The Proceedings
of the
15th Lincoln College
Farmers’ Conference
1965
LINCOLN COLLEGE
UNIVERSITY OF CANTERBURY

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LINCOLN COLLEGE FARMERS’ CONFERENCE
1965

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CHAIRMAN’S ADDRESS
S. M. Wallace, Haupiri, Nelson Creek, Westland.

Firstly I should like to thank those responsible for electing me to the chair and I assure you that I shall do my best to justify their confidence.

Your Committee is gratified and I am sure you will be equally pleased that this Conference is attracting more and more farmers year by year. It is an indication that the programmes appeal and furthermore a challenge to see that they continue to appeal to those who desire to increase their knowledge of the wide and intensely interesting profession of farming.

The aim of this Conference is for you to find out more about the techniques and policies for increasing production and in particular to learn the progress of the Agricultural Development Conference and the Agricultural Development Council have made in diagnosing the needs of the farming community and prescribing policies for farming to reach those targets of which Mr Talboys talked last year. To this end our speakers this morning will discuss some conclusions and recommendations of the Conference. Their subjects will be: “The Relationship of Farming to Living Standards,” “Capital for Development,” “Farm Man Power,” and “Taxation Incentives.”

On the practical side this afternoon we will hear the results achieved by three farmers and one Farm Advisory Officer. Professor Philpott will then give a summary of the day’s papers.

Now there is no point in my further reviewing the programme. Let me just say that as usual your Committee have tried to make it as interesting to as wide a number of farmers as possible and I hope you will find it interesting, instructive and enjoyable. What I would like to express is a few thoughts about our subject for today.

Firstly the need for a Development Conference should not be taken as a reflection on the farming community. Farming is not only New Zealand’s largest industry but basically is the most efficient. Fifteen years ago we led the world on output per man. Today we still do. Fifteen years ago a dairy farmer did well to milk fifty cows without help, today a hundred cows or more handled by one man is commonplace. Fifteen years ago our shepherds handled 800 to 1,000 ewes, today these figures are frequently doubled. In that period our sheep numbers have gone up from 30 million to 50 million, our beef cattle by two million and yet all this with reduced farm labour force (4000 less than five years ago).

One would imagine that fewer people sharing a greatly increased production would be correspondingly better off but this is not so. While we can compete successfully on world markets in spite of a 12,000-mile freight handicap, against overseas farm subsidies and other restrictions, we cannot compete against inflation. Farmers and other sections of the community who have pulled their weight, have had their efforts largely nullified by this inflation, which should, and to a great degree, could be controlled in this country. In general we have had to swim harder and harder to keep our heads above financial water. Would it be heresy to suggest that this very inflation was in part responsible for our increased production? If so, it can not continue. Inflation is the inevitable outcome of “lack of plan-
ning,” unwittingly conceived by sectional interests and pressure groups and nurtured by political expediency. It is the greatest hurdle we have to face in attaining the goal set by the Conference.

We are urged to increase production in the national interest. I believe farmers will increase production as well as they are allowed to, not from any persuasion but because their own self respect and love of the land demands that they improve their farming techniques and farms to the best of their ability. It would be hardly in the long term national interest as well as unfair, if such gains were swallowed up by inflation. It is the responsibility of the Agricultural Development Council to watch this danger and advise the Government accordingly.

The Minister and those responsible for organizing the Agricultural Development Conference deserve our thanks. Unique in conception it aims at a complete overhaul, a “new look” at our farming economy. It was not worried about making odd groups better off or a few individuals rich, but at making the nation as a whole more prosperous. And more prosperous it must become if we are to retain, if not improve, our present high living standards. It will be a tragedy if the Conference’s recommendations are not acted on with courage and vision.

As I see it the Agricultural Development Conference has achieved far more than merely indicating targets and recommending ways and means of attaining them. Its deliberations covered not only farming but every associated activity of the national economy. Not only individuals and bodies with farming interests, such as Federated Farmers, stock and station agents, and Producers Board, gave their opinions, but also Chambers of Commerce, manufacturers, the Federation of Labour, accountants, banks, insurance companies, universities and Government departments. This wide representation and its resultant publicity has created a public awareness of the national need and of the overwhelming necessity for planned development. While this concept is in the public mind, I give you this thought—would not the time be opportune for all aspects of our national economy to be subjected to a similar investigation. Exhortations from the Government for increased effort are of little value if applied to one group only. It is, and I cannot emphasise this too strongly, the responsibility of the Government to see that all sections of the community are measured by the same yard stick and that all have to search for ways of being more efficient.
LINKING LIVESTOCK NUMBERS TO LIVING STANDARDS

Mr W. A. E. Green, Assistant Director, Research Division, Treasury, Wellington.

Just over a year ago the Agricultural Development Conference recommended, and Government accepted, a national livestock target of 111 million ewe equivalents by 1972-73.

The Government had asked the Conference to indicate what increases in meat, wool and dairy products were practicable and desirable over the next ten years, and to recommend measures for achieving them. The Ministers of Agriculture and Finance, Mr Taylor and Mr Lake, had already set up a Targets Committee at the expert or official level. It was chaired by the Agriculture Department, the other members representing the three Producer Boards—the Dairy Board, Wool Board and Meat Board—the Meat and Wool Board's Economic Service and The Treasury. About that time negotiations were in process for access to overseas markets for certain products and, rather than spell out the prospects for individual commodities, a target was presented to Government in terms of ewe equivalents.

The starting point chosen was the beginning of the 1962-63 farming season when there were 80 million ewe equivalents in existence.

A special survey was conducted by the Agriculture Department. Field officers were asked to estimate the likely increases in stock numbers from different classes of land. These estimates were to be based on existing policies and attitudes. This work was started before the price of wool rose in 1963-64; furthermore, the Budget had just been presented and field officers along with the farming community had had too little time to weigh up the tax incentives announced by the Minister of Finance, Mr Lake. Farming investment was still affected by the cost/prices squeeze of the preceding years. It was therefore not surprising that the survey led to an estimate that under the existing policies livestock numbers would grow by only 2.3 per cent per annum to reach about 100 million ewe equivalents by the beginning of the 1972-73 season.

The picture can be seen at a glance from the graph I have brought along. The continuous line is the historical rate of growth of total livestock in millions of ewe equivalents. The dotted line is the Agriculture Department's estimate.

Meanwhile, my Department had completed a path-breaking piece of economic research. We attempted to calculate what this country would have to earn over the decade in overseas exchange to pay for imports, shipping services, travel, and suchlike items, on the assumption that our population continued to grow at its recent rate, and that national income per head of population grew at a rate of 2 per cent per annum.

We allowed for varying rates of growth in the main sectors of the economy. Some sectors have been and are expected to grow faster than others. For instance, the manufacturing sector has been growing much faster than farming, and we assumed a continued
relatively high rate of growth in this sector, in power generation and in the construction industry. We made a close study of the various export products and allowed for particularly fast growth in non-pastoral exports. It was assumed their earnings would more than double. This left the pastoral industries the task of increasing export earnings by half as much again as was exported in 1962-63. To work back to livestock numbers, further assumptions had to be made about prices. Everything else had been worked out in 1962-63 prices. Producer Boards were asked to consider the relation of the targeted higher production to the scope for marketing at remunerative prices. They considered what would be a reasonable price level for working out the livestock projections. Marketing was therefore part and parcel of the factors brought into the exercise. The Boards assumed that markets would be available for the increased output at prices of 42d. for wool, £150 per ton for meat, with dairy products taken at the then guaranteed or "basic" price.

When the whole jig-saw was fitted together, the Targets Committee of the Conference had still to decide whether the livestock needed to produce the desired exports were reasonably practicable of attainment.

You will recall that the Government's request was for a target not only desirable but also practicable. Certainly a rising standard of living was desirable. A 2 per cent increase a year was perhaps not spectacular, but by the end of the decade the man in the street would have at his disposal one-fifth more goods and services of one kind or another than he had at the start of the decade. Could the farms produce the number of sheep, cows and run cattle implied in the target?

The Targets Committee studied past periods. Turning from livestock to actual production for a moment (and, of course, we speak here of total production, for home as well as export use), they found that the target rate of increase (3.8 per cent cumulative per annum) was almost exactly what had been achieved during the period 1956-57 to 1962-63. At the same time, it was a good deal higher than the average annual increase for the whole of the post-war period. (From 1947-48 to 1962-63 the rate had been 3.1 per cent.) It was concluded from the more recent experience that the target was in fact practicable and, though such a high level of improvement represented a challenge to all concerned, the Conference recommended the target for 1972-73 of 111 million ewe equivalents. As I have said Government accepted the recommendation.

The scope of the challenge can be gauged by the dotted lines on the graph. The top dotted line shows how many livestock would be needed to balance our overseas payments at three points, 1965-66, 1967-68 and 1972-73. If livestock numbers grew at only the rate foreseen in the Agriculture Department survey, our earnings of overseas exchange would fall short of what is needed for a reasonable rise in living standards.

The effort needed is obviously a major one. We have, however, done it in the past more than once (e.g. in the fifteen years after the First World War, farm production actually doubled). The task is one calling for a many-sided attack.

The key to livestock growth, as Professor Philpott's researches have shown, is investment. It takes time before investment in land clearance, oversowing, fencing, or fertilizer application actually reflects itself in an increase in the number of livestock. Animals can
be bred only so fast. So a lagged effect is to be expected. The high livestock increases of the late 'fifties can be traced to high investment of the earlier 'fifties. Low increases in the last two years to the lagged effect of the costs/price squeeze of the period after 1957 which ended in 1963. Since 1963 farm investment has risen sharply and we may expect to see the results in rising livestock numbers in the next several seasons.

It takes about £4 of investment to secure an annual increase in production of £1. Therefore, the targets look as though they will imply between £300 and £500 million worth of investment in capital application of fertilizers, in land clearance and sowing, in buildings, tractors and houses, and so on. The Deputy Governor of the Reserve Bank, Mr Low, will fill in the picture about the supply of farm finance. The Assistant Secretary of Labour, Mr Woods, will deal with the manpower side. That absorbing subject of taxation obviously bears an influence on the level of farm investment and is to be the theme of the address on incentives by the General Manager of the Wool Board; Mr Fraser was incidentally a member of the Targets Committee of the Conference whose work I have been outlining and also of its successor, the Production Committee. The Production Committee consisted of the same members as the Targets Committee, namely the Agriculture Department, the Producer Boards, the Economic Service and The Treasury, with the addition of the Federated Farmers. Over the whole it operated at a higher level than the Targets Committee and the chairmen of the Boards and the Dominion President of Federated Farmers attended several meetings.

It is to the recommendations put forward by this Production Committee that I want now to turn. The Conference made four important policy decisions arising from its work.

First, it recommended to Government, and Government accepted the proposal, that the process of industry/government consultation which had evolved in the Targets and Production Committees had proved extremely useful and should be put on a more lasting footing. You have, I am sure, heard about the outcome. The matters dealt with by the Conference are to be kept under review by an Agricultural Production Council. The Minister of Agriculture is chairman. The other bodies represented are Federated Farmers, by its Dominion president, Mr Eric McCallum, the Dairy Production and Marketing Board, the Meat Producers’ Board and the Wool Board are represented by their chairmen, Sir Andrew Linton, Sir John Ormond, and Mr Jack Acland. The Department of Agriculture is represented by its Director-General, Mr Neil Webb, and the Treasury, by the Assistant Secretary, Mr H. G. Lang. The Council is served by an executive director with a vast and intimate knowledge of the field, Mr Bob Stuart. The appointment of a secretary is pending.

At the heart of the Council’s work will be the task of keeping the target under review. It will consider, in the light of actual events (e.g. population changes, growth of the economy, prices of imports and exports, access to overseas markets) whether any changes are necessary in the target or in the measures aimed at their achievement.

The second concept arising from the Production Committee’s deliberations is also under the surveillance of the Council. This is the all-important dual flow of information down to the grassroots and up again to the organs of administration marketing and Government. An experiment is being made with district committees. Some have already been set up. Others are being established, in some cases spontaneously. These committees will have the task of seeing that farmers receive the information they need about the targets, about sources of finance, about the advisory services available; and
about incentives. The committees should also help to isolate any local factors which are limiting carrying capacity in particular districts.

Thirdly, the Production Committee considered the allocation of the national target to districts. It reported to the Conference that the Agriculture Department had made certain projections of livestock potentials for different regions, based on soil types, and that the Department had set up consultative groups between its field officers and the advisory officers of the Dairy Board and the Meat and Wool Board’s Economic Service. These groups were drawing up proposals for the advisory services to work with farmers to achieve the target.

The fourth matter concerns industries ancillary to farming. No one is under any illusion that the mere setting of a target is of itself going to shower down from the sky meat or wool in vast quantities, or those queer beasts called ewe equivalents in millions! But one of the most useful effects of target setting is what I might term the teleological effect. The very process of setting a target pulls towards its own achievement because people come to think in terms of the target. They talk about what is needed to achieve it. They start taking actions in harmony with the target. An illustration is the fertilizer industry.

