 21 trials last season on wheat was that an average increase in yield of about 14 bushels per acre was obtained from one well-timed application of systemic insecticide.

This represents an average profit of £7 per acre on land yielding 46 bushels per acre without spraying or 60 bushels per acre after spraying, based on current costs of production and returns. (See Table 1.)

The Future

Following a field day held by the D.S.I.R. at Lincoln last April and Aphid and Virus Committee was set up to study aphid populations and issue warnings to farmers regarding the prevalence of aphids and the necessity for spray application to control virus diseases.
The basic knowledge on aphid flight behaviour has been obtained in New Zealand by Dr K. P. Lamb, previously of the Plant Diseases Division, D.S.I.R., and now at Sydney University. Later work by Dr R. Close and Mr Alan Lowe has shown the typical flight patterns of the cereal aphids as shown in figure 5 which shows the results for three years 1960-1, 1961-2, 1962-3.

**CEREAL APHID FLIGHTS LINCOLN 1960-1-2.**

![Graph showing Cereal Aphid Flights](image)

Two of these years were bad for aphids and yellow dwarf virus—1960-1 and 1962-3—and it is quite obvious that the significant flights infecting wheat crops are those during May and June.

In 1961-2 there were very few aphid flights during this period and little yellow dwarf virus subsequently.

The middle graph shows the population increase of cereal aphids in a wheat crop last season and the lower graph shows the increase in virus infection in the same crops.

It is quite apparent that there is a period of four to eight weeks after the last flight before aphid multiplication is rapid and before virus spread is serious.
This period from the beginning of July until the middle of September in Canterbury is the best time to spray for control of aphids and yellow dwarf virus.

Twenty aphid traps are now manned by a cooperative effort between the D.S.I.R. and the Department of Agriculture in all wheat growing districts and the farmers will be kept informed of aphid flights and the necessity of spray application to wheat crops.

Summary

1. Yellow dwarf virus is the most serious disease affecting wheat in New Zealand. It is followed in importance by leaf and stem rust and powdery mildew.

2. A severe outbreak of yellow dwarf occurred throughout New Zealand this year causing an estimated 20 per cent reduction in yield (eight bushels per acre). BYDV incidence was high in the North Island and Marlborough, moderate in Canterbury and Otago and slight in Southland.

3. The severity of yellow dwarf in autumn sown wheat crops appears to be closely related to the intensity and duration of cereal aphid flights in May and June.

4. In replicated field trials BYVD was highest in Aotea (61 per cent), less severe in Hilgendorf (1961) (48 per cent) and Cross 7 (1961) (51 per cent), and moderate in Arawa (43 per cent).

5. The average increase in yield from 21 trials on the control of yellow dwarf in districts from Hawke's Bay to South Canterbury was 14 bushels per acre representing an average profit of £7 per acre.

6. A survey of farm crops in North Canterbury in relation to aphid infestation and spraying showed an average increase in yield from spraying of about eight bushels per acre. The effect of drought was more severe in this area than where the trials had been located.

TABLE 1
Profit from Wheat Spraying for Yellow Dwarf Virus Control

<table>
<thead>
<tr>
<th>Per Acre Cost of Production</th>
<th>Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>£  s. d.</td>
<td>£  s. d.</td>
</tr>
<tr>
<td>Seed at £1 per bushel</td>
<td>1 10 0</td>
</tr>
<tr>
<td>Fertiliser, 1cwt</td>
<td>. 10 0</td>
</tr>
<tr>
<td>Labour</td>
<td>. 2 0 0</td>
</tr>
<tr>
<td>Cultivation (plough, disc,</td>
<td></td>
</tr>
<tr>
<td>harrow, sow)</td>
<td>. 2 0 0</td>
</tr>
<tr>
<td>Sacks, 20 at 1/-</td>
<td>. 1 0 0</td>
</tr>
<tr>
<td>Cartage</td>
<td>. 2 0 0</td>
</tr>
<tr>
<td>Heading, 1/3 bushel</td>
<td>. 2 0 0</td>
</tr>
<tr>
<td>Spraying</td>
<td>+ 1 15 0</td>
</tr>
<tr>
<td></td>
<td>. 2 0 0</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Profit</td>
<td>. 25 15 0</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

108
## NOT SPRAYED

<table>
<thead>
<tr>
<th>Per Acre Cost of Production</th>
<th>Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>£  s.  d.</td>
<td>£  s.  d.</td>
</tr>
<tr>
<td>Seed at £1 per bushel</td>
<td>1 10 0</td>
</tr>
<tr>
<td>Fertiliser</td>
<td>10 0</td>
</tr>
<tr>
<td>Labour</td>
<td>2 0 0</td>
</tr>
<tr>
<td>Cultivation</td>
<td>2 0 0</td>
</tr>
<tr>
<td>Sacks, 15 at 1/-</td>
<td>15 0</td>
</tr>
<tr>
<td>Cartage</td>
<td>1 10 0</td>
</tr>
<tr>
<td>Heading, 1/3 bushel</td>
<td>2 0</td>
</tr>
<tr>
<td></td>
<td>17 6</td>
</tr>
<tr>
<td>Profit</td>
<td>18 15 6</td>
</tr>
</tbody>
</table>

- Increase in profit from spraying £7 per acre with increase in yield of 14 bushels per acre. Average 21 trials.
- *Less than price for milling wheat because of greater proportion of seconds.
BULK HARVESTING STORAGE AND DRYING

C. J. Crosbie, Department of Agriculture, Christchurch.

Bulk headers in the South Island now total approximately 230—the numbers having doubled each year since 1958 when four machines were at work. Some 130 farmers have built bulk granaries with a total capacity in the order of 11,000 tons. There are now 70 grain driers of different types working in the South Island and five home-made grass seed driers.

However, these numbers are small compared with the 5,500 headers currently at work in New Zealand and there is obviously plenty of scope for more bulk machines. The next purchase for most header users should be a bulk unit—this even though he has no intention of harvesting bulk grain in the near future—for grain and seed can be bagged off a bulk header far easier than it can on a bag machine and away from the noise and dust of the latter.

Bagging Methods

Crops that can be currently harvested and sold in bulk include wheat, barley and linseed with oats and peas in some areas. Where grain or other crops that have no market bulk are harvested in the field with a bulk header, it is a simple matter to bag them off. The header merely discharges into the raised tray of a tip truck and the crop is bagged off through slides in the tailboard. (Trays with a short overhang behind the pivot point are best.) The sacks are placed in a heap behind the truck and as the heap grows, the truck is shifted up the field approximately six feet at a time to obviate carrying. The workers sew the sacks while standing firmly on the ground and away from the header’s noise and dust. The farmer at night has a heap he can cover if required instead of hundreds of sacks scattered over the field in four or more windrows. The local carrier will uplift sacks from a dump for up to 2d per sack less than from windrows. So with three different groups of people happy, there must be advantages in the scheme.

Where only flat top trucks or trailers are available, farm labour can easily construct a V hopper for mounting across the tailboard and fit slides and sack holders at little cost. Alternatively, to transport bulk grain on such farms, a self unloading V hopper with a horizontal auger in the bottom may be useful and this can be used for bagging off if fitted with a remote hand clutch. Such units can be built for £100 or purchased for approximately £200.

Under another system, some growers bulk all their crops into the granary where they are passed over a dressing plant or through an old big mill screen before sacking off.

Bulk Methods

According to circumstances, districts and availability of materials, different methods are used. Broadly, there are now so many bulk headers at work, that public transport can no longer cart bulk grain direct from the field to rail or mill. So most systems incorporate some form of farm storage—even though it only be temporary storage on the floor of an implement shed for two or three weeks. Because few mills take in grain on Saturdays or Sundays, most growers need farm storage to enable harvesting to continue over the weekend if the weather is suitable and to this end many are building storage equal to one half their wheat crop.
1. Field to Mill

A few early growers are able to bulk harvest and cart their grain direct to rail or have carriers take it by road direct to the mill but they are few in number nationally.

2. Field—Temporary Storage—Mill

Some growers who do not wish to farm store grain for long periods but who nevertheless anticipate delays in haulage to the mill, have adopted a system of temporary storage. The grain may be temporarily stored on the concrete floor of an implement shed. The walls of a 4in x 2in timber framed shed will support grain to a depth of 4ft without further bracing. These walls are generally lined inside with ship-lapped timber, or sheet metal for ease of cleaning. Some growers have two or more 13, 20, 30 or 40 ton plywood bins built on sledge bases and fitted with metal roofs. They harvest into these bins and the local carrier carts from them as required, but both at their own convenience and independent of one another. Such mobile plywood bins, if fitted with a galvanised steel roof, cost approximately £4 per ton—labour extra. Some growers farm store the last fill of such mobile bins to make them self-supporting financially.

3. Field to Farm Granary

This system is becoming increasingly popular, for the grower is largely independent of public transport and mill intake rates at harvest time. Farm granaries should equal at least half the wheat crop. On such a farm, the barley is harvested into a bin and flows to store. The first half of the wheat crop is harvested into the granary and flows to the mill as transport and other factors permit. It and the barley provide current finance for the farm. The second half of the wheat crop is farm stored and held for varying times up to the end of November (by arrangement with the miller) and the increment obtained offsets the costs involved in the granary.

Where the granary is equal in size to the wheat crop the grower is entirely independent of outside influences at harvest time except in those areas where barley is harvested after the wheat crop when some wheat may have to be sold to provide space for the barley. Because there is no storage increment for barley, such bins remain empty for the winter.

Costs of different granaries used with this system are discussed later.

4. The One Man Bulk Harvest

On one man farms growing an area of grain but finding increasing difficulty in obtaining itinerant labour to sew bags, the bulk header makes a one man harvest possible. A mobile field bin of 20 or 30 ton capacity is built on a sledge base and can either be towed into the grain field onto a previously harvested spot—or can be set up next to the fence in an adjacent grass field. The grower obtains a header bin of bulk grain in a round of the field (or portion of it) and pulls up at the fence line where he then augers the grain over the fence and up into the storage bin.

An engine-functioned mobile 6in auger is used to elevate the grain at the rate of approximately half a ton per minute so stopped time is small. Some augers are P.T.O. driven from a tractor.

Each night the grain that is harvested is under cover and is as good as money in the bank. On every harvesting day the grower makes progress—indepenent of outside labour and at a rate equalling earlier bag harvests. From time to time, the local carrier will arrive and take away grain to prevent the bin from overflowing. For the small grower experiencing labour worries at harvest time, this is a fine system that can be strongly recommended.
Existing trailer and self-propelled headers are usually fitted by farm labour with a gravity unloading bin at small cost. An engine-functioned mobile 6in auger retails at approximately £190 and a 20 or 30 ton sledge-based plywood field bin can be built from materials costing 4 per ton.

5. Field—Drier—Granary

Where difficulty is experienced in field ripening grain to safe bulk storage moisture (M) levels (Wheat 15 per cent M, and barley 14 per cent M) the grain is bulk harvested, fed over a drier and then farm stored for periods governed by farm finances. On such farms, the granary incorporates the drier, pits, elevating and conveying equipment and one or more bins and is built of a heavier more permanent type. On the larger properties, the continuous flow drier and granary cost from £8 to £10 per ton dried and stored, but where slower driers are farm built, the costs are lower (see below).

Storage Structures

The types used and their costs vary widely depending on the facilities and labour available.