On the basis of the national livestock target, a study was made of the fertilizer needs for a long period ahead. The Production Committee set up a sub-group to meet with fertilizer manufacturers to consider the adequacy of plans for fertilizer production. A second meeting has been held more recently with a wider group associated with fertilizer manufacture and distribution to see whether the various proposals regarding fertilizer transport bounties were administratively feasible. The occasions provided opportunities for looking at manufacturing capacity. It appears that notwithstanding the phenomenal rise in usage—something like a 50 per cent rise in three years—superphosphate works will keep abreast of current demand, with perhaps a bit of a squeeze in one or two parts of the country this autumn. Future capacity will be ample. What the target does, in short, is to assist more orderly planning.

What has happened over the past two or three years is the development of what is known overseas as “indicative planning.” This type of planning is really a consultation procedure between Government and industry. Goals are “indicated” which are not just plucked out of the air. Like our national livestock targets they are carefully worked out in a framework which takes into account the development of the whole economy. The targets are not mandatory. No one says you must do this or that, but the implications of the goals are assessed and steps are taken to make sure that enough finance and other resources will be available to achieve the desired ends. In this sense we are “planning” our agricultural development.

Before leaving a closing thought with you, let me sum up. The target is 111 million ewe equivalents by the beginning of 1972-73. To reach it, stock numbers will have to rise at about the average rate they did over the late ’fifties. If we achieve the goal, then our living standards should rise by about 22 per cent, or an average of 2 per cent per annum cumulative. If we achieve the target and the terms of trade are favourable (i.e. if export prices rise more than import prices) we could support a higher growth in living standards. If we don’t achieve the target, we will either have to make do with a lower standard of living, or we will need to borrow more heavily.
overseas. Consultative machinery is in existence and actually working under which the Minister of Agriculture meets with the leaders of Federated Farmers and the Producer Boards and top officials of the relevant Government Departments. Besides the opportunity this provides for reviewing progress toward targets, it assists coordination of policies for production, marketing and economic policy. District committees will carry the dual flow of information out to the individual farmer and back to the centre. It is however, realised that the targets will be met or missed on the farms, not in councils and committees. Priority attaches to getting the story across to the grassroots, to making sure the resources are adequate, and to ensuring that the incentives are real.

The programme for this conference shows that your Committee is well aware of these facts.

The closing thought is this. Animals in millions may not be very meaningful to an individual farmer. The target can, however, be roughly expressed in more down-to-earth terms. If for the sake of simplifying the issues we leave aside for the moment the question of additional farms. We can then express the link between living standards and livestock in the following terms. The moderate increase in living standards outlined in this paper would require the man who wintered 1,000 ewes in 1962-63 to winter 1,400 to 1,500 ewes in 1972-63. That's an average, and I know averages can be deceptive. But it gives a fair idea of the magnitudes individual farmers should have in their minds.
CAPITAL FOR FARM DEVELOPMENT

A. R. Low, Deputy Governor, Reserve Bank of N.Z., Wellington.

Mr Green has shown what it is necessary to achieve in increased livestock numbers during the next eight years and beyond. This might be relatively easy if there were plenty of unoccupied land awaiting settlement, but such land is scarce now. It might be easy if there was a supply of additional labour awaiting employment on the land; but it obviously does not exist. For New Zealand as a whole, and for farming in particular, both land and labour are, and will continue to be, scarce commodities. The required increased production must come mainly from existing farms, as a result of two fundamentally important factors—more intelligent farming, and more capital. I am going to talk about the second of these—capital for farm development; but the first is far from being irrelevant to my topic, because capital also is relatively scarce and must be used in the most productive way. It is too easy to waste capital.

It is too easy to waste capital. It is not possible to say exactly what it costs a farmer to increase his carrying capacity. It is different for each farm, but it has been estimated at between £8 and £15 per ewe equivalent, with an average of say £10. When this figure is multiplied by the several million additional ewe equivalents required it is obvious that a lot of money must be spent on farm development as a matter of high national priority. The exact amount can not be calculated. The important thing is not to argue about the figures but to ensure that farmers want the money because they want the development; then it is the responsibility of the financial institutions to provide the money, on reasonable terms, to creditworthy borrowers who can use it effectively.

Existing sources of capital for farming are extensive, generally adequate, and capable of growth to meet the hoped-for demand. A high proportion of the money for farm development now comes out of the farmer's own net income, after he has paid tax and his family's living expenses. Unfortunately this residual amount varies greatly from year to year, and may at times be a negative quantity. By contrast, if a farmer is to undertake the task of developing his property he is likely to need funds regularly over several years to match the programme of work. Since reinvestment of income is a major source of farm capital, a pruning of vital expenditure when farm income falls will sooner or later bring about a decline in the rate of growth of farm production. Continuity of supply of capital is important, and should if possible be reasonably assured before the development programme is started. Lending institutions have been urged to watch this aspect, because borrowed capital plays a part, and often a predominant part, in farm development.

Finance for an effective development programme has four component parts:

(a) a willing, even a keen, borrower;
(b) a willing lender;
(c) reasonable loan terms;
(d) a creditworthy borrower who can use money effectively.

Let's look at these in turn.
The Keen Borrower.

People will incur debt only when they feel it is worthwhile, financially and in other ways. One of the objectives of the Agricultural Development Conference and the continuing work of the Production Council is to persuade farmers that spending money (borrowed if necessary) for increasing livestock numbers is highly worth while in the national interest, and also profitable from the farmer's own point of view. It means higher net income (not necessarily immediately), a larger capital asset, a worthier estate to pass on to his heirs (death duties notwithstanding), and a boost to his self-respect. If all this happens to be in accord with the national welfare (and it is), how much more willing should a farmer be to get the best out of his land, even if it means borrowing. Farmers in general have plenty of equity against which to borrow.

The Willing Lender

There is no lack of institutions from which to borrow. There is not, and should not be in the future, any great difficulty in the provision of seasonal finance for farming. Credit for this purpose is normally available from stock and station agents, trading banks, and to a lesser extent from dairy companies. A good deal of minor development work is financed within these seasonal arrangements. Often development work is undertaken without any specific repayment arrangements being made. The result may be a "hard core" of nominally short term debt, which is unsatisfactory to both borrower and lender. Refinancing of this hard core by means of long-term mortgage is probably appropriate, especially if further borrowing for farm development is wanted.

When we come to talk more specifically about loans for farm development, it must be made clear we are not talking about mortgage loans for the purchase of a property. In practice there may be some money for development included in such mortgages, and also in many cases a change of ownership is a prerequisite to the improvement of a property. However we are concerned here with loans to farmers specifically for development purposes. There are three main sources of this capital—the State Advances Corporation, the Marginal Lands Board, and the term loans of the trading banks.

The policies and activities of the State Advances Corporation should by now be well enough known among farmers, but this is not always true. In the last two or three years in particular, the Corporation has increased its rural lending both in amount and as a proportion of its total lending; and of its rural lending an increasing proportion is directly or indirectly for farm development. It has a lot of experience now, and has adapted its methods and lending terms to meet the circumstances of the borrowers. It has the great advantage of having trained field staff who can help the farmer to work out his programme of expenditure on development. The same applies to the Marginal Lands Board. Here are two specialised and skilled institutions whose job includes lending to farmers who want loans for development. In 1964-65 the State Advances Corporation authorised rural loans amounting to £21 million; the Marginal Lands Board in the same period authorised loans of £1,120,000. These funds have to be provided by the Government, that is, by the people of New Zealand.
I mentioned the term loans made by the trading banks. This system is only two years old and is perhaps not very well known yet. The amount available is still small (£2.9 million) and its use is not limited to farming—it is for any form of worthwhile productive project. A term loan is for a medium term of five to seven years, with repayments by regular instalments. So far about half a million pounds has been lent to farmers and farm contractors under this scheme. The amount available for term loans might some day be increased, and any farmer wanting money for a development programme would do well to inquire about term loans from his banker as well as visiting S.A.C. and M.L.B. and other institutions.

Loan Terms

A borrower is seldom satisfied with the terms on which he has to borrow. This is human nature; we would all like to borrow very cheaply (if at all) and repay in a leisurely manner. But we must remember that the lenders are not charitable institutions (even the Government lenders); the funds they lend have cost them money; they have administrative expenses to meet; and they may have (e.g. insurance companies, banks, savings banks, etc.) many thousands of customers who have lodged money with them and expect it to be kept safe and available. The Government might lower its already very favourable lending rates, but this would amount to a subsidy which, on top of the other concessions to farmers, many people would not think justified. In any case, the Finance Working Party of the Agricultural Development Conference found that “a low interest rate is not in itself a major incentive and that other inducements are likely to be more successful in encouraging farm development.” A well-conceived programme of farm development should produce such a growth in net income over a period that the rate of interest on the borrowed money—unless well above the present range of rates—is a fairly minor consideration. I have seen examples of actual figures to confirm this.

Creditworthy Borrowers

Not every borrower is able to get the money he wants and thinks he deserves, and the blame is readily placed on the lenders. But as I said before, lenders are not charitable institutions, they are experienced at the job, their funds are not unlimited, and there are alternative uses for those funds. In short, the borrower must be creditworthy in the eyes of the lender, and the purpose of the loan must pass a number of tests, too. So a loan is not likely to be forthcoming unless:

1. The farmer is a good farmer, reliable and hard-working.
2. He can provide security for the loan.
3. His fixed commitments are not so high already that the servicing of a new loan would create too much of a burden.
4. The loan money is to be used wisely in a properly thought-out programme of development, from both a technical and financial point of view.

The personal factor is always important. So also is the development plan. Good money can be wasted in farming as well as elsewhere. I cannot emphasise too strongly the importance of using the advisory services which are available in respect of both farm manage-
ment and accounting. There is plenty of technical knowledge available that is not being used.

I cannot fully describe all aspects of finance for farm development. But I do want to emphasise again all the main points I have made:

Farm development is a national necessity.

Funds are likely to be available to creditworthy farmers who have a well planned programme of development for their property.

Such programmes are likely to be sufficiently profitable for the farmer to give him a strong incentive to borrow for the purpose.

The need, the means, the technical knowledge, the incentives are all there. All that is needed is the people to take the initiative—the farmers.
My task today is to give you the thinking of the Manpower Working Party of the Agricultural Development Conference as far as it is possible to do so within some twenty minutes.

We started out, of course, by digging for facts. Farmers and other people connected with farming had personal impressions, prejudices, knowledge of what someone else had said, and so on. For years the farming industry seems to have been content to live on this sort of hearsay regarding its manpower position. This "hearsay" is quite unreliable stuff but, of course, if you haven't got solid factual information you fall a victim to it.

When we started digging for facts on farm manpower we found some very serious deficiencies. The only year-by-year statistics of the number of persons in farming are the estimates prepared by the Labour Department. The Labour Department had only the five-yearly census information of the Statistics Department to work from. When practically every other industry in this country has labour force information collected at six-monthly intervals, farming (the most important) has labour-force information collected only once in every five years. This is bad enough. But it is very much worse when this five-yearly information does not become available from the Statistics Department for another three years. The estimates of farm labour force which the Labour Department was making in 1963 were still being based on the 1956 Census, because the Department could get no later figures. The estimates were well off the beam. You won't be surprised therefore, that the very first recommendation we came down with was for annual collections of statistics of farm manpower with results to be available three months after collection.

Let me now tell you some of the facts we were able to establish. Some of them are bound to surprise you.

In 1962 there were 3,395 boys and 220 girls who, as they left school, indicated farming as their work interest. Some 13 per cent of New Zealand's labour force is in farming, but some 17 per cent of school leavers were looking towards farming. So we can't say that there are not enough young people interested in farming. If they don't actually end up in farming, farmers will have to ask themselves the reason why. These young school leavers with an interest in farming are sufficient in numbers to give us all the farm labour force farming can use—if farmers can clinch their interest and hold them in the industry.

There is a good field of recruitment in school leavers. However, farming has also done reasonably well from immigration. In the ten years 1951-1961 farming occupations had a net gain of 6,407 from immigration. Over those ten years, with something of the order of 30,000 school leavers plus upwards of 6,000 immigrants looking towards farming you cannot possibly claim that farming hasn't had ample opportunity to recruit all the labour it needs. Why, then, is it short of labour? We must chase facts along a bit further to answer this.
The age-structure of the farm labour force suggests that, while the industry fails to get possibly a quarter of the school leavers who indicate an interest in farming, it nevertheless does pretty well in recruitment. In 1961 it had 22,700 people under 25 years of age, and it had retained all except a few hundred of the 23,943 people who had been in the industry and under 25 years of age in 1951. But at about 35 years of age the exodus begins and the age-structure figures indicate that between 1951 and 1961 some 12,000 people between the ages of 35 and 65 left the industry. There's plenty of water going into the bucket, but there is a big hole in the bottom of it. The important thing is not to cry out for more water (which is what the industry has been doing) but to plug the hole. Plug that hole and you'll have plenty of labour in farming, experienced labour.

The Farm Manpower Working Party also secured some factual information on farm wages. First of all we looked at the various Extension Orders and we found them unattractive documents as compared with the general run of awards an industrial agreements. The adult rates are at about the level of rates for unskilled labour in other industries (yet it is consistently claimed that farming is a skilled occupation). The Orders give no recognition for skill and responsibility above the minimum. Awards usually recognise the more skilled workers and the in-charge positions. The award for green-keepers recognises the man who has qualified for a certificate. In other industries these things are formally recognised and the award or industrial agreement gives the young man both the promise and the guarantee of recognition. But farm Extension Orders are dumb on such matters. They hold out no promise and give no guarantee. The farm worker is entirely dependent upon the beneficence of his employer as to whether he gets these things or not. Some do and some don't, but good-quality men with a due sense of responsibility for their future and their families do not accept a nebulous prospect.

Of course, we have many times heard this answered by the assertion that farmers are paying actual rates far above the minimum rates in the Extension Orders. Here again, we were able to get some facts through the New Zealand Meat and Wool Board's Economic Service. In a sample of 438 sheep farms married men were, on average, receiving £3/17/3 above the minimum and single men £3/7/9. These are averages, which means that while many farm workers were receiving more than this, just as many were receiving less. At the time of this survey the average wage of a married man with house provided but no rations was £13/18/- on the farms covered in the sample.

The Labour Department's ruling rate survey of February, 1964, showed that a carpenter was then receiving, on average, £16/13/5 for the first 40 hours worked during the week. At that time the average amount of overtime worked in the building industry was five and a half hours and so we can estimate that, on average, a carpenter was then receiving at least £20 for a working week of 45½ hours.

The Working Party appreciated that farmers' incomes are governed largely by export prices and that the farmer cannot pass on increased costs. The Working Party also appreciated that in individual cases farmers were in fact paying £20 a week or more to experienced farm workers and finding it worthwhile to do so. Bearing these
things in mind the Working Party was convinced that several things needed doing regarding farm wage rates.

First, farmers should get rid of the cloak of secrecy round the actual rates being paid. In many cases these are rates fully capable of attracting a good type of worker if they are made known. Take for example a farmer who approaches the local Labour Department Office for labour. He wants a good man who can handle a tractor. When asked what he is offering he names the minimum rate, but "something more for a good man." He will not say how much more. Our Office knows of a good tractor driver who might be interested and puts this vacancy to him. The driver immediately wants to know the wage offered. The vagueness of the offer kills his interest. He takes a job with a local authority at about £17 a week. When the farmer hears about this he says, "But I would have paid him £18 a week." If he had said £18 a week at the start he would have got his man.

Second, the fringe benefits could be publicised with advantage. Free firewood, milk, meat, opportunity to own some livestock, and so on are valuable additions to income but they won't attract people to farming unless people know about them.

Third, the Extension Orders should be reconstructed to give formal recognition for skill, experience and responsibility, to show visibly that a good man entering farming is assured in due course of something better than the minimum rate, and to ensure that any such assurance is based on something firmer than the good intentions of his erstwhile employers.

We came to the conclusion that Extension Orders could and should provide certain rates above the minimum rates for certain classes of workers—e.g. for workers who have completed a recognised course of training; for workers with special competence in the handling and maintenance of farm machinery; for in-charge positions such as head shepherds. This would not necessarily cost farmers anything extra because they are in fact already paying higher rates to such people, but it would present the industry in a better light as compared with others, and particularly to younger workers looking for a future in it.

We came across other things which possibly cause people to leave farming. We were told of farmers (not too many, though) who give the farm worker the uninteresting and hard work and keep the more interesting work for themselves. Naturally the farm worker (unless he is a dis-spirited no-hoper) will not put up with such a situation for very long. We were also told of farm workers who left farms when their children began to reach high school age because they wanted to live within reach of a school. We have expressed the thought that at least a proportion of such people could be saved to the farming industry if there was some organised means of putting them in touch with vacancies on farms near post-primary schools. We have been told how school bus services affect farm labour, how farm workers' wives may suffer from boredom, how transport services or car ownership might reduce problems of isolation; how the need to start buying a house in preparation for retirement may induce farm workers to move into the towns in middle life. There are many of these social factors which could be inducing people to move out of farming and
we recommended that there would be a small permanent staff engaged in studying such problems and seeking solutions.

(Even if there were only half a dozen such problems and each of them causing only a dozen people to move out of farming each year we have a loss of 60 well-experienced farm workers a year—some £12,000 worth of immigrant fares; how much in terms of livestock which they look after? But we are not losing 60 a year from farming. We are losing nearly 1,000 a year. If research could save only 10 per cent of this loss it would be paying a handsome dividend.)

We also tried to get at the facts regarding shortages of farm labour. Here we had more difficulty. It would no doubt be difficult to find a farmer who did not genuinely feel that, at least at certain times of the year, he would like more assistance than he actually gets. It is obvious also that many farmers and the members of their families are working long hours. This does not mean, however, that all these farmers are able and willing to engage and pay for full-time permanent farm workers.

On this question of labour shortage the Working Party had reports from various District Officers of the N.Z. Meat and Wool Board’s Economic Service, the results of a survey made by the N.Z. Dairy Board, and the results of a survey of 26 branches of the Waikato Provincial District of Federated Farmers, together with some other information. We were satisfied from the material in front of us that there was a current shortage of some 200 to 250 experienced shepherds and that this was the most serious shortage of permanent farm labour. Apart from shepherds there was a continuing demand for permanent farm labour, but while this was greater in some districts than in others it could not be fairly described as a serious general shortage of permanent employees.

A shortage of seasonal or casual labour, particularly at certain times of the year, was more evident and poses quite a difficult problem. As we said in our report: “The days when such calls for labour could be adequately met from a pool of more or less permanently unemployed or under-employed men are long past.”

We saw three solutions to this problem, none of them being in any sense a complete solution. The expansion of agricultural contracting enterprises was one possible remedy. On this one, however, we felt it necessary to point out that such enterprises might find themselves subjected to cut-rate competition by farmers themselves anxious to make some extra money out of idle farm machinery, and that the farmer could not have the benefit of such enterprises and at the same time run them out of business. Group labour schemes also offered a remedy in suitable circumstances. In the past some such schemes have succeeded and others have failed and it is only common sense that in future the pattern of the successful schemes should be followed. Another solution was the increased use of labour-saving machinery coupled with the development of farms of an appropriate size to enable full use to be made of both full-time labour and labour-saving techniques. In general terms, farming must increasingly learn to live without casual and temporary labour in a world where full employment is an international as well as a national objective.

There is one other difficulty in measuring the labour requirements of farming. The demand for farm labour is influenced directly and
immediately by the profitability of the farmer's operations. This makes it somewhat unpredictable.

All over the world there has been a decline in the ratio of farm labour force to farm output as farm techniques and machines have improved and rising farm incomes have enabled farmers to take advantage of these things. New Zealand is no exception. In 1952 our farm labour force was 129,000 and farm output was in the ratio of 482 ewe equivalents to each member of the farm labour force. In 1962 the farm labour force had reduced to 121,000 but farm output had increased very substantially and was in the ratio of 658 ewe equivalents to each member of the farm labour force. The Targets Committee of the Agricultural Development Conference estimated that by 1972 farm output should reach a level of 111 million ewe equivalents. If output per member of the farm labour force continued to increase at the same rate as between 1952 and 1962 (when it increased from 482 to 658 ewe equivalents) it would reach 904 ewe equivalents in 1972 and on this basis a total farm labour force of some 122,800 would be needed.

This is, of course, very rough reckoning, but it is sufficient to assure us that to meet such a target we don't have to achieve any really large increase in farm labour force. But these figures heavily underline that we must have a farm labour force of steadily and rapidly increasing efficiency. By 1972 each member will, on average, have to be twice as efficient as in 1952.

For this reason the Working Party on Farm Manpower considered that its most important recommendations were those dealing with the training of farm workers. It heard more evidence on this topic and devoted more time to it than to any other. I don't think I can do better than quote from the Working Party's Report:—

"Training of farm workers is important for many reasons. The existence of recognised training encourages the recruitment of a type of young person interested to learn and seeking a lasting vocation rather than a job. Properly organised training, moreover, widens the usefulness of an employee and brings him to full competence more rapidly. The well-trained farm employee, like the well-trained farmer, will give better care to livestock and crops, will maintain and use machinery more effectively, will cope better with emergency situations, and will avoid losses and contribute to better production. Moreover, an employee who has won a recognised status as a skilled man in any occupation is less likely to leave that occupation. The Working Party therefore gives considerable weight to the importance of training as a factor in increasing farm production.

"In its consideration of training the Working Party has kept in mind the position of the skilled manual worker in other industries who is trained under the apprenticeship system. The operations or skills the employer is to teach him are clearly specified as also are such matters as the duration of the apprenticeship, regular wage increments during training, and any theoretical instruction to be taken by correspondence course or attendance at technical classes or block courses. Both the apprentice and the employer formally commit themselves to certain obligations towards each other. Both have the assistance, where needed, of a district committee and a full-time district commissioner of apprentices who in turn receive guidance from a national committee and a national commissioner. At the end
of his training the young man receives his written evidence of qualifi-
cation, steps into the recognised status of a tradesman, and qualifies
for a higher level of minimum wage than the less skilled adult. Such
is the way in which other industries predominantly train their skilled
manual workers. While we do not say that the training of farm
workers should be identical, we are definitely of the opinion that it
must be appropriately equivalent.”

The Working Party considered that there should be a unified
national training scheme instead of continuing growth of bits and
pieces with varying training techniques and different standards.
Existing schemes, where they have proved themselves, should con-
tinue, but they are not able to cater for more than about 10 per cent
of the young people entering farming and in some cases are very
expensive schemes to operate.

These are the main features of the national scheme recommended
by the Working Party: There would be a National Farm Training
Council representative of Federated Farmers, Young Farmers’ Clubs,
the Departments of Agriculture and Education, the Agricultural Uni-
versities and any substantial organisation of farm workers. Associ-
ated with this Council would be a full-time Commissioner of Farm
Training to run the administration of the scheme.

In any district where it was decided to operate the scheme an
Advisory District Committee on Farm Training would be set up on
much the same representational basis as the National Council. Asso-
ciated with the Committee there would be a full-time District Super-
visor of Farm Training to carry out the local administration of the
scheme.

The National Council would be the policy-making body, deciding
such matters as types of training, length of training, conditions of
traineeship, and so on. The District Committees would be responsible
generally for applying such policy in the district, but more particu-
larly for approving farms as suitable for training, approving changes
in training, transfers of trainees, terminations of training contracts,
and certifying completion of training to a satisfactory standard.

The District Supervisor would be the main point of contact
between school leavers and approved farms and would arrange the
contracts of training, maintain follow-up contact with the trainees,
keep the necessary records, attend to inquiries, and keep the District
Committee informed on progress of trainees and report any problems
to it.

Training would be for three years. It would be mainly on-the-job
training with the trainee working for the farmer for wages and
changing from one farm to another to get experience. There would
be a certificate issued on completion of training to the satisfaction of
the District Committee. There would be no examination but trainees
would, in appropriate cases, be encouraged to sit examinations or take
university training.

It’s a simple training scheme. We think it is an intensely practi-
cal one which will be easily workable. Farming is a skilled and com-
plex industry with many special problems. We were able to suggest
many things which would be able to help the industry to secure a
labour force adequate to its needs. Of these, without a doubt, the
most important is training.
TAXATION INCENTIVES

J. D. Fraser, General Manager of N.Z. Wool Board, Wellington.

At the outset, I wish to make it clear that I am not a tax authority. I work for the woolgrowers and I know that on tax matters which concern farmers, a great deal is not known by me and I know this applies also to many of my farming friends.

But I believe there is in existence at the moment a long and valuable list of concessions which are available to the farmer in the taxation field. These have been enacted by various Governments over the years and many have come to be taken for granted by farmers.

Development Expenditure

Today, a farmer can spend as much as he can on development and all this expenditure is deductible for taxation. If he wishes, the farmer can spread it equally or unequally over any one or more of the four succeeding years (now five years per 1965 Budget).

Typical items of expenditure which are fully deductible for taxation are construction of fences, irrigation, clearing of land of timber, scrub, undergrowth, etc., prevention of erosion, forming of air strips, and eradication of vermin or pests.

The Government has seen fit to extend this provision whereby all development expenditure is fully deductible up to the end of March, 1967.

Standard Values for Stock

Then there is the provision regarding standard values for stock. A farmer may adopt, and most farmers do adopt, a standard value for their stock so that increases in their stock can be written down from market value to standard value thus deferring the tax liability on the difference. In most businesses where stock is carried, the Tax Department requires that stock be valued at the lowest of three alternatives. These alternatives are cost price, market value, or replacement cost. However, in the case of farmers, an additional option is available, that is the standard value system for livestock.

The effect of the standard value basis is that where a farmer adopts a standard value of 30/- per head and purchases sheep at £3 per head, he is able at the end of the year to obtain a deduction for income tax purposes of the difference between the purchase price of £3 and the standard value of 30/-. Of course, while a farmer is continuing his farming occupation, his tax liability is deferred, but problems arise when the farmer sells out or wishes to hand his stock on to his family or if he dies. There have been various provisions written into the tax laws to give some relief from these situations.

Where a farmer gifts livestock to a child, step-child or grandchild, who is over 18 years of age, he may hand on the livestock at standard values provided the standard value is not unduly low. In this way, the farmer may pass on the deferred liability to the next genera-
tion and this could, of course, be done in turn to a further generation. There is also the provision for trustees of farmers' estates to continue farming at the standard values which had been adopted by the deceased.