<table>
<thead>
<tr>
<th>(A) For Use in Existing Sheds</th>
<th>Cost per ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Bin of vertical galvanised iron and bands (materials only) 27 or 41 ton</td>
<td>£1</td>
</tr>
<tr>
<td>(2) Plywood bin (kitset) 20 or 30 ton</td>
<td>£2.2</td>
</tr>
<tr>
<td>(3) Welded wire bin and hessian (kitset) 20 ton</td>
<td>£1.5</td>
</tr>
<tr>
<td>(4) Christchurch steel bin walls only (kitset)</td>
<td>£4</td>
</tr>
<tr>
<td>(5) Southland steel bin walls only (kitset)</td>
<td>£0.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(B) Where No Shed is Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Using farm labour</td>
</tr>
<tr>
<td>(6) Build a silo of vertical galvanised iron, galvanised roof and concrete base 27 or 41 ton</td>
</tr>
<tr>
<td>(7) Build a sledge-based plywood bin with galvanised roof 20 or 30 ton</td>
</tr>
<tr>
<td>(8) Build a 4-bin, 90-ton wooden framed double-skinned granary with concrete floor, £270</td>
</tr>
<tr>
<td>(9) Build a Christchurch steel bin plus roof (concrete floor extra)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(ii) Using outside labour</th>
</tr>
</thead>
<tbody>
<tr>
<td>(10) Have built a lean-to shed of poles, concrete floor fill in one end and back with galvanised iron, and install 6 x 20 ton plywood bins £593</td>
</tr>
<tr>
<td>(11) Have built a “Cyclone” prefab. steel granary with double-skinned walls and concrete floor 60ft x 20ft x 10ft stud, 240 tons, £1200</td>
</tr>
<tr>
<td>(12) Have built a “Cyclone” prefab. implement shed with concrete walls and install 8 x 20 ton plywood bins, 45ft x 20ft x 12ft stud and 6in gable, £783</td>
</tr>
<tr>
<td>(13) Have built a silo of vertical galvanised iron, galvanised roof and concrete base, 27 or 41 tons</td>
</tr>
</tbody>
</table>

Irrespective of what type of structure is built, some broad principles apply:

(1) It must be strong enough. Bulk wheat 10ft deep extends an outward thrust on the base of the walls in the order of 200lb per square foot and the structure must withstand this.

(2) It must be watertight—not only from the weather but also from the soil. Concrete floors must be laid on a vapour barrier—polythene sheet, malthoid or tar and sand—and must be dried out
before grain is stored on them. Concrete poured close to Christmas must be covered with a polythene sheet before the grain is stored.

(3) It must be easily cleaned and the walls grain tight and their tops covered to prevent grain entry into them. Such lodging on the dwangs or girts will ultimately be a source of infection of storage pests in a position where they can't be cleaned out or treated chemically. The concrete floors should have a steel trowel plastered finish for cleanliness and hygiene purposes. Pop rivets can be used to close the joints of galvanised iron sheets that stand open between girts or bands.

(4) The site is important—recent heavy thunderstorms have caused flooding that embarrassed some growers.

(5) Doors and slides on granary and bin ports must be weatherproof and grain-proof. Leakage of bulk grain caused sheep losses on three farms last season including 12 ewes on one farm and a stud ram on another.

Provided the above principles are adhered to and the grain is put in at the correct moisture content, it will come to no harm and the moisture content of the mass will not change.

There are some popular misconceptions about bulk grain:

(a) The moisture level of the mass will not change if stored through the winter months. Only the surface takes up moisture from the damp winter air and this change cannot be detected nine inches below the surface.

(b) Augering grain from one bin to another will not dry the grain, i.e. reduce its moisture. This will temporarily reduce "hot spots" due to temperature rise, associated with pockets of damp grain, but the mass could warm up again. Just shifting from one bin to another will not dry the grain because it is not exposed to the air for long enough. In an in-bin drier, an air flow of 20 cubic feet per minute per square foot floor area is used and for a 20 ton bin this means that 20 x 100 x 60 x 24 equals 2,880,000 cubic feet of air pass through the grain each day—and this would remove only one-half per cent M. from the grain.

(c) Grain sweats when stored against metal surfaces. It won't if it is of safe storage M. level. Bulk grain can be stored in structures made of wood, plywood, aluminium, galvanised iron, sheet metal or concrete (dry) and it will come to no harm if put in at the right M. levels.

Shapes and Numbers of Storage Units

Bulk grain bins can be either round or square—the former being easier to construct and having less material in them. But it is often argued that when round bins are fitted into rectangular buildings, valuable floor space is lost, i.e. approximately 25 per cent floor loss. However, the floor space lost under an eight-inch wide wall is also considerable and this point should not be a factor of design.

Grain bin numbers are more important. Internal walls cost money and large round bins are more economical than smaller ones. So ideally if the grower had only one variety of wheat and stored his crop in one mass, this would be the most economical way.

Growers who are not wedded to wheat for a lifetime often desire a multipurpose building that can be used for other purposes when the wheat era passes. Such growers tend towards a rectangular double-skinned building with one large door at one end and the crop is stored in one mass. If desired a single partition can be provided to keep two varieties separate.

But some growers have more than one variety and there is also the possibility of sprout damaged grain which has to be kept separate from sound lines. To this end, multiple bins are most useful and a nest of square bins or a series of smaller round ones meets this
requirement. However, such granaries are single purpose structures and are for those who regularly grow grain.

Augers

Augers over the years have proved themselves to be most versatile machines for elevating grain and are widely used in New Zealand. They are available in different diameters (measured across the tube) and lengths. They are available as plain tubes or as mobile units easily portable on road or farm. The two standard sizes used on farms are the 4in and 6in diameter models (approximately 8 and 30 tons per hour delivery respectively), but 8in and 9in diameter units are used on headers as unloading units (approximately one ton per minute), the 4in augers retail at 30/- to £2 per foot and the 6in augers at 47/- to £3 per foot. Larger sizes are made to special order.

Recently a sweep auger attachment for fitting to mobile augers to assist in cleaning grain off bin floors, has appeared on the market and promises to be a useful tool. Many farmers buy plain augers and make them mobile and adjustable for height in their own workshops.

Bulk Grain Transport

Undoubtedly the most efficient unit for transporting bulk grain is a tip truck, but not all farms own them and other variations are used. Second-hand tip trucks have been bought—usually about £400, but a competent mechanic’s opinion should be obtained to avoid expensive repairs.

Where a flat top truck or trailer is available, a V shaped hopper can be built from plywood and slotted angle or from sheet metal and angle iron. A 6in or 8in horizontal auger and drive arrangement is fitted in the bottom of the V—possible with assistance from the local engineer. Driven from the truck or tractor’s P.T.O. shaft this has proved a popular unit. Many have been built by farm labour for approximately £100 and are available commercially for approximately £200.

Hydraulic farm tip trailers are also useful in this field, but the tray should pivot at the back of the chassis—not over the axle because this latter type cannot tip over a low wall into a pit. A number of farmers have bought old tip trucks with no motor in them for £30 to £60 and in their workshops converted them into dual tyred three to four ton hydraulic tip trailers at small cost.

A second-hand hydraulic cam and roller three ton hoist can be purchased for £30 to £50 but new five to seven ton hydraulic hoists cost in the vicinity of £250. Some farmers have purchased the former type and converted flat top farm trucks. For the one man bulk harvest system described above, no farm transport is required.

Moisture Meters

Moistures are all-important in bulk handling and all operators should own their own meters—or have ready access to one. (A number of grain merchants’ representatives now carry one in their car at harvest time.)

Quick testing electronic meters are commercially available at £45 to £70 each and for accuracy in our variable harvest, they should be used with a ground sample of grain. Hand grinders are cheap and an electric coffee grinder (approximately £3) is very suitable for grinding grain. All grain drier owners should have an electric grinder.

A Swedish infra-red tester (approximately £36) is very good for ryegrass seed (some electronic machines have not been calibrated for this crop) but is too slow for many grain samples. It takes approximately 30 minutes to run one sample.

To exceed the safe moisture levels is to invite severe trouble in
the granary. Out of condition crops will heat, go mouldy and eventually set into a solid mass. A line of 17 per cent M. wheat stored in the centre of a silo heated to 121 deg. F. approximately four weeks after harvest and was found to be setting solid when it was augered out. Some of the lines 16 to 16.5 per cent M. began to heat in the second and third month after harvest. At present I have no record of serious heating of lines between 15 and 16 per cent M.

Checking Service

The Wheat Research Institute, Hereford Street, Christchurch, offers farmers the service of checking their moisture meters for accuracy in the off season but please do not embarrass their staff by leaving it to the last moment to bring in your meter.

Insect Storage Pests and Mites

After the 1961 harvest, two cases of storage pests were noted on farms storing bulk wheat. Three more cases have already been reported this year and more are expected because of the increased amount of borderline grain stored on farms at present.

Canterbury, because of its hot harvesting conditions and the two warm months between the harvest and the frosty weather, offers excellent conditions in the granaries for insect and mite reproduction. Grain has been harvested at 100 deg. F. Grain put in a silo at about 90 deg. F. does not cool down naturally to 60 deg. F. until nearly three months later in Canterbury. Insect storage pests will breed between 100 deg. and 65 deg. F. and mites in temperatures down to 40 deg. F. The activity of both pests decreases with lowered grain moistures. At 9 per cent M., the reproduction of most insect storage pests is nil and survival of the adults is short.

Of the above five cases, two concerned insects and the other three were heavy infestations of mites. The latter abound on all farms, but insect pests do not occur naturally on farms—they have been carried onto them to produce from mills and merchants' stores.

It will thus readily be appreciated that good hygiene in farm granaries is a basic requirement. All infestations are associated with a residue of old grain, dust, straw and other rubbish. Between seasons, the granary must be thoroughly cleaned and about three weeks before harvest, it should be fumigated or sprayed with an approved insecticide.

Regular Inspections

Grain stored for long periods should be regularly inspected for heating, mould and storage pests. This means sampling from the centre of the silo or mass for it is here the grain is warmest and is here that the pests will be as soon as day temperatures drop. They will come to the surface in the spring when the days warm up—but by that time the damage will be done. A grain sampling spear is essential for a thorough inspection and all bulk operators must have one. Immediately after the harvest, all grain bulk stored should be sampled from top to bottom at regular intervals for moisture content as a check against those taken at harvest time. This is best done on a meter other than the farmer's unit and the Wheat Research Institute offers this service to farmers. All samples submitted should be suitably identified on an insert card and the sample transported in plastic bags.

It is often forgotten that 20 tons of bulk wheat are worth approximately £500 at harvest and about £60 more in the spring. Many farms have the equivalent of 4, 6, 10 and up to 20 of this size of silo, so that the capital involved is high. Regular inspection is thus in the farmer's own interest. In the past, I have personally check sampled most of the farm stored bulk wheat for moisture, but the quantity
and the numbers of silos and farms are now too great for this service to continue. From now on, this must be the farmer’s responsibility.

**Bulk Grain Financing**

As indicated above the costs of converting to a bulk harvest vary widely according to circumstances, but in general they offer no insurmountable problem. Where available finance is short, the changeover may be accomplished in stages to ease the burden.

Take for example a farm growing 60 acres of wheat averaging 60 bushels to the acre and 30 acres barley yielding 80 bushels to the acre. All the barley and one third of the wheat is sold at harvest time and two thirds of the wheat is farm stored until September. A three-year-old header in good order exists on the farm.