The farmer who wishes to retire and sell his property faces rather a special difficulty. If he does not transfer his stock to a child or grandchild but sells his farm and his stock to a stranger, he has in the past been permitted to apportion the extra profit he makes from the sale of his livestock over the year in which he sold his farm and the preceding three years. In this way, some relief was afforded to the farmer but in most cases the assessable income was quite substantial in the three years prior to sale and high taxation was still paid by the farmer.

Quite early in the work of the Agricultural Development Conference, it was recommended to Government that some further provision be made for such a case. Accordingly, in the 1964 Budget, the Minister of Finance told farmers that provision would be made in the 1964 tax legislation to enable a farmer to spread the profits made from the sale of his livestock over the three years succeeding the year in which the stock was sold. This would mean that a farmer on retiring could have three options—he could spread the profit which he made in the year of sale over the three years before he sold, or assess the profit in the year he sold, or assess the profit over the three years following sale.

I think farmers everywhere have welcomed this recognition by Government over a particular problem and the enactment of this legislation should encourage farmers who are becoming elderly to sell their farms to younger men.

Fertilizer Concession

We have the fertilizer concession which exists at the moment. You will all know that for 1964 and 1965, a farmer can deduct at the rate of 150 per cent for taxation purposes the cost, that is the spread cost, of increases in fertilizer over and above a five-year average usage.

Although there have been anomalies in the use of this concession, I believe it was well used and was a most timely incentive to farmers to increase their usage of fertilizer. It has been recognized, though, that the continuation of this 150 per cent concession for increases must be of diminishing value to farmers because as they progressively use a five-year average to fix their base on which to gauge increases, these increases will become less. On this account, the Development Conference did not recommend that the 150 per cent deduction be continued unless Government found it was not able to bring into effect the recommendation of the Farm Costs Working Party of the Conference which asked that a transport subsidy on fertilizer would be preferable to a tax incentive. These proposals have now come forward in the 1965 Budget and I know farmers welcome them.

Depreciation Allowances

Several depreciation allowances are applicable for farmers. We have the investment allowance of 10 per cent for plant and machinery.
This allows a farmer to write off 110 per cent of the cost of an asset during its useful life. On the West Coast of the South Island, there is a special provision whereby the investment allowance is at the rate of 20 per cent.

Special depreciation on plant and machinery is a further concession whereby the farmer is allowed to write off 20 per cent of the cost of plant and machinery in the first four or five years after purchase.

Initial depreciation applies to farm buildings. Up to last year, a farmer could claim depreciation of 20 per cent of the cost of certain buildings on the farm such as employees' cottages and shearsers' quarters. The Development Conference recommended to Government in 1964 that this provision be extended to cover all farm buildings with the exception of the owner's homestead. The Minister of Finance, in the 1964 Budget, announced that Government had accepted this recommendation and now the provision has been enacted whereby farmers may claim depreciation on farm buildings such as woolsheds and barns as well as farm cottages and shearsers' quarters. These depreciation allowances are in addition to the ordinary depreciation which is applicable to every asset.

Income Equalization Reserve Scheme

I now wish to refer to the Income Equalization Reserve Scheme. This scheme was recommended by the Development Conference at the end of last year and it was announced by the Prime Minister early this year that Government had accepted the proposal. Government has decided that the scheme should apply for the year ending 31st March, 1965. As this scheme is new to farmers, I will deal with it in more detail.

The basis of the scheme is that a farmer shall be permitted to create a reserve of up to 25 per cent of his assessable farm income in any given year. A minimum of £100 is imposed in respect of individual deposits.

The time that payment can be made is most important. A farmer may make a deposit during the year in which he earns the income, or he may make it up to one month after the time for putting in his tax return, or within six months after balance date, whichever is the earliest. I believe this to be a most important provision for it enables the farmer to know how he has progressed during the year in respect of which he wishes to make a deposit, and he also has some idea as to how he is faring in the following year.

There is a provision which will be incorporated in the legislation that a deposit may not be made in respect of any given year if a voluntary withdrawal has been made. This provision is designed to ensure that the scheme is not merely used as a means of building up deductions for tax purposes and thereby becoming an arrangement for holding working balances.

No interest will be paid on deposits and this is in line with the position regarding the two wool retention schemes which operated in 1951 and 1964, and it is also the case with snow loss reserve deposits.

As regards refunds, these may be taken out with the same provisions as to time as apply for deposits. There will normally be a
minimum period for deposits of twelve months but in case of hardship this provision can be dispensed with by the Commissioner of Taxes. All deposits will require to be refunded within five years from the end of the year in respect of which the deposit is made. If, however, in any given year a withdrawal has to be made because of the five-year provision, then in that same year a deposit will be allowed. This deposit will, of course, be 25 per cent of the farmer's total assessable income from that year which will include the compulsory refund.

The keynote of this scheme is that it will need to be used intelligently by the farmer. It is easy to criticize the scheme and say that a farmer who does not make a planned use of it, does not avoid paying much income tax. I believe the whole idea of the system is to allow the farmers to plan development which otherwise is difficult because of fluctuating income. Demand for goods and services created by high farm incomes, such as happens in the year of a high wool price, should be avoided and the farmer enabled to plan his expenditure. The greatest advantage which can be gained by the farmer is, of course, if he works out his farm operations to ensure that refunds which he takes from his income equalization reserve account are spent on deductible items, such as repairs and maintenance or development. In this way, the farmer can gain a very real advantage. Again, the farmer will be helped if the country receives a greater measure of stability in its economy. Many inflationary pressures come on farmers' costs because of large expenditures during years of high prices. Higher costs for farmers never seem to come down when overseas prices are falling.

I have told you about some of the provisions which are in force at the moment including some recent alterations. I now want to put before you some of the recommendations of the Agricultural Development Conference which have been made to Government but which so far have not been accepted by them or at least have not been put into effect.

**Land Tax**

I think you will agree with me that land tax should be abolished. We are told that just over £1 million is collected as land tax but because it is deductible for taxation, the costs of abolition are probably not more than £500,000 when costs of collection are taken into account.

**Meat and Wool Levies**

The Conference has recommended that meat and wool levies should have special concessions in taxation. These levies are already deductible for taxation in the ordinary way but they are expressly prohibited from enjoying the special provisions for promotion and development expenses of manufactured goods and tourism. Today, all market development expenses and promotion expenses for exports other than meat and wool and dairy produce enjoy a 150 per cent tax deduction. The Conference recommended that a tax rebate of 5/- in the £1 for all meat and wool levies should be put into effect immediately. The Conference felt that such action by Government
would be recognition of the work being done to increase the price levels of our primary exports.

**Estate Duties**

The Development Conference also recommended a reduction in the scale of estate duties which have long been recognized as a disincentive to farm development.

A strong recommendation was included for an exemption for all adult children. At present an exemption of £500 exists for each child under 21 years but a child older than 21 years does not receive any exemptions in the parents' estate. The recommendation for exemption for all children is £2,000 per person with increases as soon as possible to £5,000 per person.

The recommendations on estate duties are in two tiers and some examples of the effect of the first tier will be of interest to you:

1. Estate duty on an estate of £20,000 left equally to two children would be reduced by one third.
2. Estate duty on an estate of £30,000 left as one-third to the widow and two-thirds equally to three children would be reduced by 56 per cent.
3. Estate duty on an estate of £45,000 left as one-third to the widow and two-thirds equally to three children would be reduced by 40 per cent.

We believe that the first stage of the recommendations should be enacted as soon as possible and then serious consideration should be given to the bringing in of legislation to encompass the second stage.

**Maximum Rate of Income Tax**

There are two proposals of which little mention has been made in recent times. The first is the level at which maximum rates of income tax apply and the steep graduated scale of tax. The Conference urged immediate study of this problem for it strikes at the heart of the drive for increased production. This recommendation was in fact made the first one in priority of the Conference. It is recognized that the maximum rate of 13/6 in the £1 is reached at £3,600 while the maximum rate in 1938-39 was not reached until the figure of £7,900. Exemptions at this time are greater than those obtaining in 1938-39 but there is no question that the value of money in 1965 is a great deal different from that of 1938-39. As we know, the raising of the maximum at which the top rate applies could be expensive to revenue for it would encompass all taxpayers throughout New Zealand. But we think that this move should be made in the interests of increased effort by all workers in New Zealand.

**Livestock Increase Incentives**

Second, there is the question of a direct incentive for increases of livestock which the Development Conference examined very carefully and has since received much attention from the Agricultural Production Council. Several schemes have come forward. Some of them are able to be administered but are not good enough as an incentive, while others are sufficiently dramatic as an incentive but are full
of loopholes and most difficult to administer. Two schemes which had much merit involved the payment of a cash benefit to the owner of livestock for every head of increase in livestock which he attained. These schemes have failed mainly because the farmers' books of account are not kept universally on a sufficiently high standard. The schemes themselves were desirable but there were so many opportunities for farmers to gain more benefits than they were entitled to receive that we were not able to recommend the acceptance of the proposals by Government.

I wish to refer particularly to the standard of accounts which are kept for farmers. I know many farmers pay a fee to their accountants which demands that the books are properly kept and ensures that all information which the farmer should have, is rendered to him. This would include full reconciliations for all classes of stock for the year concerned. Farming is big business today but I regret that a large number of owners of property do not consider that their business warrants the standard of accounting which I believe it does.

At the moment, the research group of the New Zealand Society of Accountants is examining an acceptable form of standard accounts for farmers. I hope these are produced in the near future, and when they are, I trust that farmers and their accountants will accept them readily. I believe the Tax Department should insist that farmers should use the standard form of accounts if certain concessions in taxation are to be gained. I know you may feel that these are strong words but I believe a viable incentive for livestock increases would have been proposed to Government before now if all farmers had been using a sound form of accounting.

I have listed for you some of the major concessions available to farmers including the provisions that have been sent to Government from the Development Conference, some of which have yet to be enacted. Positive action has been taken on some of the measures. I hope with you that the job taken in hand by the Development Conference will be completed with all speed.
INCREASING PRODUCTION IN HIGH COUNTRY
B. E. Jessep, Peak Hill, Lake Coleridge.

Introduction

My job here today is to give you my experiences over the last fifteen years of improving and bringing to a higher stage of production my piece of tussock country.

Peak Hill is a small grazing run of 4,660 acres, situated between Lake Coleridge and the Rakaia River. It is six miles due north of the Lake Coleridge Power Station and 74 miles from Christchurch (or as is commonly known) up the Rakaia Gorge.

The country all lies between 1,300 feet on the river flats to 4,080 feet at its highest point. A 33-inch average rainfall is reasonably distributed throughout the year. The summers most years are hot and dry with very little growth during the January-February period. Due mainly to its aspect and being gorge country we are subject to our fair share of winds. The winters are moderate and not severe although we have recorded frosts of 20 degrees.

The old nor-westers are a jolly nuisance sometimes, especially when you are drilling, or out in the river trying to cast for that wily trout; but for all that its the nor-westers that make our climate; if it was not for them we wouldn’t have such good sweet sheep country. Adequate shelter belts are necessary in this area, and planting for shelter to break the frequent winds cannot be overdone.

The cover is silver and fescue tussock on the lower slopes with scattered patches of matagouri, running up to snow grass (Dantlwnia flavescens), cotton plant (Celmisia) and flax on the upper slopes.

In general it is typical of a large strip of country running almost the whole length of the South Island, in between the relatively high rainfall foot hills area and the true high country, with its alpine climate and vast tracts of shingle tops.

It is a well-balanced run having a good proportion of winter to summer country. By this I mean, the winter country is steep and lies to the north and is not subject to a severe snow risk. The summer country has a southerly aspect, and it’s on this area that the majority of my development has taken place. There are no arable flats, all the cultivation has been done on the lower easier slopes.

We took over the farm in 1950. Then as now the farm carried halfbreds. First cross English Leicester-Merino rams are used. We were carrying 1,300 ewes, 560 dry sheep and no cattle. This was near enough to one sheep to two and a half acres. It was considered then that we could never run cattle on this country as it dried out so much in the summer there wasn’t enough roughage left in the autumn to carry them through the winter.

In the limited time available, I will endeavour to tell you about the important factors which have brought about a 100 per cent increase in our stock wintered, an increase in lambing percentage, a build-up in cattle, and an overall spread of risks. I might add that my aim has been diversification. Instead of all our income coming
from wool and store sheep, as was then typical for this class of country, we now have income coming from as many baskets as possible.

The important factors in development have been:

Aerial topdressing and oversowing of the hill tussock areas.

Improved subdivision and increased stocking.

The establishment of lucerne on cultivatable areas.

In 1953—after the wool boom—there was a little more money in kitty, so we could start this development.

Aerial Topdressing

First to topdressing and oversowing.

In April, 1953, we used the aeroplane for the first time when two Tiger Moths distributed 20 tons of straight super (44/46 as it was known then); and a little white clover, over 300 acres of tussock running down to the Rakaia River. The composition of this original tussock sward on the lower slopes was quite good, having a fair distribution of native grasses plus white and suckling clovers.

At first the results from the topdressing and oversowing were slow, but encouraging enough to put on in 1954 another 25 tons of super and 8lbs of alsike and white clover per acre. Results from this were a little quicker as it was a better summer for growth.

However in 1955 there was only 10 tons of super spread on the paddocks by truck, none at all applied by aeroplane because of other farm expenditure—a new house for permanent labour and fence improvement.

In 1956 we began to see in a number of trials laid down by the Department of Agriculture, some quite outstanding responses from sulphur and molybdenum. In July of this same year, 1956, our first loads of bulk super arrived, direct from Kempthorne and Prosser’s works at Hornby. We mixed 30 tons of this super with one ton of flowers of sulphur. This mixture was spread at one hundredweight per acre with four pounds clover seed.

From this topdressing we had very good results, and from here on, a pattern for future topdressing and oversowing emerged.

The policy now is:

Initial topdressing

1½cwt sulphurized molybdic super (400lb mix).
4lb white, Montgomery, and alsike clover.
1-2lb cocksfoot.

At a cost per acre of £2.

Subsequent topdressing (every third year).

1½cwt sulphurized super (400lb mix).
2lb white and Montgomery clover.

At a cost per acre of £1/10/-.
The detailed cost of this is:

<table>
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<th>Cost</th>
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<tr>
<td>Cost super landed on air strip</td>
<td>17 6</td>
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<tr>
<td>Cost super sowing—aircraft</td>
<td>6 0</td>
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<tr>
<td>Cost seed</td>
<td>15 6</td>
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<tr>
<td>Overhead, labour, airstrip maintenance, etc.</td>
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Initial application (per acre)  
| Cost super landed on airstrip      | 17 0  |
| Cost super sowing—aircraft         | 6 0   |
| Cost of seed                       | 6 0   |
| Overhead, labour airstrip maintenance, etc. | 1 0   |

Subsequent applications (per acre)  
| Cost super landed on airstrip      | 17 0  |
| Cost super sowing—aircraft         | 6 0   |
| Cost of seed                       | 6 0   |
| Overhead, labour airstrip maintenance, etc. | 1 0   |

These costs have risen by 25 per cent since the first work was done by aeroplane in 1954.

Today I am applying annually, 40 tons of sulphurized super by aircraft, 20 tons of sulphurized super, on lucerne areas, at two hundredweight per acre—by truck, and five or six tons of straight super used for drilling. A total of 65 tons annually. Also annually, we apply 25 to 30 tons of lime in establishing new lucerne areas. Of the seed used over the years, in the oversowing by aeroplane, results were as follows:

Alsike and white clover were the best in the early stages, with Montgomery and cocksfoot showing up after the second topdressing.

Although cocksfoot was not used extensively in the early years, I am sorry now that it wasn’t as it takes several years to establish in the tussock sward. All my areas have now received some cocksfoot.

Fencing and Stocking

Having had a look at topdressing, I must mention the next essential ingredient—fencing. A considerable amount of work has been done to make existing fences cattle proof. We have used posts, waratah standards and barbed wire. The work of cattle proofing our fences is still going on. This is quite a big thing on this tussock country as we find with improvement we need ever-increasing numbers of cattle. It is no use growing this grass unless you have extra stock to eat it.

Establishment of Lucerne

Little was known about lucerne in our district when we started and we had to feel our way. However in November, 1953, we decided to make a start and sowed 14 acres of mother seed Marlborough lucerne. Half the paddock had two tons of lime the previous autumn. This half did particularly well though the remainder was by no means a failure. The stand looked very promising the following year and in fact this same stand is still doing well eleven years later.

In the spring of 1955 we put two more paddocks down in pedigree Marlborough lucerne, after swedes. These paddocks had received lime before the lucerne was sown.
This programme has been carried out for a new paddock a year—lucerne sown as early as possible in the spring after swedes or turnips.

Today, out of a total of 240 acres which have been ploughed and sown to pasture, 184 acres are in lucerne and lucerne mixtures. Between 12 and 14 thousand bales of lucerne hay and silage are now made annually.

Lucerne Mixtures

I have tried a number of mixtures with lucerne:

- Lucerne and timothy.
- Lucerne and cocksfoot.
- Lucerne, H1 and cocksfoot.
- Lucerne and prairie grass.

There are only two of these mixtures that I would consider using again.

A. Lucerne at 16lb and cocksfoot at 1-2lb per acre. (The cocksfoot must be the very best grasslands.)

B. Lucerne at 16lb and prairie grass at 2lb per acre.

Both these mixtures have proved very useful, especially for late autumn feed for weaner calves and ewes at tupping.

I have tried nearly all the different strains of lucerne, and now I sow B strain—pedigree seed at 16lb per acre. This heavy sowing seems necessary for quick establishment on this country. Also some Government Stock lucerne areas are now being established.

All lucerne seed sown today is lime pelleted with the inoculum next to the seed.

So much for lucerne.

Those, then, are the ingredients: topdressing, fencing, lucerne and increased stock numbers. They have cost a lot of money but the majority has come out of income. Let us now turn to results.

Results

Firstly, we have been able to increase sheep numbers from 1,300 ewes and 560 dry sheep to 1,850 ewes and 800 dry sheep. Further we now have 100 breeding cows and 90 dry cattle. These are mostly Galloway-Shorthorn cross—we keep a Galloway bull for breeding replacement heifers. In other words we now have one sheep equivalent for every one and a quarter acres compared with one sheep to every two and a half acres in 1950.

Wool sold has increased from approximately 12,000lb to 18,000lb, lambing percentage increased from 83 per cent in 1950 to 100 per cent today. We can now fatten all our lambs if necessary. There are surplus calves each year to sell or carry on and fatten. There are more cull 2-tooth ewes and annual draft cast-for-age ewes. Then there is surplus lucerne hay for sale together with lucerne seed.

All these have helped fulfill the aims of diversification. This has made the farm less vulnerable to price fluctuations in the wool and store sheep market.

However, all this development has not been without its problems.
During this work I have found it necessary to be ever ready to change old accepted methods and be ready to meet the new problems as they have arisen.

Grass Grubs

For instance grass grub and Porina have been a problem, especially in any pastures sown on cultivated ground. This problem has been overcome by the establishment of lucerne. In fact grass grub in lucerne seems to be an advantage, in that it helps to keep the stand clean.

I have not had any trouble with grass grub in new lucerne stands sown immediately after a fodder crop. In the tussock, grass grub and Porina seemed as though they were going to be a big problem. Now I stick to two principles as regards this.
A. Never let the pasture in amongst the tussock grow too long in the summer—keep the cattle moving about.
B. Clean up any rank growth with cattle during the late autumn-winter period. If necessary feed hay out to hold the cattle on certain areas.

Keas

We had trouble with keas killing ewe hoggets up on the autumn hogget block. By vaccinating the ewe lambs at weaning and again three months later with Blackleg Malignant Oedema vaccine we have almost eliminated this problem.

White Muscle

White muscle in lambs is now prevented by the use of selenium. Lucerne is grazed by ewes both in the spring and autumn, without any ill effects. Lambs are also fattened on lucerne. All sheep on lucerne for any length of time are given selenium.

Pulpy Kidney

Pulpy kidney in lambs has been prevented by vaccination.

Weeds

Although no major problem in the past, weeds will, I feel, be an ever-increasing problem in the future because of the rising fertility. (Weeds in prominence so far are sweet brier, broom, horehound, barley grass and thistles.)

So far we've been able to cope with most of these problems. A word of warning: there are some areas in our tussock grasslands that are harder and drier where improvement will be much slower. Then there are the more favoured areas, mainly in the higher rainfall zones where results will be even more spectacular. Also don't over do it, don't plan to do too much in any one year—let time be your guide.

Future Possibilities

On Peak Hill we have already climbed to one sheep equivalent to one and a quarter acres. It appears that this is by no means the limit. In 1956, when setting out some shelter belts, I fenced off 10
acres of tussock, and have treated this area as a guinea pig area ever since. This paddock was first sod-seeded with a good general mixture of grasses and clover seed, plus two pounds lucerne, and the necessary fertilizers. Since this initial treatment the grazing has been strictly controlled. It has had one and a half hundredweight of sulphur super every second year plus D.D.T. once. All the introduced grasses are still in evidence.

Now the fertility has risen so much in this paddock that I consider it would support two sheep per acre all through the year. Another notable feature is that its winter dormant period has been reduced by at least two months, and more in some winters. It also recovers more quickly after our dry summer periods.

Conclusion

In summing up, the key to development on my property has been topdressing to grow more grass, fencing and extra stocking to use it, and lucerne to provide supplementary feed.

In all this work of improving this moderate rainfall tussock country I see a similarity in our problems to the problems facing the dry land farmer of the Canterbury Plains.

There is no doubt in my mind that the potential of our tussock grasslands is enormous but initially results are slow. One has to forego income for a long time before the benefits roll in compared with development on the plains. Further the runholder faces uncertain prices from the wool and store sheep market.

Incentives for runholders to increase output must be aimed at increasing the benefits from development and of reducing the costs. The incentives I would like to see are these:

A. A better research and extension organization so that runholders can see more clearly the benefits and costs of development. I think it has paid me to develop my run—but I’ve no facts to prove it.

B. A reduced rate at which taxation rises, so we don’t net 13/6 in the pound until we are earning £6,000 in taxable income. This could be compensated for by increased indirect taxes on luxury goods.

C. A subsidy on the cost of transport and application of fertilizer on hill and high country together with a subsidy on the transport of fat stock off these farms.

The present subsidy scheme through the Soil Conservation Council provides mere chicken feed for the runholder who wants to develop his property.

Give us the incentives and I am sure the job will be done.
COSTS AND BENEFITS OF INCREASED STOCKING IN WEST OTAGO

M. A. Monteath, Farm Advisory Officer, Department of Agriculture, Gore.

Introduction

The district referred to by West Otago is shown by the shaded area on the map. The area I am speaking of is not confined precisely by the provincial boundary but extends across it towards Gore. It includes Edievale, Heriot, Crookston, Kelso, Tapanui, Waikoikoi, Merino Downs and Waikaka.

This country is at an altitude of 500ft to 900ft, has a 34-inch to 36-inch evenly spread rainfall, a winter of approximately 100 days when grass growth is at a low ebb and is subject to frosts and two or three snow-falls a year.

The country which the paper deals with is flat to easy rolling with 80 per cent or more ploughable with a wheel tractor and the soil is a YGE/YBE Waikoikoi soil type (in farmers' terms a clay loam) capable of growing 70-plus bushels of Aotearoa wheat. It tends to be wet in the winter but responds to tile and mole drainage; it is responsive to phosphate and potash. This country has been farmed for 70 or 80 years.

Within the shaded area of the map there probably is somewhere in the vicinity of 60,000 acres of this country.

Today I am going to tell you about a possible pattern of farm development—a pattern of development which has been undertaken on a particular farm and which I believe is a pattern, which with farm to farm modification, could be applied to West Otago generally.

Several farms have started it and the "case-study" farm which I'm going to tell you about has nearly doubled its stocking rate from 4½ ewe equivalents per acre to 8 ewe equivalents per acre in five years. I'll outline what he did, how his production increased, and what the financial results were.

Before detailing the results of the increased stocking on the case-study farm I must point out the two main objectives in producing meat and wool.

Principles

(1) As much grass as possible should be grown. This pre-supposes grass grub and porina control, adequate fertilizers and good pasture management.

(2) All the grass grown must be used. This means having enough stock on a pasture to eat all the grass that grows. It means heavy stocking, drainage, and subdivision and last but by no
means least a feeding system which provides the amount and kind of feed required by the stock.

In West Otago at present the weak link in the chain of meat and wool production lies in pasture utilization. Stocking rates aren’t sufficiently high to allow maximum use of pasture growth. The average stocking rate is 4.5 ewe equivalents per acre, and production per sheep at 124lb of wool and 34-35lb lambs is too high for maximum production of meat and wool from the feed that is being grown.

As a result wool production is only 65lb per acre and meat per acre is approximately 180lb per acre, although on total dry matter production it could be over 100lb of wool and 300lb of meat per acre.

The remedy for this situation is to first increase stock numbers accepting less production per head but more per acre and second, to change the feeding management so that the extra stock can be carried in the pinch period of August-September. This can be done by making full use of the technique of autumn-saved pasture.

I have been fortunate to have been given access to the full details and results of a programme of increased stocking which was started in 1959-60 on a 488-acres property. This case-study farm in 1959 was similar in all respects to the average farming pattern today in West Otago.

The remedy of increased stocking rates with A.S.P. has been the key to the development programme. The increased stock numbers in terms of ewe equivalents wintered are shown in graph (1).

The production increases resulting from this increased stocking are shown in graphs (2). Note that although production per head has fallen total production has gone up following increasing stock numbers. The feeding management has changed with increasing emphasis on A.S.P. This is illustrated in graphs (3).

The feature of both these sets of graphs is that the increased production is dependent largely on management. For management to have achieved this however it was necessary to provide drainage and subdivision. The drainage and subdivision programme is illustrated in graph (4).

That these measures made better use of the grass already being grown is shown in the graph of topdressing (graph 5) where it will be seen that topdressing didn’t increase substantially until the fourth year when wool production was 93lb per acre.