<table>
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<tr>
<th>DEBIT</th>
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<tbody>
<tr>
<td>Converting header to bulk, say</td>
<td>£100</td>
</tr>
<tr>
<td>Moisture meter and grinder</td>
<td>48</td>
</tr>
<tr>
<td>Farm transport</td>
<td>100</td>
</tr>
<tr>
<td>20ft of 6in mobile auger and motor</td>
<td>190</td>
</tr>
<tr>
<td>60 tons steel silos at £3 ton</td>
<td>180</td>
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<tr>
<th>CREDIT</th>
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<tr>
<td>Savings on bags, labour, twin, and cartage:</td>
<td></td>
</tr>
<tr>
<td>Wheat at least 30/- per acre</td>
<td>£90</td>
</tr>
<tr>
<td>Barley about 47/- per acre</td>
<td>70</td>
</tr>
<tr>
<td>Farm storage increment 60 tons at 1/6 bushel</td>
<td>168</td>
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<tr>
<td></td>
<td>£618</td>
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<td></td>
<td>£328</td>
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In this example the capital outlay is recouped in two years. Other systems are self-financing in three or four years.

In addition

There are other valuable features of a bulk harvest that cannot be costed:  
The ease and convenience—reduced labour.  
Increased speed of harvest.  
Safety—crops are covered at night—no wet bags to turn—no fire risk of bags in stubble field.  
Early grazing or cultivation of the field after harvest—no waiting for bags to be carted.  
The one man harvest is possible with the bulk system.

**Grain Driers**

There are now 70 grain driers in the South Island—56 of them in Otago and Southland and 14 in Canterbury. They comprise the following types:

Sack driers | 17  
Batch driers (in-bin, radial, tray) | 15  
Continuous | 38  
---|---
|  | 70  

The choice of a drier depends on the method of harvesting and the frequency of poor harvesting conditions.

**The Sack Drier**

It was designed for those harvesting into sacks, but in New Zealand (and as now appears the case in England) they have proved too labour-demanding. They require to be emptied and filled twice a
day in New Zealand and whilst 17 were built some three years ago, none are being built currently. Sack operators now prefer to cut and tip, dry on a contract continuous drier (at 1/- per bushel for up to 3 per cent M. removal) and sack off the drier.

Where difficulty is experienced most years in field curing grain down to 15 per cent M. (as in South Otago, Southland and the Willowbridge areas) the obvious choice is a continuous drier. Where the frequency is not so great, but in areas where other crops require drying, the continuous drier is again the choice, for some of them will dry a number of different crops—grains, grass seed, peas, rape, etc.

Practically all these driers are imported from the United Kingdom but at least two have been home-made by enterprising farmers. Six different makes have been imported and most manufacturers offer several different sizes—the output being expressed in hundredweights or tons dried per hour at 5 per cent M. removal (20 per cent down to 15 per cent). In New Zealand wheat is rarely dried above 17 per cent to 18 per cent M., so the drier outputs are proportionately greater. Prices range from approximately £1000 for a small machine (21cwt per hour) to £1320 for a medium size (35cwt per hour) to £1450 for the 48cwt model—dust extractor fans approximately £125 extra (all continuous driers should be fitted with one).

Contractors are purchasing this type of drier. Mounted on a trailer chassis and powered from a tractor's P.T.O. shaft, the drier moves around the district drying damp crops which can either be bagged off, augered into farm granary or trucked direct to mill. An interesting development in Otago and Southland is two, three or four farmers forming a company to purchase one of these driers, and mounting it on wheels so that it can move to members' farms to dry their grain in turn. Larger companies have static driers in a large granary where they dry members' crops and also dry at contract rates for neighbours. These driers are all oil fired and the heat is thermostatically controlled at any desired level. Grain for seed or malting is dried at a maximum temperature of 100deg. F., milling wheat at 150deg.-170deg. F. and feed grain at 180deg. F. The latter temperature will inhibit germination and give rise to "heat damage" in milling wheat—but not always—the degree of damage being governed by the moisture content of the grain and the time of exposure to the heat.

Tray Driers

These are used in poor harvesting areas where a relatively high throughput is desired. A sloping tray of grain 18in to 2ft deep on a ventilated floor is arranged over a concrete plenum chamber into which a fan blows hot air (120deg. F.) from a diesel furnace. The fan and heater are related to the size of the tray—one, two, four or five ton capacity and drying is at the rate of 1 per cent M. removal per hour. Thus a try of any size drying from 18 down to 15 per cent M. is ready in three hours, but the grain is now over 100deg. F., so before discharging, the heater is turned off and the fan blows cold air for approximately half an hour to cool the grain. Hot grain cannot be stored in bulk, for it cools slowly in mass and heat damage results.

The trays in use in New Zealand have all been home-made. The fan-heater units for four or five ton trays cost in the vicinity of £500. Perforated metal for the floor of the tray retails at approximately 7/- per square foot.

In-bin Driers

The in-bin drier is the simplest, cheapest, most efficient grain drier and is the obvious choice where the frequency of high moisture lines is small. It consists essentially of a storage bin fitted with either a perforated floor or a system of ducts, into which cold or warm
air is blown. However, it is a slow drier. Only one-half per cent M is removed from the mass per 24 hours. The advantage is that in a non-drying season, the drier can be used as a storage unit.

Air flow is at the rate of 20 cubic feet per minute (c.f.m.) per square foot of floor area and pressures in the order region of four or five inches water gauge (w.g.) are required to force this air flow through 10 feet of wheat. N.B.—One ton of wheat equals 37.3 bushels equalling 50 cubic feet. A 20-ton mass is contained in a 10ft cube.

Thus two 20-ton bins require a fan of $2 \times 20 \times 100 = 4,000$ c.f.m. at 4in w.g. Such a fan (which should be of the non-overloading type) is made by two manufacturers in Christchurch and retails for approximately £130. It requires five horsepower to drive it. If this power is taken from a petrol or diesel engine, the waste heat from the engine can be used to warm the air on damp days and nights. A maximum of 10 degrees of added heat is used with this type of drier so heat damage is impossible with it. It works on the relative humidity (R.H.) of the air being blown through the grain. Air of 65-70 per cent R.H. is in balance with wheat of 15 per cent M. and will dry it down to this level and no lower. When damper air occurs, it is warmed to reduce the R.H. to the desired level. However, when low R.H. air occurs (as in a Canterbury nor-wester), say down to 35 per cent R.H., then the grain is dried down to 11 and 12 per cent M.

With this type of drier, adding extra heat does not speed it up. The grain only dries to a lower percentage M. The way to speed it up is to blow more air, but this increases the resistance and more horsepower is needed. It should be possible to convert two 20-ton bins into driers on this system for a cost of less than £250 above the cost of the bins which can be either round or square. Interest on £250 at 6 per cent is £15 per year—a small insurance policy in the years in which it is not needed.

An American in-bin drier is currently being marketed in New Zealand and will fill a place with farmers who are not handy with their hands or do not have the time for home construction.

The Radial Drier

This is also a cheap drier which farmers can build, similar to the in-bin in that it can be used as a storage unit but twice as fast—it can remove 1 per cent of M. per day. The walls of the bin are permeable to air flow. In the United Kingdom perforated metal is used (about £100 for a 20 ton bin) but in New Zealand welded wire mesh and hessian bins are used (30/- per ton as a kitset). An underground air duct discharged into a central perforated plenum (bound with fly-screen netting—7/6 per square yard) about two thirds of the bin height so that there is an even layer of grain around and over it—generally about 3ft 6in in depth. With less grain, for a given horsepower, the fan will deliver more air against the lowered resistance so that faster drying results. If extra heat is added, this results in over-drying around the central plenum and careful mixing must be achieved to blend the contents when unloading to take advantage of this technique.

The Grass Seed Drier

The continuous drier fitted with louvres can be used to dry grass seed, but the vertical types are purely grain driers. Particularly with H.1 and Italian rye, driers are being used in a new technique to enable early harvesting and so reduce seed loss in the field. Heading can proceed two days after the mower. Curing is completed by passing the damp seed over a drier in the granary. But not all growers can afford a continuous drier, so based on an English technique pioneered by John Rowsell, five growers in Canterbury built their own grass seed driers on the batch principle. Briefly, an airtight plenum is built,
covered with welded wire mesh or 2in x 1in battens (as in a coarse sheep grating) and the grass seed is supported on top of this on a sheet of hessian. Warm air is blown through it at the rate of approximately 20 c.f.m. per square foot. (Resistance is about 1in w.g. per foot of seed) and in approximately six hours a line of grass seed harvested at about 20 per cent M. will be completed. Moistures are determined on the infra-red tester. At the moment, unloading the drier is laborious shovel work, but undoubtedly this will be mechanised in the near future. Seed of any sort can be dried on a drier of this type. Temperatures are low and heat damage will not result.

**Other Driers**

Other types of grain driers exist overseas and a few will be built here from time to time.

The large capacity fan used for drying large batches of baled hay can also be used for grain drying. An emergency field drier was built last season using a wooden duct covered with scrim or fly-screen netting and the grain contained in tarpaulins and walled in with bales of hay. The hay drying fan was used and a batch of 40 tons of wheat at 20 per cent M. was dried in 48 hours. Such a fan could dry up to 200 tons of grain if stored over suitable ducts in one mass in an open floor type of granary.

**Other Crops**

A drier has been built for gladioli bulbs at Belfast and another at Woodend. Another is being currently built at Blenheim for cabbage and cauliflower seed. Two others are in planning for tulip bulbs and pumpkin seed in the North Island. All work on the same principle—the passage of warm air through the mass.

**The National Situation**

Had the last wheat harvest yielded as previously expected, a crop approaching 11 million bushels would have resulted. To transport this crop at harvest time and store it in mills and merchants' stores would have thrown an impossible strain on the country's transport, labour and storage facilities. But this crop would still be some four or five millions short of the nation's estimated requirements in a few years time. When this latter amount is grown in New Zealand, the majority will have to be farm stored to reduce the handling, transport and labour worries at harvest time. To this end the farm storage increment has been increased from 9d to 1/6 per bushel and at this latter figure farmers as well as covering the costs involved in farm storage, receive an additional incentive to cover the risks involved and provide a profit on this new farm activity.

Under the old increment of 9d, a number of large granaries have been recently constructed ranging from 100 to 480 tons capacity. The next season should see more built, for only in this way will growers be independent of outside influences at harvest time.

Bulk handling and storage techniques have made the harvesting of such an additional crop practical and within the scope of our labour forces and grain driers have reduced the risk of inclement weather conditions. More bulk headers and driers will undoubtedly be used in future. In the words of one recent convert, "I'm sorry we didn't use change over years ago."

**Acknowledgement**

My thanks are due to those bulk header and drier owners who have cooperated with trials and investigations and to the many who have made their experiences available. The code of these men is to share their knowledge with others for only in this way is true progress possible.
EXPERIENCES WITH BULK HARVESTING AND STORAGE


My father, brother and I farm a property of nearly 1,300 acres on the banks of the Hawkins River, near Darfield. From the early 1900s to 1937, all the grain was threshed with a wooden mill and traction engine. In 1938, we purchased our first self-propelled header, which served us well for 21 years. In 1959, we purchased our present bulk machine. This is briefly the history of wheat handling on our property.

After four seasons in which we harvested all our crops in bulk, I would suggest to you that the next header you buy should be a bulk machine. No matter whether you grow grain or small seeds, I can see no point in dropping bags all over a paddock and then turn around and pay someone to pick them up. Having to turn them, if it rains, isn’t fun, either.

In 1958, my father happened to mention that he thought our old header might not do another season. We boys fully agreed with him, because here was a chance to get away from sewing bags flat out all day on a moving header in the dust, wind and heat. We stopped only for more bags and then turned around and had to cart them off the paddock. After a fair amount of discussion, we decided to purchase our present bulk machine.

Two Systems

We have two systems of handling our bulk seeds.

One is to transport the grain in bulk direct to rail, or to the silos in the granary; the other is to transport all other seeds in bulk to another shed, where they are bagged off a screen.

We purchased eight 20-ton plywood silos for the first season and two more in 1960. We now have storage room for 8,000 bushels of grain.

Equipment

To fit our truck deck, we built a V hopper with a 6-inch auger in the bottom, and at the back another 9-inch auger sloping up at 45 degrees, both driven off the trucks P.T.O. shaft. This can unload at over 40 bushels per minute. We can now deliver direct into a railway waggon, no matter where it is shunted on the siding. This 4-ton hopper cost about £120, plus our own time in building it—most of the cost being in the two augers.

The silos cost us £38 each of which £30 per silo was recovered in storage increment in the first season (9d per bushel for six months' storage). By not using sacks, a further £11 per silo was saved, against which we had to pay fire insurance and we lost the interest on our money, had we sold our wheat at the time of harvest. We also purchased a 6-inch auger with a 2-h.p. electric motor.

Barley is the only grain we cart direct from header to rail. During the first harvest we found that with a three mile haul to rail the header was always waiting for the truck to return, so we had to make up a field bin. This bin holds about 80 bushels. It is filled from the header while the truck is away. It is emptied with a 6-inch auger driven off the tractor's P.T.O. shaft. Because it relieves the pressure on the truck driver, we now use this field bin for nearly all the crops we harvest.
The Granary

In the granary which was an existing grain shed, we have eight silos arranged in two nests of four at either end of the shed. These are filled with a 21ft length of 6-inch auger which elevates the wheat from a small hopper at ground level, into which the truck unloads. At the head of the auger, a chute is used to direct the grain into any one of the four silos.

It has been our practice over the last two seasons to keep one silo in each nest free for wheat of borderline moisture content such as the first grain harvested early in the morning. We are thankful now that we have our wheat stored in separate silos where we can quality test each silo during the months of storage. Where more than one variety is grown, we can also keep them separate.

Bagging Off

With all crops that have to be bagged, we cart them in bulk into our other shed where we sew and sack off in comfort. Here the truck unloads into a 60-bushel hopper from which a 4-inch auger elevates the seed into an adjustable wire screen 5ft 6in long and 20in in diameter. We have now handled 12 different crops in this manner. I would suggest, that farmers thinking of handling their wheat in bulk, should handle all other crops in bulk. I can see no future in a farmer buying a dual header. The extra money for a dual header is better spent in making up a hopper, elevator and screen from which you can bag off in comfort either in the corner of a field or a shed. Although our wire screen is reasonably large and adjustable, it is only in the last foot or so that small peas are separated from the larger ones. This is true also for taking screenings out of barley. It is my opinion that the screen should have the same sized slots or holes right along its length to remove screenings to best advantage. In other words a fixed screen with a selection of outside casings. Better still, a small seed dresser could be used.

Owing to a shortage of shed room for bagged seed; peas, rape, and the like are grown on contract and, therefore, can be shifted as soon as harvested. We have had excellent cooperation with the Department of Agriculture, in the branding of certified seeds and transport operators are only too willing to shift bags from a shed—especially when there is a break in the weather.

Storage Pests

We have taken the precaution of treating our granary against the pests of stored grain. Where a shed has been erected for some years, this is very necessary. Hygiene is most important.

Borderline Moistures

We are running a little experiment with wheat over 15 per cent moisture. We have one silo of wheat of 15.7 per cent to 16 per cent, i.e., borderline wheat. For pests and mould to attack stored grain, they must have two conditions to eat and multiply—namely moisture and warmth. Remove either of these conditions and the grain is much safer. You can remove the moisture in a drier, but we feel a much cheaper way is to remove the heat. By using a fan and a 1-h.p. motor, sucking the cold night air through the mass, we had last season's silo of wheat that had an average temperature of no more than 35 degrees F.

Our latest piece of equipment is a 7ft sweep auger which we attach to the intake end of the 6-inch auger for clearing up the bottom of the silos when loading out.
Farm Storage

Last harvest we harvested just on 600 acres with our header, nearly half of which was barley and wheat. I foresee an increasing number of bulk headers in Canterbury. I would suggest that farmers should make provision for storage of at least two days' threshing where they are relying on transport operators to cart their grain. They should, if possible, store till September, at least half their wheat. A terrific problem will arise if we all want to send our wheat away in bulk at the same time.

High Loading Bank

Where rail authorities have suggested putting in a high loading bank I would remind you that we can't all use it at the same time, unless it is sufficiently large. I am sure that farmers and transport operators would use it, providing they didn't have to manhandle too often, their own or other half-full wagons. If that happened, I think farmers would bring their own mobile auger with them just like they do now.

Bulk handling of our crops—particularly grains—has made our harvest extremely easy. I can remember three of us carting and stacking over 2,000 sacks inside the shed where our silos are. Now one man can cart the lot with little effort and can store it all in the granary by merely pressing a button.

Personal Contact

I think it is most important that all bulk growers should know their mill manager personally. They should arrange with him the quantities to be farm stored so that both parties can budget accordingly. Farmers must appreciate the difficulties of mill managers at harvest time and cooperate accordingly. It is good business to make contact with them in the off season at least once a year. Above all, get to know them personally and don't forget that when you are harvesting, other people are harvesting, too.

Acknowledgement

Finally, I wish to acknowledge the assistance of my father and brother Keith, who have worked with me in the development of this system—this has been a team effort throughout. Looking backwards, we have no desire to return to the old bag harvest.
Mr Garrett: Well, Mr President, ladies and gentlemen, my first duty is to introduce this panel of speakers: On my far right Mr J. M. Kelsey, Officer-in-Charge of the Entomology Section, D.S.I.R., Lincoln. Mr Crosbie you already know. Mr R. D. Evans of Kaiapoi, representing the New Zealand Flour Millers' Association, and Mr Gillanders on my extreme left you already know. My first question is to Mr Crosbie. Has the introduction of bulk handling speeded up harvesting by about 50 per cent? If for instance, it took say 10 hours to handle a 25-acre crop at 50 bushels to the acre, would you now be able to do it in six hours with bulk harvesting?

Mr Crosbie: Yes. A man with his 25 acres at 50 bushels is harvesting 1,250 bushels of grain; in other words 420 sacks with 10 hours to do the job. He is only harvesting 42 sacks an hour. That is only three tons of grain per hour. Any self-respecting bulk man would exceed that rate. You would expect four and a half to five tons per hour from a little-sized machine, even a little trailer pulled behind a header covers two to two and a half tons an hour. A large machine would average between six and seven tons in ideal conditions, recording rates of anything up to 10 tons per hour over short periods, so it would be quite practical for a bulk harvester to finish the 25 acres in six hours.

Mr Garrett: Thank you, Mr Crosbie. I wonder, Mr Gillanders, if you could give us your experience on rate of harvesting since you changed from bags to bulk?

Mr Gillanders: I doubt whether harvesting time has been greatly increased for seeds because this is all dependent on the capacity of the header. However, we can thresh wheat and barley at a rate of 300 to 350 bushels per hour. This saves labour because two men can load it on to the rail or into the silos. In the old days, with the old header, we used to cart the bags off the field. That took a long time. There is another important point. Fatigue does not catch up with you. When sewing bags on the header, any mention of “knocking off” was quickly agreed on.

Mr Garrett: I would like Mr Evans to answer this question. We understand from Mr Crosbie that the number of headers in New Zealand is increasing fairly rapidly and we think from the remarks that have been made that the capacity of each header is also increasing. Now this seems to suggest that the speed of harvesting will be increasing still more. How will the flour millers be placed to accept this increased flow of grain?

Mr Evans: The capacity by millers to take in grain is limited by two factors. First is location. Some millers in the Christchurch area cannot increase their storage capacity because they have not enough land or because they cannot get any more land. The second factor is labour. Now, millers consider they have been taking in grain at a maximum rate during the past harvests. I don't see how we can increase it any more. Perhaps some of the country millers could, because land is not so hard to come by, but in the country mills labour is very difficult to get. The town mills also suffer from the labour shortage, especially for bagged wheat. It is very difficult to get skilled labour to stack the bagged wheat. Also the town millers suffer from their location with respect to building restrictions. This does not apply to the North Island millers because they have been handling bulk wheat for years, but very few of the South Island mills have any quantity of silo space whose cost is absolutely prohibitive on a large scale. We consider it beyond the financial capacity of the millers.
The Millers' Federation have built a new silo in Wellington for handling feed wheat. It holds approximately what I would require at my small mill at Kaiapoi. I have another small mill at Waikari and that uses about the same. The Wellington silo cost about £150,000. I cannot see any miller in my position or anyone else building silos to meet their requirements. There is not only the cost but also the risk. Maybe wool and meat prices will rise and farmers may then get out of wheat as they have done before. What are millers going to do with their silos? I don't want to be one of those chaps with £300,000 lying idle.

Mr Garrett: Well, it seems that there will not be a large scale increase in the capacity of mills to absorb large quantities of wheat around harvest time. But we have a very useful new provision this year. The storage increment has been doubled from 9d to 1/6 a bushel. Does it pay farmers to store their own grain, Mr Crosbie?

Mr Crosbie: Last year I had a good look at this problem. I worked out your costs for storing grain on the farm and I was pretty generous in my estimate in the cost of the granary. I allowed £5 a ton for its erection. The total cost of having this granary plus the cost of getting the grain in and out of it amounted to about 8d a bushel. At that time you were paying 9d a bushel to have that job done for you, so I could not see that it was an attractive proposition financially. You are accepting risks of storage pests and having it go mouldy on you. There is even the possibility that the wheat you are storing is not milling quality wheat, for it is only milling quality wheat that received this storage premium. So it seemed to me that you needed an incentive to increase your storage capacity. Well, I thought of offering you five per cent on the whole deal, but the Drainage Board will give you five per cent for your money without work or worry. Debentures on the market are six per cent to six and a half per cent at the moment so this level of interest wouldn't attract you either. Then I thought, "This is a business operation." This business of storing is separate from all other farm activities. It costs you money to get started on it and you want to examine it as a purely business proposition. So I asked, "What are these other businessmen in town getting when they pour their money into other businesses and factories?" To get the answer I looked up the official record on the Stock Exchange and, boy, this is interesting reading! Any firm that turns in less than 10 per cent profit on invested capital is held in very low respect by New Zealand investors. They have got to turn in about 15 to 20 per cent to get themselves in favour with the public. Look down the column further and you will see that some firms turn in 20 to 30 per cent profit. Others pay out only eight per cent but hand out bonus shares every now and then which doubles the pay-off. So, in all fairness, I could not offer you anything less than 10 per cent on the whole deal—to build a granary and store grain worth thousands of pounds. I reassessed my costs and I added 11d to the 8d I already had, giving 1/7 as a fair return for you. Now your representatives last year, in the form of the United Wheat Growers, made a case to the authorities. They were successful in obtaining 1/6 a bushel for you, which is a penny less than my estimate. You are getting something in the order of nine per cent on this deal and I think that's good. Farm storage of grain is therefore now quite an economical proposition.

Mr Garrett: Thank you very much Mr Crosbie for that most informative reply. Now, our next question is a difficult one. It is almost an impossible question, Mr Evans, but the thought we had in mind was "What proportion of the national crop would farmers need to store in order to make the millers' task an easy one?"
Mr Evans: It is almost impossible to answer. It really raises the question of the matter of short term or long term storage and also sacked wheat against bulk wheat. Bulk wheat would have to be stored on the farm to have samples taken and the tests carried out because, as you know, we cannot store bulk wheat safely until it is first tested for moisture and for baking quality. One of the big dangers is "bugged wheat." It takes as little as one per cent to upset completely the flour quality for bread-making. As I mentioned previously, the millers are not in a position to take in large quantities at the moment and if the present sack storers were to go over to bulk wheat, the total capacity of those stores would be reduced by one half to two thirds. This is because you cannot stack bulk wheat as high as bagged wheat.