Other development expenditure was incurred in a haybarn and manure shed, and two bigger new tractors. An extra labour unit was employed in late 1963-64.

Now you people, being businessmen as well as farmers, will quite rightly be wondering what the case-study farmer got out of this programme of increased stocking. No doubt you are also wondering what Mr Lake got out of it, too.
Graphs 1

**EWE EQUIVALENTS WINTERED**

**SHEEP WINTERED**

WINTER: 59, 60, 61, 62, 63, 64
E. Hogs., E. Sheep
Graph 4  
SUBDIVISION & DRAINAGE

Graph 5  
TOPDRESSING PER Ac. PER ANNUM
Financial

If in 1964-65 no further development was undertaken and stock numbers were not increased further the 488-acre farm would produce approximately 21,700lb of wool, 20,000lb of lamb meat, 350 2-tooths and 300 one and two-year-old ewes more than it did in 1959-60. At current prices this represents approximately an extra £8,000. The additional expenditure in 1964-65 is approximately £4,500 and so the farmer after tax can put an extra £1,200 cash in his pocket.

Graph 6 compares the cash after tax when developing with that he would have received if he had not increased stock numbers. The cash after tax he would have received if he had not increased stock numbers is represented by the base line. The cash he was unable to put in his pocket because of development is represented by columns below the base line while the extra cash after tax resulting from the stock increase is represented by the columns above the line. From now on assuming that prices remain the same he will annually be £1,200 better off than if he had not developed. If prices do not remain the same and there is a cost price squeeze then this farmer can withstand it better than he would have before development. The £1,200 after tax represents an annual return of 17 per cent on the cash he did without during the years of development.* If he could have found an investment that would have returned him more than 17 per cent (after paying 13/6 in the pound income tax) then he should have put the money into it instead of the farm. If not, however, he’s made a good business decision by increasing stock numbers.

*Calculated by A. T. G. McArthur, Senior Lecturer in Rural Education, Lincoln College.

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This case-study has looked at the business side of increased stocking. New Zealanders (South Islanders, anyway) have always prized farming as a way of life and what impact does increased stocking have on our traditional way of life?

Non-Financial Costs and Benefits

Farmers must change their accepted and traditional ideas and methods of farming in the sense that in order to have production per acre feeding levels are not so high and so stock do not produce or look so well. Group pressure and criticism from neighbours and outsiders who do not fully appreciate what is happening does not provide encouragement. It means trying something new, and taking on something new always has risks attached to it until experience is gained.

The unpredictable weather plays a bigger part at increased stocking levels.

Additional labour must be employed following stock increase and while it is profitable to do so it does raise social problems.

Generally speaking increased stocking along the lines of the case-study farm requires a change of established thought patterns and the acceptance of new ideas. This is never easy but unless the change is made when embarking on the increased stocking programme, there will be dissatisfaction and sleepless nights.

What of the non-financial benefits?

An interesting benefit which has shown up on the case-study farm has been the almost complete disappearance of footrot and the improvement in stock health.

Under this increased stocking soil fertility is also increased. If a farmer included cash cropping in his programme then advantage could be taken of this.

The other main benefit is a personal one—the satisfaction of achievement which comes when a challenge is accepted and won.

Summary

It seems therefore from the case-study farm that the financial benefits are distinctly superior to the financial costs. On the other hand the non-financial costs could possibly outweigh both the financial and non-financial benefits. The extent to which it might of course depends on the individual's background, age, aims and desires.

For those farmers who have a desire to maximize financial progress and who are prepared to face the non-financial costs I have no hesitation in recommending to them a programme of increased stocking similar to this one.
INCREASING PRODUCTION ON LIGHT LAND

D. E. Rankin, Pendarves, 7 R.D., Ashburton.

In presenting this paper I will explain how, over a period of ten years, we have developed a 600-acre block of Mid-Canterbury light land. A good many other farms in my district have been following the same trend of farm development over recent years because a younger generation of farmers now farm smaller acreages using improved methods and new ideas, to maintain or lift their standard of living. Today a farmer has to look at both technical and financial management if he is to make progress.

Our farm at Pendarves is on the Lismore silt loam soil. This soil is up to six inches deep in places and no less than four inches in the lighter parts. It is free of surface stones and lies on a clay sub-soil up to 12 inches deep, and below that a clay shingle mixture which dries out severely in a normal summer.

The farm itself was originally half of a 1200-acre block and when I first leased it from my father in 1955 it was fenced into six 80-acre paddocks, with stake and wire and gorse fences. These were by no means stock proof. However, the land was starting to show the effects of about two tons of lime to the acre, which my father applied after the high wool prices in 1951. Pastures, however, were poor due to low fertility and lack of subdivision and stock. There was no house, wool shed, sheep yards or other buildings. Two county stock races which had a habit of drying up in a hot dry summer provided limited stock water. This made good stock husbandry, particularly lamb fattening, very difficult during these spells.

Capital Development

Let's look at capital development. I have completely refenced the farm into 30 20-acre paddocks since 1955. We planted five-chain by five-chain shelter belts in the south-west corners of the paddocks. We built a new house and an implement shed as well as a combined wool-shed with a lean-to for storage, two hay sheds, a garage, a three-roomed single man's cottage, sheep yards and a dip. With the exception of the house which was built with a mortgage, all improvements have been done out of revenue. Now our investment is returning a reasonable income and we are enjoying a very satisfying way of life. The result of this development has also given us a greatly improved tax-free asset and my wife and I have a lot of personal satisfaction from seeing the farm improve. I have been ably assisted by several good single men.

Finance

Turning now to finance. I started farming with some cash of my own and borrowed the rest. I was able to buy 800 ewes and some plant to start with. With this as security, Pyne, Gould and Guinness financed my farming operations for the first 12 months. By leasing the farm from my father for four years, I was able to save enough for a down-payment on the purchase price of the land. This,
together with an outside mortgage that covered the price of a new house and my wife's savings allowed us to set up a husband and wife partnership. This partnership covered land, stock and plant and is on a two-thirds to one-third basis. Over the years I had been leasing the farm, by far the biggest cost was income tax. By farming in partnership, we saved from £400 to £600 in tax per year and this is a useful amount of interest-free capital which we have used for development. Without a doubt this extra capital saved from tax has been one of the biggest single boosters in getting my farm developed in the shortest possible time. However, income has again crept up to where tax has raised its ugly head again. Consequently we decided to form a trust for our three daughters who now get the benefit of the returns from the cash crops. As a result more of the farm income is held within the family.

This covers the capital and financial side. Now to the practical business of farm development starting with pasture development.

Pasture Development

Pasture improvement has followed two definite phases. The first phase was the transition from browntop to semi-improved pastures. We first ploughed the browntop in the winter and sowed it to permanent new grass the next autumn—grass to grass for quick improvement. These paddocks did well but only lasted four to five years.

In the second phase to get top pastures we ploughed for turnips and afterwards sowed to either rape and grass, or new grass after a fallow, with a ton of lime. Continued and systematic topdressing has increased fertility over recent years and now several paddocks have been put back to grass directly after wheat with good results. My future policy will be to sow new grass after peas which will follow the wheat crop. Under this system the peas should restore the fertility to a level that will support a good ryegrass crop the following season.

Stock

But more grass has to be converted by animals to give a profit so I will now talk about the stock side. Over ten years we have trebled the original 800 ewes to 1800 ewes plus 500 ewe hoggets, 670 fattening wether hoggets and 20 two-year-old cattle in the current season. In previous years we have wintered more cattle but these have now been replaced with hoggets. They are sold to butchers during winter and early spring.

Per sheep performance over this period of development has increased. The average lambing percentage has climbed from about 110 per cent to 120 per cent. Wool weights now average 11¾ pounds per sheep including hoggets and the quality has been reflected by relatively high prices at the sales. We got up to 73½ pence in February, 1964, and 51½ pence in March, 1965.

Stock Management

And now to stock management. Sixty per cent of ewes are tupped in the first cycle, and by the end of the second cycle all ewes bar eight had been served with very few coming back to the ram.
This quick tupping is, I think, due to a paddock of Early York Globe turnips and Italian ryegrass which I feed during tupping time. This gives the ewes a high plane of nutrition in a difficult month when quality feed is hard to provide. Now to get this crop of turnips ready for tupping I have found they must be sown by the first week in December. To achieve this deadline I finish ploughing the paddock by the middle of September to provide adequate moisture for germination. I can afford to sacrifice the spring grazing from this paddock as spring feed is no problem because of the autumn-saved grass we can save.

Coming back to tupping again, this paddock of turnips puts the ewes in better condition for tupping than hay. It also means we can save more autumn-saved grass. Consequently there is no problem in fattening the extra lambs which flushing induces. After the first feeding, the turnip paddock is shut up to provide spring feed from regrown Italian. The paddock can be harvested for seed, or deep ploughed in plenty of time for a crop of wheat. As you can see this turnip paddock takes an important place in our stock programme. The replacement policy for the sheep over a number of years has been to buy half-bred ewe lambs from Central Otago. Up until the last three years, these were kept for six or seven years to build up stock numbers. Since then the best have been retained as five-year-olds, and the remainder sold to a good local market. In recent years the policy has been to lamb these five-year-olds early. These ewes are sold together with their lambs before the end of October, to the butchers' market. This has proved most profitable, compared with quitting them the previous autumn, returning in the vicinity of an extra £6 per head.

Two-tooths are run separately till after they are tupped, and then boxed with the four-, six- and eight-tooth ewes for winter-feeding and lambing. We mark each cycle of tupped ewes. This has a very definite advantage when lambing is only two to three weeks away. Up until this time all the ewes are fed on turnips and grass. The earliest lambers, which are roughly one third to one half of the flock, are now drafted off and fed on a higher plane, by feeding them on Italian or winter-saved grass at least every second day. We take care not to feed them too well as this leads to lambing complications. We start main lambing in late July. The mob is cut off at least twice a day leaving behind ewes and lambs which are not disturbed for at least four days.

We tail at two weeks with rubber rings and inject for pulpy kidney in the neck. We make up mobs of up to 160 ewes with their lambs for every 20-acre paddock, and set stock the paddock for as long as it will carry them and then on to spare paddocks. Any surplus paddocks are shut up for hay or for ryegrass and white clover seed. Lambs are drafted about the time the Works open. By the end of November, when all lambs are weaned and just before shearing, we have quit 75 per cent to 80 per cent of the lambs fat off their mothers at 21-32lb for the season just finished.

Topdressing

Now to topdressing and its timing. With increased fertility we can go into the problem of lambs failing to thrive on spring top-
dressed pastures. Today instead of splitting topdressing between spring and autumn, we now make a double sowing of two hundredweight per acre in the autumn. This also grows extra winter and early spring feed—a critical time. It also saves 3/11 per acre in application costs.

All lucerne is treated with two hundredweight of super in early August; 120 acres of grass is also treated annually with D.D.T. During the last three seasons I have increased super topdressing rate to two hundredweight per acre over all the grass ground. This costs me an extra £260. This cost is offset by tax to some extent and the actual cash expense only amounts to £130. My extra manure, therefore, only costs £6 per ton. I am very pleased with the result. The extra hundredweight means that pasture responds much more vigorously after autumn rain, than it did with one hundredweight. We have used this extra grass to fatten butchers’ stock, cattle or hoggets, which has proved most profitable, though of course half of this is taken in tax. On the other hand the super helps build up the value of the farm as an asset.

The two tons of lime which my father put on before I took over has been a great benefit. It was applied in the day of the lime transport subsidy. Now I find it necessary to sow only one ton per acre with new grass and peas, and two tons when sowing new lucerne.

Cropping

Let’s look at the cropping policy which plays only a secondary role.

For the first five years, we did not crop because soil fertility was too low. Now, about 100 acres go into crop every year—40 acres of certified Aotea wheat, 20 acres of partridge peas, 20 acres certified white clover, 20 acres of pedigree perennial. This year there should be a further 20 acres of mother Italian and 20 acres of special purpose white clover if the feed situation allows. This is the result of increased fertility. Self-sown clover struck after a crop of peas. Up to the present the cropping policy has been flexible but the aim is to go from old grass to turnips, to wheat, to green feed oats, followed by partridge peas the same autumn. Then the paddock will be sown out in certified grass and clover in the next autumn as soon as the peas have been harvested.

Future Policy

Now to future policy. Having reached the present level of production, I am anxious to increase it still further, and this is how I hope to do it. Up until the present, lucerne has played only a minor part in the programme for hay and lamb fattening. In future following recommendations from Ashley Dene, we will increase the lucerne acreage for grazing up to a total of 200 acres. Twenty acres of new lucerne was established last season, and I intend to sow another 35 acres this spring, giving a total of 75 acres altogether. I don’t agree that lucerne is either difficult or costly to grow providing you sow it early in the spring on well-limed and well-cultivated ground on which the fertility has been built up.
We should be able to get from our present five ewe equivalents per acre to seven ewe equivalents per acre by:

1. This greater area of lucerne.
2. Improved winter growth because of the build up of fertility from topdressing.
3. The greater use of autumn-saved pasture made possible by our early turnip paddocks for autumn feeding.

In conclusion, increased production at Pendarves is the same story as everywhere else in New Zealand. It is a matter of building up fertility with topdressing, legumes, subdivision and stock. We can now winter increased stock numbers—the winter is no great problem. The dry summer is still a limiting factor to high summer stocking but you can dodge this to a large measure by having flexible stock and cropping policies which are complementary. For instance we feed out rye grass straw along with feed barley to keep the ewes going through the drought.

This increase in fertility and stocking has been expensive, but I have been able to equip the farm from current revenue without undue sacrifice. The present situation is that we are able to farm this light land with good financial returns. I had an ambition to farm at the level achieved at Lincoln College and my wife and I have gained a great deal of fun from trying to achieve this goal.
INCREASING PRODUCTION ON A SOUTH CANTERBURY DOWNLANDS MIXED FARM

S. J. B. Campbell, Otaio, Timaru.

In presenting this paper I would like to say to begin with that I do not consider our production to be greater than many other farms in South Canterbury. Indeed, I would be the first to agree that there are possibly many higher. But it may be interesting to follow the development and production rise over the past 17 years.

The farm is on easy rolling downs country with a small proportion of steep facing and is situated 20 miles south of Timaru and two to three miles in from the coast. The soils in the area are predominantly loess and are known as Timaru silt loams. The average rainfall is 20 inches to 22 inches, but in keeping with the most of Canterbury, is extremely variable and last year was only 17 inches.

When the property changed hands in 1947 it was carrying 400 ewes and some low yielding crops on the 390 acres. In those days it was a solid block of twitch, browntop, thistles, docks, and sorrel, with some gorse and broom for good measure. To round this off, we had no power and the old team of horses had wreaked havoc with the fences, as anyone who had the assistance of greasy-heeled horses will know.

Although the farm presented a sorry picture it looked potentially productive and had a very important attribute—it lay well to the sun with a minimum of back facing. However it was very apparent that to achieve full production the twitches and other weeds would have to be eradicated, new pastures established with ample lime and fertilizers, new fences and buildings erected and the farm reticulated with power and water.

The first objective was to grow some sort of sheep feed other than twitch. Fortunately the first two seasons were dry ones and ideal for killing twitch. We tackled it in the following way. The ground was worked up in the spring and grubbed every week during a summer fallow to kill the twitch and other weeds. In the autumn the paddocks were sown in Italian or Short Rotation ryegrass for greenfeed. They were ploughed up again in the late spring and summer fallowed to kill any twitch which had survived and then sown down to permanent pasture with rape. Certified seeds were not used for the initial pasture sowings.

Once the twitch was killed, we began an intensive liming programme. The results were spectacular in the reduction of sorrel and in the establishment of clovers. Unfortunately I didn't know the pH of the soil at the time but it was obviously low and very deficient in calcium. The soil appeared to require three or four tons to the acre and it received this over the next five to six years in three dressings of one ton to 25 hundredweight.

In 1953 soil tests revealed that the pH ranged from 6.4 to 7.4 and we took the advice of Jack Symons, the local farm adviser when
he said “For goodness sake don’t apply any more lime for a while.” Since then little lime has been applied but each year we have top-dressed about 60 acres of one- and three-year-old pasture with two hundredweight of D.D.T. super to the acre with extremely good results.

Liming and topdressing in conjunction with twitch eradication and the establishment of new pastures, allowed an approximate increase of 100 ewes per year. We reached our peak stock numbers in 1958 with 1,500 ewes going to the ram plus 300 ewe lambs for replacements, 70 ram lambs and 20 cattle. During this period no grain crops were grown.

In common with many other farmers about that time I found that although our ewe numbers were going up, our wool and lamb weights were dropping. After considering both the lower production per ewe and the added costs such as extra drenching, vaccinating and growing rape, it was quite obvious that we were carrying the last 200 ewes for a net return of about 50. In 1959 we therefore began to reduce our ewes by 100 a year and started back into grain cropping and have continued to grow it since then.

Last year we grew 60 acres of grain. The wheat yielded 68 bushels and the barley 87 bushels to the acre which was very good considering the season. It was the first year we haven’t been able to save at least 20 acres of grass or clover seed.

In addition to crop we carried 1,300 ewes, 300 ewe hoggets, 75 ram hoggets and 25 rams. One hundred Romney wether lambs were also carried until July for sale on the local market. In addition 30 yearling cattle were run. Two hundred of the ewes are studs which do not lend themselves to heavy stocking. In fact, I would say that if we changed to all flock sheep we could carry an extra 200 ewes, but as this stud work is an interesting hobby we intend to carry on with it.

Prior to carrying 1,000 ewes, Romney two-tooths were bought in for replacements each year. Once we reached this figure we started putting out Romney rams to breed our own. This has proved a very satisfactory procedure but I don’t think it pays for a flock smaller than a 1,000.

One pitfall with our breeding policy in the past was that we put only sufficient ewes to the Romney ram to breed a minimum number of replacements. The remainder of the ewes were put to the Southdown or South Suffolk. The reason for this policy was to enable us to draft as many of the cross-bred lambs as possible fat off the mothers from October to early December. During the past two seasons we have set out to remedy the position by putting an increased number of ewes to the Romney ram so as to give us at least 400 ewe lambs fit to keep. In the future we will be able to select two-tooths for the flock, instead of retaining everything to keep our flock numbers up.

Romney wether lamb fattening calls for farming practices different from those required for fattening Down or Down cross lambs. In producing crossbred fat lambs, the farming accent is on plenty of
greenfeed and young grass in the spring to get good milk lambs off the mothers. This is possible to a lesser degree with the Romney lambs. It has been our practice to give the best feed to the crossbred lambs and the second choice to the Romneys with the idea of growing rape to fatten them after they are shorn. Incidentally all our Romney lambs are shorn in January or early February as I think they do much better when the wool is off.

One interesting point in favour with Romney lambs is worth quoting. Last year, 100 of the lambs left after drafting on February 5th were kept. They shored three pounds of wool in early January and a further seven pounds in late May and were sold at stock sales up till the middle of July at from 75/- to 81/-. We didn't exactly lose on them although it is truthful to say that they did eat a lot of rape and young grass and turnips. However one must be careful not to overdo this tail end at the expense of the ewe flock.

Lambing begins about August 1 and percentages have varied from 100 to 118 per cent of lambs marked to ewes put to the ram. This may not seem very high but I personally have no desire to lamb 1,300 ewes plus studs at anything higher than 118 per cent as many of the marking mobs have over 150 per cent. All lambs are vaccinated at marking for pulpy kidney and any crossbred lambs left after Christmas are done again. Ewe and ram lambs are also vaccinated against blackleg and drenched with Thiabenzole and Selenium at the same time.

We haven't had footrot on the property for the last ten years. Concreting the sheep yards was the turning point in this battle, as we could run all the ewes through the trough irrespective of mud or weather conditions at the slightest sign of lameness. Fairly heavy ewe culling was required to begin with, and this did a lot to eradicate the disease. Everything showing signs of footrot was sent to the works regardless of age, and inside two years we had the back of the problem broken. Prior to this we had tried to divide the clean and infected mobs, but found that many of the seemingly clean ones came back again under bad weather conditions—hence the disposal scheme which we have never regretted. Treating footrot in an attempt to eradicate it is a time-consuming job and I appreciate the difficulties facing farmers who have to buy in sheep each year. We are extremely fortunate that we have to buy only stud rams now.

Up until two years ago we pre-lamb shored all the ewes, but this meant going round the sheep for cast ewes at harvest time, and after being caught with a serious blowfly strike in the middle of harvest one year we decided to try shearing every eight months. These three shearings every two years take place at the following times:—Pre-tupping in February, after weaning in November and pre-lamb in July. I agree that this system may not suit even our neighbours, but it fits into our programme very well. Although the price per pound is usually slightly less, we are getting increased wool weights. The sheep have been shearing eight pounds in eight months, or one pound per month and I am quite sure we couldn't shear 12 pounds in 12 months.
The increase in wool production over the years may be of some interest to you. In 1948 it was 6,079lb. Over the last four years the average has been 19,445lb or 50lb per acre.

As the stock numbers increased we found that the provision of stock water from the existing dams was inadequate and entirely unsatisfactory. The problem was overcome five years ago by reticulating the whole farm from a deep well. Although the cost was high, I considered it money well spent as it is absolutely essential to have a good supply of water for stock at all times.

Winter feed cultivation practices have been changed over the years. Originally we had to start working ground for turnips or swedes during the preceding winter, but as the fertility built up, the fallow period was shortened. Now we don't start working ground for winter feed until December, after most of the fat lambs are sold. The lambs are weaned in November and ewes stocked heavily on old grass paddocks until they are cleaned right off. Then we start top working with a stiff-tyned hustler. Six or seven grubbings may be required, going a little deeper each time, and by Christmas the ground is grubbed to a depth of four or five inches. The paddock is left in this state until late January or early February when it is ploughed over and sown with one pound York Globe turnips and one and a half pounds chou moellier to the acre. The reason for not ploughing earlier is that the topsoil can get too dry for the crop to strike in February. By delaying ploughing until we are ready to drill, we can keep the moisture in the ground until we need it. Even over the last two years, which have been very dry, enough moisture has remained in the ground to get a strike. After that we can usually rely on odd showers of rain to keep the crop growing. By delaying sowing until February we appear to miss the aphids and virus infection which used to play havoc with the Imperial Green Globes which we used to sow between Christmas and New Year.

However I think that one of the most important features of this late cultivation for winter feed is that the maximum area of pasture is available for the grazing of stock during the spring and early summer when feed is usually at a premium.

To give you an idea of our rotation, the 20 acres of turnips and chou are followed by a rape crop next November. After the rape comes a crop of wheat, then another crop of either wheat or barley. Cape barley or oats are then sown for greenfeed, and the land is fallowed from October till January the next year before sowing down in a permanent pasture mixture consisting of:

1 bushel perennial ryegrass.
3lb certified Montgomery red clover.
2lb certified white clover.
1lb of York Globe turnips.

Our sowing rate of turnips with new pastures may seem to be unduly high to many of you but I can assure you they serve a very useful purpose. Our normal management is to put lambs on in March to eat the turnips and they are left there until they are thinned down to the equal of a quarter pound sowing. This early feeding,
besides providing a good bite of feed for the lambs also assures that the ground is well consolidated before the winter and makes the paddock better for feeding in the early spring, particularly if it is wet.

My favourite pasture mixture of perennial ryegrass, Montgomery red clover and white clover has a variety of uses and is preferable to straight ryegrass and white clover which has its limitations on our class of land. With our mixture we can get ryegrass seed in the first year and possibly a white clover crop in the second. We have harvested one to two bags to the acre but this has only been achieved when we have been able to close the paddock early and cut it before the Montgomery clover takes charge. The straw is baled straight behind the header with the Montgomery stalks and ryegrass straw making excellent hay. In the third year we may get either hay or a Montgomery clover seed crop or even both in some years. This is only possible when we can cut the hay in late November and get a good rain in December. With all these practices you need a good deal of luck to strike the weather right but then what line of farming exists that isn’t dependent on the weather. Our best crop of Montgomery clover has yielded three and three-quarter sacks of machine dressed seed to the acre but this is only part of its value as a crop. Its main attribute is that the paddock need not be shut up until late November and is available up till that time for the grazing of stock.

Complex pasture mixtures with such species as cocksfoot, timothy and dogstail have been tried but I found they all had certain limitations. Both cocksfoot and timothy for example, did not establish very well under the early hard grazing management. If the paddock was closed for a hay or seeds crop the cocksfoot tended to dominate and the feed it produced was not particularly attractive to sheep. Our rainfall does not appear to be high enough for timothy as it didn’t persist for long in pastures even when we had a good initial establishment.

We have also tried short rotation ryegrass with clovers. Such pastures gave excellent feed in the first year and were always too good to tear up in the autumn. This was a mistaken idea as we were often let down badly in the second or third years when they packed up quickly under dry conditions. Now it’s our practice to leave it for one year only and treat it as one would Italian ryegrass.

We have grown lucerne, but it doesn’t appear to last very long in our country, and always seemed to be ready to cut in the middle of shearing or harvest. This has encouraged the swing to Montgomery clover, which, unlike the lucerne, can be out when we are ready. Our hay shed holds 3,000 bales, and we aim to fill it each year with Montgomery hay plus threshed grass or clover straw.

After being born and reared in mid-Canterbury the thing that struck me most about South Canterbury was the lack of trees. So after the first rush of clearing ground was over, we began an intensive refencing programme with an eye to shelter planting. We gave this added priority after the 1949 storm which lasted for three days in the middle of lambing. In the early stages we planted Pinus
radiata for quick shelter, followed by Oregons, then Cedrus deodara. Since starting the programme we have planted 15,000 trees, all in gullies or unworkable ground. At present we are in the process of removing all the pines as the Oregons and cedars are getting to the sheltered stage. We found that Oregons didn't do very well in single rows, but thrived whenever they were used in block planting. These blocks have now been limbed to a height of 10-12 feet but the outside rows have been left for shelter. Cedrus deodara are slower establishing, but are good for single rows, especially on dry facings and in smothering conditions. All the fences, including the boundaries which have been double fenced and planted in a single row of cedars, have been renewed since 1947. Apart from the first block of Oregons all the tree planting and fencing has been done without outside labour.