Mr Garrett: The question that we had in mind has been answered. After there is a large scale swing to bulk, and Mr Crosbie and Mr Gillanders are fairly sure that this will take place in the near future, then it seems that there will have to be coupled with it a measure of farm storage of the bulk wheat. Our next question is to Mr Kelsey. "For farmers who, in future, store their wheat in bulk form, say, February till September, what are the risks of loss due to insect pests?"

Mr Kelsey: The risk of course depends on the length of time the grain is in storage, but we should remember that during that February to September period there are three factors which determine the danger from pests. Firstly, if pest-free grain goes into a clean store, and by clean I mean absolutely clean, your risks would be nil. Secondly, if your pest-free grain goes into an already infested store, your infestation would start straight away. Thirdly, there is field-infested grain. This is a very rare occurrence, but again you get infestation starting straight away. The whole emphasis is on cleanliness in the store.

Mr Garrett: "The next question, Mr Kelsey, is: "Can farmers avoid this loss caused by these insects and pests?"

Mr Kelsey: Yes, and the avoidance of these pests is simple. The first thing is scrupulous cleanliness in the store and by that I mean removal of any grain whatsoever, whole or broken. The store must be clear of grain before taking in the new crop. That sounds simple, but it means removing grain from all crevices, framing, cracks in between your boards, cracks in concrete and so on. If you have already got these insects inside the store, the control is fairly simple with insecticides, sprays and fumigants.

Mr Garrett: Mr Kelsey, you suggested that by being scrupulously clean and by using these insecticides or fumigants the farmers can avoid losses, but what the farmers want to know is what is it going to cost them? What about these insecticides and fumigants, are they expensive?

Mr Kelsey: With the type of store I have in mind for farmers, it is relatively simple with a sprayer. The cost of the materials for the average store would be in the vicinity of 25/- at a maximum.

Mr Garrett: Well, it is very nice to hear that something can be done cheaply. I think many of our farmers are interested in where these insects come from. How do bulk stores get contaminated with these pests? Can we stop this?

Mr Kelsey: Up to a point. As far as the stores are concerned the infestation very, very rarely comes in with the crop. Though a lot of these pests, and there are 26 recorded, are a lot of trouble, the main source of trouble is grain kept over for poultry or stock feed, broken grain, grass seed and clover, dog biscuits and poultry pellets.
Those are the sources of insect and mite infestation. It would certainly pay the farmer to keep his poultry or stockfeed separately.

Mr Garrett: Does it matter where he is keeping the few bags of fowl feed and the old dog biscuits he has forgotten about and the old bag of ryegrass-clover seed that he did not sow three years ago in the corner of the rafters? Do they have to be 50 yards or 500 yards away from the grain store? Does this matter?

Mr Kelsey: No, it doesn’t matter at all. Of course, to have the source of infestation there is a bad thing and the farmer must get rid of that grain. It is a source of infestation and you cannot keep the store free from infestation for any length of time. You can do it for a year, but you won’t do it for a second year. Insecticide is necessary to make the farm safe.

Mr Garrett: Farmers are like other members of the community. They are full of good intentions. Now what happens if these farmers don’t use insecticides and don’t clean their bulk stores out when they are empty if they say, “I suppose I should do it; perhaps I’ll do it next year,” and they don’t bother? Can they carry on doing this?

Mr Kelsey: No. Farmers can get away with this for one year and possibly for a second; but it is very unlikely they could for a third year. The infestation is small to start with, but it builds up rapidly. Because the cost of killing them off is so cheap it is not worth the risk.

Mr Garrett: I understand that these insect pests can be damaging grain but you can see them by looking through the man-hole. Is a sampling spear part of the equipment of the bulk store?

Mr Kelsey: Yes. With a spear we can draw a sample anywhere in any silo. Use it every month or six weeks during the storage period, taking samples from three levels down the centre of the silo. Test the sample for moisture, temperature, and look for insects.

Mr Garrett: Mr Crosbie, you seem to be a father confessor of all bulk handlers and storers. Do you think this spear is part of the equipment they should have?

Mr Crosbie: I strongly advocate using spears. As far as I am concerned, a 20 ton bulk wheat is not 20 ton, is is £500 in notes. I cannot imagine people going past a stack of notes day after day and not having a look to see if they were safe. If you look in you see only the top ones. You have to delve deep to see if the middle is heating up. It could be going mouldy, going out of condition, or you could have an infestation. This spear will help you to prevent just that.

Mr Garrett: If farmers have a look every four or five weeks would they pick up any insect damage before it really got very far?

Mr Crosbie: Yes, you would certainly pick up the majority of infestations. You would not pick up mites, because these are very, very small.

Mr Garrett: Changing the topic a little, we believe that it is government policy for New Zealand to be self-supporting in wheat production. It could be possible that farmers will continue to expand wheat production by another million bushels over the next two years. How would flour millers be placed to handle that increased crop?

Mr Evans: I think there need be no great difficulty. The position at present is that South Island mills have enough locally grown wheat for their requirements this year. Prior to harvest, and in anticipation of a heavier crop than did eventuate, arrangements were made for sending South Island wheat to the North Island. Had this actually come about the Government would not have been bringing in so much Australian wheat for the North Island. In the past before
we were self-sufficient, we in the South Island have had trouble with shipments of Australian wheat and these problems upset the South Island millers. The fact that importation has taken place at all upsets the South Island farmers who, being considerably more numerous than the flour-millers, attract more attention in their protestations against importations of Australian wheat.

Arrangements I have already mentioned were finalized before this year's harvest to absorb the expected South Island surplus into North Island flour mills. Considerable amounts of Australian wheat would have been still required and this meant that the Government would have to have stocked the storage bins with the Australian wheat as a first priority. Such a procedure would involve additional storage of surplus South Island wheat. Presumably it would be held on the farms until later in the season. This sort of situation is likely to arise again if and when a surplus to South Island requirements is produced in the South Island. Apart from this I do not envisage any difficulties.

Mr Garrett: Well, it is very nice to hear the flour millers are happy in that respect, anyway.

The meeting is now open to the floor. Have you any questions?

Q.: What are the temperatures at which pests will multiply?

Mr Kelsey: As the temperature is decreased, you decrease the activities of these pests both for eating the grain and reproduction. The bigger insects pests will stop breeding at 65 degrees. If you are able to cool the wheat (naturally because you live in Southland or artificially because you live in Canterbury), get it down to 60 degrees fairly quickly after harvest and this would be safe as far as insects are concerned. But the mites are more persistent; they can breed right down to 40 degrees and as Mr Gillanders said, you have to wait until the frosts and drop the temperatures down to 40 degrees before you are safe.

Q.: Did Mr Gillanders dry that cold night air before he put it through the grain?

Mr Gillanders: This was only an experiment to see how cold we can get this wheat. We pick our nights during the frosty weather to get temperatures down to 35 degrees. However, we are more interested in getting down below 60 degrees as soon as we can after harvest. I am amazed at how long the grain will keep this temperature even after it has been put in the silo at a temperature over 90 degrees.

Q.: In that circumstance, would you have to watch very carefully the relative humidity of the air?

Mr Gillanders: Well, you cannot do anything about this. What we do is to draw the air down through the mass by “bottom extraction.” That only dampens the grain at the top. You can pack up after the top gets too wet. This damp air is one of the factors you just have to accept.

Mr Garrett: I am extremely sorry, but I shall now have to close this discussion. I would like to thank Mr Crosbie and Mr Kelsey for coming along. I would particularly like to thank Mr Evans and Mr Gillanders. I make this distinction because they are not public servants and have given up their time to take part in this discussion. I do on behalf of the College and yourselves, thank you very much indeed for coming along.
RURAL SECONDARY EDUCATION IN NEW ZEALAND

D. B. McSweeney, Lecturer in Rural Education, Lincoln College.

Introduction

There are 400 students at Lincoln College. Most of these have received all their primary and secondary education in schools quite different from the ones you attended. A number of these students were not even born when World War II ended. If you can remember the proficiency examination or even the more recent "matric." then you are either middle-aged or elderly. If you left school more than 20 years ago you probably find it difficult to keep up with educational changes. I will therefore outline the present primary and secondary school systems to you and describe the existing examinations. From there I will consider present provisions for secondary education in rural areas, referring especially to the question of boarding allowances and bursaries. I will conclude with some critical comments on the District High Schools and at that stage hand over to the panel.

A. The School System

The clearest way to describe New Zealand schools is to divide them into eight groups.

(1) Primary Schools: These are two types: full primary, which take children from infants right through to Form II (the old Standard Six) and contributing which send their children on at the end of Standard Four to the second group:

(2) The Intermediate Schools: These cater for Form I and Form II pupils only. There are over 50 of these schools in New Zealand, located mainly in the cities.

(3) The third group is very familiar to you—the District High Schools. There are just under 100 of these and they take pupils from the infants right through to the Sixth Form.

(4) Fourthly come the Secondary Schools. Though originally academic, they now offer many courses. A useful subdivision of these schools is that of single sex and mixed—which happens to be much the same as saying "the old" and "the new."

(5) In a fifth group are the Technical Schools. They have an administration separate from the secondary schools and no doubt Mr Jefferies will wish later to comment on them.

(6) Combined Schools are a residue from the past. There are only seven of them. They were originally formed by combining technical and academic schools. Today they are scarcely distinguishable from the secondary schools. Nelson College is an example of a combined school.

(7 and 8) Two final groups should be mentioned—the Correspondence School and the new Form I-VI High School. I’ll say more about both later.

B. The Examination System

Today 98 per cent of primary school children enter high schools where they can be expected to stay on average for about three years. Normally, they will progress from the third through to the fifth form in three years. It is at the end of the fifth form that they sit School Certificate—their first public examination. For it they take a maximum of five subjects, at least four of which must be passed, including English. The minimum mark for a pass in any subject is
30 per cent and the total marks for the four subjects must not be less than 200. The overall pass rate in New Zealand is just over 50 per cent. The examination will be commented on later in the session.

Successful School Certificate pupils go on in the following year to the Lower VI. It is at the end of this year that they hope to be accredited for University Entrance. If they are not accredited they can sit the U.E. examination. If a pupil is accredited or passes the U.E. exam, he will move into the Upper VI (normally in his fifth year). If however, he is not accredited or fails the U.E. exam. he will still qualify for Endorsed School Certificate (a certificate to which are attached substantial bursaries). At this stage he will either leave or repeat his Lower VI year.

In the Upper VI year an able student will probably try for Scholarships. The remainder, on completion of a satisfactory course, will qualify for Higher School Certificate.

One further quite recent qualification should be mentioned—the Certificate of Education. This may be awarded to a pupil who fails School Certificate but obtains at least 30 per cent in one subject. This qualification may serve a useful purpose and possibly Mr Knight will say something about it later.

C. The Myth of Equal Educational Opportunity

Having sketched in quickly the details of the present school system I would like now to look particularly at rural secondary schools. Perhaps it is not appropriate to quote Mr Peter Fraser at a farmers' conference, but a statement he made in 1939 summarizes an ideal which has been generally held in New Zealand for a long time:

"The Government's objective ... is that every person, whatever his level of academic ability, whether he be rich or poor, whether he live in town or country, has a right, as a citizen, to a free education of the kind for which he is best fitted, and to the fullest extent of his powers."

You know as well as I do that we have fallen and probably always will fall far short of achieving this ideal. Country parents are beset by very great problems of education for their children. In the face of these problems they are inclined to look with envy towards the city and ask for better facilities for their children. However, very many steps have been taken in New Zealand to improve the education of country children. Those of you who have read or travelled at all widely will know that in most countries the disparity between urban and rural education is much greater than it is in New Zealand.

Better education for country children can be obtained either by improving education in rural areas or by sending rural children to boarding schools. In general, rural New Zealanders have looked at boarding schools and found them wanting. With what I think is commendable wisdom they have preferred to set up a vast network of school bus runs and consolidated schools and keep their children in the home—this in spite of inheriting a typically English system in which boarding schools were valued highly. What are the measures which have been used to improve rural education?

School Transport is one. Today it is big business. It costs two million pounds a year which is 4 per cent of the net expenditure on education and over the last ten years has been used to transport 18 per cent of all school pupils. Though school transport facilities are used widely in urban areas, by far the greatest benefit from them is felt in country districts.

Linked to school transport is the consolidation of rural schools. This process is not new. It was being carried out in the United States

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in the 1870s and was suggested in New Zealand before the turn of the century—typically, the advantage claimed at that time was that it was cheaper! I would suggest that consolidation, in spite of all the criticism levelled at it, is one of the finest means we have had to improve the quality of rural education. It is interesting to note that when Mr George Parkyn wrote his report on consolidated schools some years ago he recommended that FI and FII classes be consolidated on larger schools, leaving younger children in the local district. The spirit of this recommendation is inherent in the recently proposed FI-VI high schools that I will say more about shortly.

The Correspondence School provides a service for rural secondary children which only those who have worked closely with it can fully appreciate. I like the Commission's statement that "the service provided by the Correspondence School for country children... is of a very high standard indeed." (p. 447.) This school is organised to give tuition in almost all secondary subjects and provision, quite widely used in district high schools, exist for the Correspondence School to give tuition in subjects not available in the local school. It is thus not unusual to find VI Form pupils in small district high schools taking a subject with the Correspondence School. In 1961, 483 full-time and 2546 part-time pupils were enrolled in the secondary department of the Correspondence School.

As a teacher who has seen the so-called "Country Service Clause" in action I hesitate to describe it as a measure which improves rural education. This provision in the regulations governing teachers states in rather official language that unless a teacher serves for a time in a country school he can not expect to get more pay or more promotion. However, most people would agree that through this measure many talented, if initially reluctant teachers have taught for a period in country schools. There is no doubt also that it has lessened considerably the staff shortage in country schools.

Other educational services—school broadcasts, specialist itinerant teachers, museum educational services, the National Film Library and the National Library Service—these also are doing much towards achieving Mr Fraser's ideal.

So far then, I have described measures which improve education in rural schools. I have also stated that in general New Zealand parents do not take kindly to boarding schools. In spite of this, though, the boarding school system is well established and gives a much needed service to rural children. Education Department policy in this matter can be summarized as an attempt to supply the widest range of facilities in rural areas and where these are still not adequate for individual pupils' needs, to pay allowances which cover part of the cost of attending boarding schools.

I will give you a few figures about boarding schools and bursaries and then describe the various allowances which can be obtained. Mr M. A. Bull of Timaru Boys' High School gave the following figures to the Science Congress in Christchurch last year.

If we take 38 typical Canterbury secondary pupils:

- 3 will be in district high schools
- 8 including 3 boarders will be in private schools, and
- 27 including 2 boarders will be in ordinary high schools, i.e. rather more than one in eight will be boarding.

One disconcerting aspect of hostel accommodation for some parents is that it is not keeping pace with the growth of school numbers. Ten years ago there were hostel places for 10 per cent of post-primary pupils. Today there are places for under 4 per cent. It seems reasonable to assume, though, that as more rural high schools are established the need for a large network of hostels should decline. Another aspect of hostel accommodation is that in 1959 of almost 4,000 state
hostel places available only 1,800 or rather less than half were occupied by pupils eligible for boarding allowances.

An allowance of £50 a year (5/- per school day) is payable for children who qualify for a boarding allowance. Those of you with children at boarding school will know from harsh experience that this sum represents less than one third of the real cost of sending a child to boarding school. State hostel charges at present run to about £50 a term. It is not, and probably never will be the policy of the Education Department to meet the full cost of boarding secondary school children.

It is fairly obvious, then, that sending children to boarding school is an expensive business. I agree heartily with a former Minister of Education who observed that even if boarding allowances were doubled, this form of education would still be beyond the means of an important section of the rural community—the farm worker with several children, the small farmer, the county council employee, the forestry worker and so on. All the more reason, therefore, for improving secondary education within rural areas.

1. Boarding Allowances—these are available to post-primary pupils whose home is three miles or more from a post-primary school or from a transport service to a school—these allowances may also be paid to pupils who have completed one year in a local school, and wish to take a course in agriculture, engineering, or building construction. Girls who, in their second year at a post-primary school are unable to obtain tuition in shorthand and typing may also qualify for this bursary.

2. Academic bursaries—these are designed for pupils who would need to live away from home in order to take a course up to School Certificate, including three of the following subjects: a foreign language, Mathematics, Science, a second foreign language. Selection for these bursaries is on the basis of ability and a maximum of 400 may be awarded annually.

3. Technical bursaries—available to pupils (boys or girls) who have completed two years’ satisfactory work in a course which cannot be advanced in their local school. These bursaries can be held only at certain specified schools and are available in: agriculture (15 years and one post-primary), art, engineering, homecraft, commerce (for girls).

4. Secondary School bursaries—available to pupils who have passed School Certificate or University Entrance, and who need to live away from home to attend a post-primary school approved for accrediting purposes. You would note that even though the local school has a Sixth Form, bursaries are available if the school cannot accredit. Furthermore, even where the local school can accredit it may not offer a wide range of Sixth Form courses (e.g. in Maths and Science). Secondary bursaries may be awarded to overcome this situation. This bursary, like the others, is worth £50 a year.

5. A further form of help for country children is that given to pupils who qualify for one of the allowances I have mentioned but who are unable to travel to a larger school daily. Such pupils can obtain free season rail tickets or have their fares paid on regular transport services or have private transport assistance up to 3/- a day.

D. District High Schools

In the last part of this talk I would like to say something about what I believe is one of the weakest sections in our educational structure. Fortunately, long-overdue winds of change are blowing, but
it will take a vigorous and determined rural community to keep them blowing. I refer to the district high schools. Nowhere in New Zealand's state post-primary system is educational inequality more clearly shown than in these schools. After teaching for some years in the district high schools of Canterbury and Otago and having recently returned from a visit to the district high schools of Southland I am impelled to make this statement with vigour and with conviction. No one interested in the welfare of the New Zealand rural community can possibly look complacently on these schools. Don't think that I am simply criticising the district high teachers—far from it. They are doing a fine job under very difficult conditions.

I am not alone in expressing this opinion about district high schools. Criticisms levelled against the secondary departments of these schools are well summarized by the Commission on Education in this way:

"The secondary department has played a noteworthy part in the education of our rural children. But today under its present organisation it does not go near enough to the ideal of providing full educational equality for country children. Although the Commission has stated its view that complete equality of opportunity is not possible for all rural pupils, it is nevertheless of the opinion that feelings of dissatisfaction with the present district high school system are not unreasonable and that country pupils generally could and should be given a much better secondary education than has been possible in the past." (p. 444.)

The major solution to this problem proposed by the Commission is the setting up of a new sort of school—the FI-FVI high school—in which secondary schooling begins at FI. This change would involve the transfer of FI and FII pupils from surrounding primary schools to the new high school. A further recommendation is that the roll number required to translate from district high to full secondary status be reduced from about 250 FIII-FVI pupils to 180 FI-FVI pupils. Such a scheme would allow about half the present 96 district high schools to translate.

You probably know that two such FI-FVI high schools have already been established—one in the North Island and one at Geraldine. I am optimistic about their chances of success. These FI-FVI schools will have a larger staff than the district high schools and correspondingly more opportunities for specialised teaching. They will have more specialist facilities and should enjoy enhanced status. Because of this they will probably be supported by a larger number of local children, a proportion of whom have in the past chosen to attend distant boarding schools.

Right now many district high communities are pressing for a FI-FVI high school and in all cases they are doing so because theirs is surely the thriving centre of a prosperous district and the logical place for a new high school! I am reminded of Oliver Wendell Holmes' comment that "The world is a globe with its axis passing through every small town."

If the Commission's report has done nothing else it has at least made people think about the problems of their schools—surely a more valuable pastime than feeding the Golden Kiwi or picking a shield team.

I would like to make two final critical observations and then hand this session over to the panel; parents of district high pupils, by and large, do not set their sights anything like high enough when they consider secondary education for their children. They attach too little value to education. In large measure children take over their educational attitudes and values ready-made from their parents. Thus parents who are satisfied with School Certificate for their child can expect him to start agitating to leave school the day he turns 15.
On the other hand parents who set high stock by sustained educational effort and whose intellectual and material values are in reasonable balance should not be surprised if their children want to do a Sixth Form year. Humane, sympathetic, yet firm parents can do much to help children of even modest ability succeed in their secondary schooling.

Talking of the role of parents and their ambitions for their children leads me into my second comment—School Certificate. This examination is not the apex of secondary schooling and I believe it has taken on a prominence never intended for it. You should think of the secondary school population divided into three—the third who, even with the best will in the world, can never hope to pass School Certificate (and what a social tragedy it is that our school system is so ill-equipped in terms of staff, facilities and educational knowledge to give these children the sort of schooling they need).

The second group includes those who could pass School Certificate with a struggle—it is these who are helped greatly by sympathetic and helpful parents.

Third are those for whom School Certificate does not constitute a challenging goal. In this group are some who drift through school without effort, score mediocre School Certificate marks then leave. The time has come when New Zealand cannot afford the luxury of wasting talent such as this. The teacher who sees such waste is even more appalled by it than is the good farmer whose neighbour never dags his sheep or cleans his ditches. The good farmer can at least console himself in the knowledge that the situation can be fairly quickly remedied—not so in the teacher's case. Here, educational wasteland will last for the life of the individual who in turn is likely to pass it on to his children.

I have attempted to describe the present rural secondary school system to you. I have also drawn your attention to what I think are some of its weaknesses and have pointed out some advances that we may reasonably expect in the future. At this stage I want to leave the world of theory and get down to individual case studies with members of the panel.
PANEL DISCUSSION ON SECONDARY EDUCATION

PANEL:
Mrs D. M. Shrimpton, sometime high school teacher, Teachers' College lecturer.
Mr S. C. Knight, Acting Senior Inspector of Post-Primary Schools.
Mr J. U. Barclay, chairman of the Lincoln High School Committee, farmer and past-president Y.F.C.
Mr W. J. Jefferies, Principal, Ashburton Technical College.
Mr D. B. McSweeney, chairman.

Mr McSweeney: I have prepared in conjunction with the panel a series of what I have called case studies. The object of these case studies is to tie the speakers down to specific problems, rather than speaking in generalities. These cases are individual problems of children in rural areas.

Case I: A boy of potential U.E. calibre who does not know what he wants to do but is reasonably keen to continue at school. So far he has attended the local district high school but if he returns, there will be only six in the Sixth Form. The school cannot accredit. The parents could afford to send him to boarding school, but only just—advice please.

Mr Jefferies: I certainly think that a boy of U.E. calibre should make every possible effort to get this U.E., whether he's going farming or going to Lincoln College. Who knows, when we become members of the European Community it may be necessary to seek other fields in farming. Should you make this boy go back to D.H.S. or go to boarding school? Given the staff and the ability I think the D.H.S. can do just as well as its big brother in the city. The two conditions, though, are adequate staffing and able pupils. Given the staffing and if the pupil is an able type of boy, then I think he can do just as well in his own district high school. It would depend of course on other factors—the course he wants to take and the fact that there are only six in the Sixth Form. I don't think this six in the Sixth Form matters. I firmly believe that the academically able child will do as well in the district high school as in larger schools. I am doubtful personally whether boarding school can offer more than the local school. Boys go off to boarding school, they mix better and benefit socially, but I have a lot of respect for the local district high schools. On listening to Mr McSweeney you have to remember this though, the 90 per cent or 98 per cent in these district high schools cover a very wide range—the academically able child as well as a large number of children who are not academically able. This is where I consider the district high school has not got the facilities. In the past, say 30 to 50 years ago, district high schools were as good as bigger schools. I would say, then, about this boy—certainly encourage him to stay at school, get his U.E., because it is valuable. He won't be accredited, well, that's all right, he won't get U.E. so easily; but he should settle down and pass it. He will know if he is of U.E. standard.

Mr McSweeney: You have stated, then, that this boy should be sent back to school and you are in favour of sending him along to the local school.

Mr Knight: I would agree with everything Mr Jefferies has discussed, or almost—I would mention how important it is that the school
should be of adequate size. The size of the school determines the number of the staff and the number of the staff determines how much time can be given to Sixth Form pupils for tuition purposes. Are these youngsters going to be entirely on correspondence courses? If so the lad should certainly be sent away to a high school which caters for these pupils. The size of the school, then, does matter. We would like to point out something else—I think we should emphasize the actual qualifications of the staff. It may be a fully staffed school, but the staff may not be qualified in subjects that some of the boys will be wanting. For instance, the boy may have an inclination towards languages. How many schools can offer two languages? He may want two sciences—how many schools can offer two sciences unless they are approaching the 200 mark? So we have got to look at the qualifications of the staff. Now, I think we have got to have a look at the lad himself. If we send him to boarding school, are his chances going to be enhanced or jeopardised? From a small district high school to a very large boarding school is a big change. It may take him a couple of months to settle down. Those are the things you must weigh up.

Mr McSweeney: I am interested in your last comment. It is something that was put to me very forcibly in Southland. This uprooting can be very hazardous indeed. There seems to be a very high chance that the district high pupil going to a boarding school can find it very difficult to settle down. So far we have backed the local school.

Mr Barclay: I am in agreement on the local school. There are other aspects which, typically of the professional class, they do not give any consideration to, and this is the last part. The parents can afford to send him, but only just. In a case like this, when the boy has no particular ideas about what he wants to be, the only thing to do is to send him where he is close to home, where he can remain if he goes back to school. To get the real benefit out of boarding school I would suggest that you have got to start at boarding school at the beginning. To go there as the lonely one in the wilderness for the last year of your schooling to a school for pupils who have grown up together definitely must give a person a left-out feeling. Going back to the smaller school—he may not receive just the selective teaching he can get in a larger school, but he will certainly gain something far more important than the U.E. That is he will be absolutely certain to be given new school jobs and responsibilities. In my opinion, education does not finish with U.E. Education really goes on, as well we all know, throughout life. That boy will get a more responsible job at a smaller school and will be better fitted for his future life.

Mr McSweeney: We agree then that this boy should certainly stay at the local school. We agree that where the district high school facilities are inadequate—and I think Mr Knight has given us a reasonable indication of this—small staffing, correspondence schools and other things—boarding school should be looked at. We agree also that there are difficulties in this, difficulties of adjustment coming into boarding school at the top end of schooling.

Case II: Parents of limited means (they run the local store) have a daughter in the Fifth Form who is very capable, but the rest in class want to get only S.C. and leave. The girl has no firmly-fixed vocational ideas.

Mrs Shrimperton: I think that by the time a girl reaches the Fifth Form she should have a fairly clear idea of where her talents lie, and in what sphere she could use those talents. If she has no particular ambition, her parents should take steps to help her. She can visit the Vocational Guidance Centre in the nearest town, and get help from
interviews with the staff, and get literature dealing with a great number of forms of employment. By the end of the second term she really should have come to a decision, so that plans for her future may be considered. This girl is described as “very capable.” It is very wicked to waste brains, and this girl should be helped to develop her brains. Even if her friends are leaving school after S.C. she should be persuaded to return and take her U.E. She will probably be made head prefect, and made to feel important and responsible, so this year will be good for her in many ways. Once she has U.E. she can go to Teachers' College, where she will be paid. If this does not suit her, she will easily get other positions where her brains can be used.

Mr McSweeney: Mr Jefferies, you know something about these girls who are not willing! Would you care to comment?

Mr Jefferies: Well, I don't know that I am quite as familiar with this problem as you are trying to make out. I certainly think that the girl should be encouraged to make an effort to get her S.C. She should have some qualification at the back of her. She may marry a nice young farmer in the locality and settle down, but failing that she would have to go out and earn a living. If she leaves when the others leave about the Fifth Form she will probably end up in the father's store. I think she should try and take up something like teaching, dental nursing or something along those lines. She has got to have academic qualification first. I would say, have a heart-to-heart talk with her and encourage her to stay at school, get School Certificate and University Entrance. If she is not capable of getting them, then I would say—leave.

Barclay: Our question master gave us a great illustration of the lady teachers getting married in Otago. As soon as this girl is of marriageable age she will get married, too. The point is, she is capable but that doesn't say whether she is capable as far as brains are concerned or whether she is capable of doing any material task that is given her. My thoughts are that she doesn't want to do anything, but I think she will get more pleasure and her parents will get more pleasure if she stays at home until she gets married. One of the parents' biggest problems is that immediately your children go from high school into a higher class you rarely, very rarely, see them to any great extent afterwards.

Mr Knight: I would just like to add another word. The operative word here is not only “very capable” but that word “but” that follows. The sentence “that the girl is very capable but the rest of the class only want to leave school,” is a commentary not on the influence of the school, but on the influence of the community. It seems that this is a community which has not much faith in education, and this problem often arises in remote places. Such communities do not care much for education. This attitude of mind is reflected in the attitude of the youngsters. Somehow or other the community must be got at. All these girls cannot be unwilling girls and they won't all have their horizons so limited unless the horizons of the community are so limited. If any of the members of the audience live in such a community I hope they will endeavour to do something about this problem.

Mr McSweeney: Thank you, Mr Knight. Mrs Shrimpton is agitated on my right. Do you want to comment on this?

Mrs Shrimpton: I do become agitated when people dismiss the idea of education for girls, arguing that they will soon marry, and their education will be wasted. No mind-training is wasted. I was once at a meeting of mothers and teachers who were addressed by a grandmother of wisdom and experience. She began her lecture by
saying: “I believe the mothers here will agree with me when I say that all human beings between the ages of 14 and 18 years, are unbearable. And the only thing you can do for them is to love them.” The mothers did agree. Boys have their troubles, but girls have to make a far more elaborate preparation for their future—and for the preservation of the human race—and they are therefore more disturbed and distressed physically and mentally. One day they are in the depths of despair and self-pity and the next they prance and giggle in such a silly way that their mothers are ashamed of them and wonder what they have done to deserve such offspring. Then one day the mother goes to a parent-teacher meeting at her daughter’s school, and nervously asks her form-mistress, “How is Jennifer behaving?” She can’t believe her ears when the form-mistress answers, “Oh, you needn’t worry about her. She is a very steady worker. And such nice manners! So helpful too, cleaning up after the school play!”

Well, you, the mother, can hardly believe this. If you ask her to clean anything at home, she says she is the family drudge, and life is not worth living. You ask yourself how it is that school can teach her to do things that you at home, have tried in vain to teach her. But you are wrong. You did teach her at home. From her childhood you have been training her to be kind and gentle and helpful, and as a little girl of 10 or 12, she was a pleasant happy daughter. Now she is often just plain horrid—something to do with hormones, I believe. But she knows that her father and mother will still love her whatever she may say or do at home, so she just lets herself go. But at school, nobody loves her. She has to make herself liked. She disciplines herself. She behaves as her parents have taught her to behave; and her teacher reports that she is polite and helpful. The friends she makes are well brought up girls like herself. The longer you leave her at school, cultivating good habits, the more thoroughly you are preparing her to be a happy and useful woman.

Now, about this question of marriage. I have a friend who had two pretty daughters. She thought she needn’t insist on long school courses, as they were sure to marry early. They did accept short periods of employment of a kind that needed no special training, and gave them no position of responsibility. It was not very interesting, so they did marry early. One daughter has divorced two husbands. The other, so far, has divorced only one, but she’s young yet. Now, why have their lives been so full of strife and unhappiness? Their minds were not trained; they had learned no trade or skill; they were not equipped to be useful in shop or office or hospital or school. They had not been working with colleagues to whom they had to be polite and agreeable and helpful. They were not trained in the art of getting on with people, so they could not select a satisfactory husband, and even if he had been satisfactory, they couldn’t have got on with him. But if a girl knows her job, knows that she is useful and necessary, and that other people rely on her, she becomes thoroughly interested in her work and is reluctant to leave it. She will not marry till she has found someone whom she can respect, and who will respect her. She will wait till she has found a man who is going to be her best friend for the next 60 years. And that is the future that in your heart of hearts, you want for your daughter.

Mr McSweeney: This young lady we have been discussing seems to have been a Jekyll at school and a Hyde at home. However, we certainly want her back to school again for a Sixth Form year. We have heard through Mr Knight about the community which gives rise to girls who want to leave school as soon as possible and we have all agreed that further education of a formal sort is necessary for this girl.
Case III: Comfortable parents of two children—no abnormal social aspirations about boarding schools but keen to do the best for their children. Their alternatives appear to be:

(a) Local district high (100 pupils in secondary).
(b) City boarding school.
(c) What factors should they take account of?

Mr Barclay: Well, first of all there are two children. It seems to be very expensive to send them to boarding school, so parents have to be more than comfortably off materially, because if they are not, although they might send their children to boarding school in town, those children might have to get along with people in better circumstances than themselves and sometimes this is inclined to give children an inferiority complex. I presume it is still comfortable and not wealthy parents we are talking about. These parents can afford to send them to boarding school without undue hardship—in that case they would have to be wealthy. As a person who never went to the local school but to a city school I always felt that I did not grow up in those vital years with the youth of the surrounding country. After three years at a high school when I went back to work on the farm I felt myself at a distinct loss as far as having a sympathetic or an intimate feeling with these boys of my own age and I would suggest to parents that that is one of the considerations they want to give boarding school. The loss of those vital years that are so essential to the youth of the farming community to join them together in the same age group. I would think that really this was the reason why I became interested in Y.F.C. It was one of the ways I had to bridge the gap between myself and boys of my own age. Therefore, unless the circumstances are very exceptional, I would personally not consider sending the child to boarding school.

Mr Knight: Well, I think Mr Barclay has covered this very well. Just one further point—with 100 pupils in the secondary department, it is quite an interesting school. If I lived in this community I would beg these parents to make it 102, and the school would then be entitled to five teachers and not four!

Mr McSweeney: I thought the most subtle problem of education was how far the local school bus would take the pupil, but here is another point of interest.

Mr Jefferies: I would agree with Mr Barclay. I think it is a tragedy where a girl or a boy is not brought up in his own community. They go off to boarding school in the city, come home for odd holidays, possibly improve their accent, but they grow away from the community and I think this is something that takes many years to overcome. It is like the neighbour’s grass, it is greener than yours until you come to examine it and find your own is better after all.

Mr McSweeney: We seem to be fairly generally in agreement with this one. I don’t know whether Mrs Shrimpton would agree.

Mrs Shrimpton: I think that if your child is brilliant he ought to be in a city boarding school. He cannot advance his subjects as well in a district high school. There are not enough specialised teachers. Also, if your child is a spoilt brat he should go to boarding school.

Mr Jefferies: I would agree with Mrs Shrimpton. Every child has to be judged on its merits and if that child is highly academic it can be just as much a fish out of water at a district high school as it is at a city boarding school and I would give the very best possible education to every child that I had to handle, with no exception.

Mr McSweeney: Well, in general you support the local school, but you believe that if a pupil is very able indeed the city boarding school is better. In summary, the local school has distinct advan-
tages as far as the community is concerned; there are occasions, though, where the local school may be limited in subjects, in which case the individual pupil may gain more from boarding school.

Case IV: A farmer lives near a country high school. He has one son and two daughters. The son will eventually take over the home farm. At the high school they offer a range of courses—academic, general, commercial and agriculture. The boy in primary school was of average ability; his father wants to know what course he should take in high school. Please advise.

Mr Jefferies: Now it seems to me that these children are potential U.E. types. What are they going to university for? Are they going to be lecturers or are they going to work on the farm? If this boy is of average ability in the primary school, on the face of it it looks as though he should take the agriculture course, but with reservations. You have got to examine the course and see what it contains. The agriculture course is not the same in every school—one school might be a very different thing to another school. If it contains an opportunity for full mathematics and a good basic science he should take the course. The reason for this is that if he is able to master this course he will then have a basic grounding for doing university work if he wants to. Now I think that that would be the advice that I would give in this case.

Mr Knight: I think Mr Jefferies has covered it very well. There is this point that I can bring out again and that is the matter of "average" for this boy. This covers a tremendously wide range of abilities. If this boy is at the bottom of this average scale he will be attracted to the rural course. Just because it offers less academic challenge, these boys will be attracted to this type of course. If, however, a boy is at the top end of his scale he would be very unwise to take the course for this reason. There is no individual challenge—I mean academic challenge, he is not extended. It is the same with the commercial course. Many of these lead nowhere. In judging a course you want to look at the ceiling of the course. If your boy is average, which means S.C. and S.C. means U.E., then lots of boys of average ability do master's degrees. Look at the course, does it look beyond S.C.? If it doesn't, have nothing to do with it. You see too many boys taking an agricultural or commercial course and finding themselves at the end of the time faced with two or three new subjects in their Sixth Form year and it is impossible under these circumstances to get U.E. They drift and finally leave school.

Mr McSweeney: Mr Jefferies, I should like to ask you a question. Why do you say that this boy should take an agricultural course instead of a general course to go back on to the home farm?

Mr Jefferies: Well, I think that the agricultural course I am visualising does not end at S.C. It is getting an opening to go through. It does not matter what course the child takes as long as he is able to get a lead through. I don't think the course itself is of such vital importance. In this case the boy is of average ability and wants to go back on the farm. This agriculture course will encourage him and if he can get S.C. in subjects that follow through he will not need to launch out into new subjects if he returns for a Sixth Form year.

Mr McSweeney: The farmer of the panel so far has been silent on a farmer's problem!

Mr Barclay: It is strange to hear people talking who seem to think that the farming community should consist of those of "average" or "below average" intelligence. I would suggest that this boy take an academic course. Now there are reasons for this. One of
them is that he can follow if he wants to, right through. The other point is that he has plenty of time after school to develop his learning in farming, if he wants to do so. We have through Y.F.C. and through Lincoln College and through rural education plenty of chances and with the guidance and help of his father he should be able to learn farming. But it does grieve me that these people sitting here are expressing the opinion of the majority of the people of New Zealand that to be a farmer you are of average or under average intelligence. It makes me boil even more than Mrs Shrimpton boiled previously to think that people put this stigma on people who go back on the land. I should think that, today with the financial and organising abilities needed to farm you would need far more intelligence than to be a teacher or a professor at Lincoln College.

Mr Knight: I only want to agree with Mr Barclay. He told me when we came in that he was not an authority on education, but I see he is, as all people are. On the other hand, what I said before is true. The best education possible should be provided for the person concerned. This boy is of average ability; that's why I denied him the academic course with two languages and two sciences and other subjects. Now this is probably beyond him. Whether it is or not I really don't know. If it is not, well then, let him have a go—two languages, two sciences, full mathematics and English. There's a course for a highly academic person. If he becomes a farmer he will be a better farmer because he has done this.

Mrs Shrimpton: When a boy leaves primary school you cannot prophesy failure or success in the secondary school. Primary school work depends much more on memory than does the secondary school work! Some boys with good reasoning power, or with a wide range of interest, will shine in the secondary school, where in primary school they were perhaps bored or careless. Therefore I should give a boy described as "average" the chance to try the academic course. In particular I believe every child should have a year of Latin. He speaks a great deal of Latin every day. And if he is to be a scientist of any kind he will be using Greek and Latin words constantly. So I should give him at least part of the academic course.

Mr McSweeney: I would dearly love Mrs Shrimpton to join Mr Jefferies and have him give her the lowest Form III girls and ask her to teach them Latin. I was thinking along with Mr Barclay, about the needs of the farming community. This boy is average because he was born that way and his father happens to be a farmer. I am pleased to see you making the most of the abilities he has. The one thing to avoid, to my mind, is getting this boy into a course that leads nowhere.

Case V: A country girl attending the local district high school has decided half-way through her Fourth Form year that she will not go back to school the following year. What should her parents do with her?

Mrs Shrimpton: No girl in her fourth form should have been allowed to make such a decision. While a child is being fed and clothed by her parents she should not be allowed to make a decision. She should have been taught the habit of obedience.

Mr McSweeney: May I go back to the Fifth Form girl earlier on who is expected to know what she wants to do?

Mrs Shrimpton: This one is only Fourth Form! She must not leave in that year, unless she is keen on taking some job that will give her out of school experience.
Mr Knight: It seems to me that the answer to this is the answer to all the principal problems up and down the Island. The reluctant learner—the one who wants to leave school and get out to work. If I were a parent I am sure the first thing I would do would be to get to the root of the matter and ask the reason. Have a look at the home and school circumstances. First of all home—has she got a quiet place to study and so on? Is she getting behind with her work because of the home circumstances? Too many dances? Too many boy friends or trouble with them? At the school—is she getting behind with her work programme because the course is too difficult? Is she bored? Has she reached her ceiling because some people do reach their ceiling and are better away from school.

Mr McSweeney: Mr Jefferes, would you like to tell us what you would do if you had this girl in your school?

Mr Jefferes: I think the only thing to do is to try and find the cause of the trouble—at home or school. These teenage problems—it's no good saying "Be a good girl and go back to school." This girl will tell the parents where to go. It is like taking a horse to water, you can drown the horse, but you can't make it drink. If after everything is considered and this girl still is insistent that she wants to leave, what's Dad going to do? Is he going to read the riot act? It will end up that there will be a rumpus in the home. The only thing to do is to send her out to work and make her pay board.

Mr McSweeney: Thank you, you have summarised that for me.

Case VI: A boy in the Fourth Form at a district high school has just turned 14 and couldn't care less about school. Nor could his parents. Who can blame them? With only a primary education they earn on their farm double the salary of the headmaster! The boy in teaching circles is known as a "seat-warmer." His headmaster wants to know what to do with him!

Mr Barclay: Warm his seat!

Mr McSweeney: Now, I think that in three words we have had the answer to this question, unless anyone is violently in disagreement. Is there any violent disagreement?

Mr Jefferes: I would just like to add here that I consider there is room here for some experimentation to be done and try to find a course that will make a reluctant learner a reluctant leaver. I think that the higher percentage of our young people who are not suited for highly academic courses become "brassed off" with school when they are kept on this academic diet. I think we shall have to find some suitable thing of real value to these people. I would consider that even a Farmers' Conference at some future time could give consideration to this. When we discuss education we always think of the people who are going to do S.C. and U.E. We tend to forget about that large number of people who are not intending getting S.C. or U.E. because it is of no meaning to them, and normally way beyond their ability. There is a big percentage of these people in our high schools and I think there is some need of research to solve these difficulties. We should convert them from reluctant learners into reluctant leavers.

Mr McSweeney: Thank you, Mr Jefferes. Now I would like to hand this discussion over to the floor.

Q.: What does the panel think of the proposition that the strongly academic subjects as taught in the secondary schools be replaced by a subject known as agricultural science. This subject would be broad
enough and full enough to maintain content right through and lead into the general field of agricultural science.

Mr Knight: This is a very difficult one. I am not very happy about rural courses for such reasons as we have already given. I think that the basic sciences are essential for boys who are going into a university college such as Lincoln and the basic sciences are things like chemistry, physics and mathematics. If a boy is of that potential then that is the course he should take. Most of the agricultural courses are designed for boys of lesser ability and it seems to suit them very well—animal husbandry, horticulture, dairy science—some boys seem to lap these up. It is designed for them, they enjoy it and I would not deny it to them. I am not happy about other subjects, technical and trade drawing going right through to U.E. It is questioned now whether it is of that standard and we are trying to alter it. We are bringing in extra mechanics and things of that nature to give it a boost.

Mr McSweeney: If I can make a comment in answer to this one—as far as Lincoln College is concerned we look in our incoming students for ability in chemistry, physics, mathematics and English and we would view agricultural science as taught in a local high school as something that would lead to poorer physics, poorer mathematics, poorer chemistry and possibly poorer English. In other words we should not like it very much.

Q.: Don't you think that this is what is wrong with our agriculture as a whole. After all, why are the agriculture courses as they are? They are really the small boy of the family; they are not given a real importance as they deserve. In the colleges like Lincoln we are getting the people with all these things that you are talking about. As farmers we are often very loath to take advice from these people who have not got practical experience in farming. I think that is one of the real reasons why the support of parents to agricultural courses is as low as it is.

Mr McSweeney: Are you satisfied with the answer you have been given?

Q.: I think this course must include chemistry, sciences, etc., but must be broad enough to give you a good general education.

Mr Jefferies: I think the speaker has got something there. It is a great pity that that was not said to the Commission on Education when it sat. I think perhaps it could have had a look at this. I don't know what the Commission on Education thinks of agricultural courses and their reasons why they should not be carried on to U.E. level, but from what the speaker says I would like a course which would have sufficient academic content to take it right through. I think it is a very good suggestion. Just how exactly we can take it through from here I am not sure.

Q.: Boarding school means that a boy can get away from the home farm at least for a year or two. Comment from the panel.

Mr Barclay: I am only afraid that if the boys get away from the farm too long they don't want to go back. Too often we have seen this happen. We have even seen it happen with young people working on the land getting scholarships to Lincoln College or Massey College and not coming back on to the land. I realise, of course, that the course they are taking will contribute to agriculture but I realise that in that case these scholarships were not given for that and I am just a bit frightened that we are going to lose from the land even more than we are doing today.
Mr McSweeney: Mr Barclay's answer then, is that the boys should not get the chance to see that the grass on the other side of the fence is greener. As far as Lincoln College is concerned I annually meet at least half a dozen boys who are leaving school in the Fifth Form. They come to us and get no bursaries whatsoever. If they can go into the Sixth Form, even though they may not get accredited or pass U.E., they will still get bursaries which in total can amount to £400. The Sixth Form year in that case is very worthwhile.

This now completes the education session. I would like to thank the panel very much for wholehearted support and I would also like to thank the people from the floor who have contributed to the discussion.