Up till 1955 the labour involved was myself plus a single man. A new home was built in 1955 and since then the farm has been run with the help of a married couple.

A petrol Farmall M was the only tractor for a start, and this did all the tractor work until 1952 when we purchased our first crawler, a T6. Although 85 per cent of this property is easy wheel tractor country, the other 15 per cent is definitely safer with a crawler. We then bought a second-hand Hamilton loader-dozer attachment which we used to bulldoze our gorse fences, fill in all lateral gullies that were not too steep (the others were fenced off and planted in Oregons), straighten out and fill in some of the creeks which wound through the flats. Some local contracting work was also undertaken. In 1962 we came to the end of our bulldozing and sold the plant, replacing it with a TD5 diesel crawler with 3-point linkage. Our Farmall M has been replaced by two wheel tractors, an A554 and a 414, thus making a complete change to diesel. Some people may think we have too much plant for the area involved but I can assure you that they all have their uses and they certainly all get used. One interesting point with regard to economy of harvesting is that we use an Allis Chalmers 72 power take-off header. Many farmers may not consider this to be very modern, but it's much cheaper than a self-propelled header and we don't require any outside labour to run it. We harvest 10 acres a day and with favourable weather, it's only a week’s work to do our 60 acres of grain. With a running cost of three-quarters of a gallon of diesel per hour, this, to my way of thinking, makes harvesting as economical as we can get it. From the safety angle it is ideal and behind the crawler it can handle any of the steeper facings.

We are now nearing the end of our rebuilding programme. To begin with we converted the old stable and chaff house into a woolshed. This served its unsatisfactory purpose till last year when we began using a new shed of 2,160 square feet, and sheep yards which were built in the preceding 18 months as a spare time job by my employee and myself. This was our first major building job and although we had our problems, I was surprised to find how simple it was. With building costs as high as they are at present, it is interesting to quote how cheaply it was built for. Apart from our labour, the total cost of material for the shed, plus complete renewal of the sheep yards with galvanised channel posts, tanalised white pine timber
and concreting of the whole yards, was £1,400. This winter we hope to complete our building programme by pulling down the old shed and rebuilding on the same site.

Practically all the development work has been financed out of income but I must add that we were perhaps fortunate in striking such good years financially. With the present high costs of development, I think we would find it much more difficult to do the same job starting at the present time, especially with such things as high land prices and PAYE to contend with.

In conclusion, I would like to mention that in common with all the coastal country south of Timaru, we have, during the past season experienced one of the worst droughts that many of the older residents can remember. Although it necessitated us sending half our ewe flock out to grazing for a month in the early autumn, we still managed to fatten all the lambs and retain the cattle. I don't think we would have fared any better even if we had less stock, because the problem was not so much what was eaten but what was burnt off. I think that the best insurance for another such year would be to carry over more hay from good growing seasons. To do this we would have to increase our hay storage capacity by building another hay barn. If we could grow lucerne satisfactorily, it would also materially assist.

I do not consider what we have done is very spectacular and I am sure that with proper encouragement the same would be possible over most of South Canterbury. In my opinion, one means of fostering increased production would be the availability of low interest finance for development purposes and more particularly to the genuine younger farmers during the first five to six years of establishment. It would enable them to establish good pastures, topdress liberally, erect new fences and reticulate with power and water and thus be able to increase production rapidly. This is preferable, I think, to the present method of growing grain crops, often on soils of low fertility, to provide the necessary cash to finance such development work. Such methods are slow and probably more costly in the long run. There is no doubt that the rate of development on any farm to peak production is, in most cases, governed by the availability of adequate finance.
PIZZLE ROT AND ITS TREATMENT

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Almost 30 years ago a veterinarian named Filmer investigated pizzle rot as it occurred in Victoria. He was mainly concerned with devising control measures for a troublesome condition and did not closely investigate the cause. Filmer suggested the name ovine posthitis for the disease which commenced as a small benign external preputial ulcer but which could progress to a severe and serious internal ulceration (true pizzle rot or sheath rot). He thought that an infective process may have been involved, and it was recommended that antiseptic treatment of the early lesions should be carried out at intervals, thereby forestalling the development of the more serious form of the disease. Although Filmer’s recommendations were never widely adopted in Australia or, I suspect, in New Zealand, subsequent work has not only confirmed that the disease is contagious but it has been found that prophylactic antiseptic treatment of the prepuce is effective in control. In my talk I will attempt to piece together the information that has accumulated about the nature of posthitis, and will say what I believe can be done about treatment and control.

Occurrence and Description of the Disease

Ovine posthitis is a chronic ulceration of the prepuce of wethers and to a less extent rams. An analogous condition “scabby ulcer” occurs in ewes. The disease occurs in Merinos and British breeds and their crosses, but may be more important in the Merinos. Some strains of Merinos may be more susceptible than others. In the early stages preputial ulceration is confined to the exterior and the disease is benign and of little economic consequence. Later, ulceration may extend to the interior of the sheath, and pus, necrotic material and urine may accumulate. This is the stage to which the name pizzle rot or sheath rot more properly applies and is the stage which brings itself forcibly to the attention of the stockowner. The sheath is enlarged and swollen, and there is a foul smell. Especially where there is difficulty in urination affected animals rapidly lose condition, and if not treated may die.

Although we do not know what factors are concerned with progression of the disease from the external to the internal form, we do know, as has already been indicated, that internal lesions do not develop unless they have been preceded by external ulceration. It usually takes several weeks and sometimes months before the severe stage is reached. Posthitis is often thought of as a disease of older sheep but the early stages are common in lambs and weaners.

Distribution and Economic Importance

In Australia posthitis in wethers is common in the cooler elevated areas of the Eastern states of Tasmania, Victoria, New South Wales.
and Queensland and is of little importance in Western Australia. Sown pastures of grass and clover and heavy rates of stocking probably predispose. The disease is reported to be widespread in New Zealand and sometimes a high incidence has been noted. The type of farm enterprise will be an important factor determining whether posthitis is a problem. Those solely producing fat lambs are unlikely to be concerned except where unfinished stock are carried over to the next autumn. Wethers on comparatively poor feed or high hill-country farms are less likely to develop posthitis than those on lower country and on fattening properties.

Posthitis is economically important, not only because of the loss of condition and possible deaths of seriously affected animals, but in addition wool production is reduced, sale value discounted, and the cost of control measures and cost of replacements must also be taken into account. Staining around the prepuce may predispose to fly strike, and makes the animals unpleasant to handle at shearing and crutching.

Cause of Posthitis

Our ideas as to the cause of posthitis have been considerably modified over the past few years. Previously the disease was not thought of as contagious in any form and it was considered to be primarily dietic in origin. High protein diets such as those associated with legume-containing pastures were known to favour the development of posthitis, whereas fasting or the supply of a low protein ration were known to be curative. A diet of capeweed was also noted to produce cures in many wethers. Early investigations had shown that the effect of diet was operative through the urine.

Diet remains as an important factor but it has now been shown that the external form of the disease is in fact contagious. The causal organism is a bacterium which has the power to break down urea in the urine very vigorously and it seems likely that ulceration is initiated by the ammonia liberated as a result of this action. If this suggestion is correct it certainly provides a fairly neat explanation as to why diet and urine are involved in the disease. It also means that there are now sound reasons for attempting to control the disease by prophylactic treatments aimed at destroying the causal organism.

Another factor of importance is the male sex hormone, testosterone. A general observation was that rams tended to be less often and less severely affected than wethers and, in the early post-war period Watson and Murnane in Victoria used testosterone implants with some success in the control of the disease. At the time testosterone was very expensive and its use did not appear to offer a practical solution. Later, the chemical synthesis of testosterone changed this situation and a re-assessment of its potential was made at Armidale in the 1959-1961 period. It was found that prophylactic implantation with the hormone was effective in controlling posthitis, more especially the severe stage of internal ulceration. Testosterone was also useful in the treatment of affected animals but for this purpose was best combined with local treatment of the prepuce with antiseptics. At the time we didn’t fully appreciate the value of antiseptic
treatment in controlling the specific infection which is now known to be associated with the disease.

Methods of Spread

Once it was found that the external form of the disease was contagious it was necessary to learn something of the way in which the disease was spread naturally. This knowledge would obviously assist in devising methods of control. Studies showed that some if not all forms of vulval ulceration in ewes could be caused by the same organism and apparently in the same way, and ewes mated with affected rams developed ulcerative vulvitis. Material taken from preputial ulcers on wethers was found capable of establishing preputial ulceration on cattle and vice versa. Posthitis in cattle is fairly common but seldom progresses to a severe stage. However it is important to realise that cattle may serve as a reservoir for re-infection for sheep.

As might have been expected wool surrounding affected prepuces is a potent source of contagion, as are scabs. Hence there is a need to remove preputial wool before initiating antiseptic treatment. Infected sheep are probably the most important source of infection for other sheep. Contagion may be transferred on pasture or could be collected from contaminated camping grounds, and flies may also be important. Another very important aspect is that sheep with no signs of lesions may in fact be carrying the causal organism. This means that it is necessary to include all the stock in any treatment programme.

Treatment and Control

In discussing the cause of posthitis and the way in which it may be spread we have already indicated some of the lines of treatment that are likely to be of assistance in controlling the disease. The diet can be manipulated, the causal bacterium can perhaps be eliminated, and the male hormone can also be employed to help things along. In particular I would enter a plea for a return to a preventive approach in the control of posthitis. Wherever possible aim to forestall the serious disease, and the financially unpalatable consequences, by prophylactic antiseptic and other treatments. The hypothetical control programme set out below will serve as a background for more detailed discussion of specific treatments. There are many possible variations to this programme which for maximum benefit should commence as early in the life of the wether as possible.

The number of wethers with posthitis tends to fluctuate in seasonal feed conditions. Usually the highest incidence is seen in the autumn and spring when the protein content of the pastures is highest. A lower incidence prevails in the summer and this is generally a more favourable time to commence treatment. If the initial treatment can be fitted in with shearing so much the better. Shearing itself has some effect in reducing the incidence of posthitis but you need to have the wool removed from around the prepuce anyway. Also, if you wish to restrict the diet as part of the treatment the best time to do this is when a break in the wool would be unimportant.
CONTROL PROGRAMME FOR POSTHITIS

AFFECTED FLOCK

Low Seasonal Incidence
Wool removal
Shearing

NO VISIBLE LESIONS
May carry causal bacterium
Treat with antiseptic
Isolate
Rest paddock (all stock)

VISIBLE EXTERNAL & INTERNAL LESIONS
Fast, or graze poor pasture 10-14 days

NO VISIBLE LESIONS
Treat with antiseptic one or more times

EXTERNAL LESIONS
Antiseptic
Testosterone implant

INTERNAL LESIONS
(Sheath rot)
Antiseptic
Testosterone implant

CLEAN FLOCK
Prophylactic preputial treatment
2-3 times per year

DISEASED FLOCK
Restricted diet
Re-treatments with antiseptic [2-4 week intervals]

DISPOSAL

CLEAN
DISEASED

Examine all the sheep carefully. Those without lesions are isolated, treated with antiseptic, and if possible placed in a paddock previously rested from stock. This clean flock probably will then only require inspection and treatment two or three times in the course of the next 12 months. Work these treatments in with other operations involving handling the sheep, e.g., at crutching.

The affected animals will require more attention. Don't treat the prepuces with antiseptic straight away but first see what some fasting or dietary restriction will achieve. After a week or so you will find that a proportion will no longer have visible lesions. Treat these, segregate if possible and examine and re-treat before letting them join the flock.

The wethers with persisting lesions will comprise those with external lesions only and those with external lesions and internal lesions. At this stage I think it is worthwhile treating all these animals by removing preputial scabs, pus and debris and by applying antiseptic. A number of antiseptics have been found useful and include 10 per cent copper sulphate ointment, 20 per cent alcoholic solution of cetrimide and 0.8 per cent-3.2 per cent hibitane. For irrigating the sheath a 5 per cent copper sulphate solution with detergent is effective and in some cases antibiotics may be valuable. Implantation with testosterone could also be considered. Keep the wethers on a restricted diet and re-examine and re-treat at intervals of two to four weeks. Wethers cleaning up and staying clean for two inspections can be transferred to the clean flock. After a month or so you will be left with the problem cases which have failed to respond, and more heroic measure are indicated. Most of the stubborn cases
will be those with internal lesions (sheath rot). If they are in good enough condition perhaps the best thing is to dispose of them without further ado. Otherwise it may be necessary to open up the sheath surgically; after this fairly drastic treatment it is usually possible to fatten wethers satisfactorily.

Does a prophylactic approach to the control of posthitis work in practice? At Armidale we have achieved a very satisfactory level of control in both weaners and in mature wethers using the principles outlined. More work under different conditions is needed, but I see no reason why the method shouldn't apply equally well elsewhere. However, some research work will be needed in New Zealand before firm recommendations can be made.
SYNCHRONIZED LAMBING

Professor I. E. Coop, Lincoln College.

The breeding cycle of ewes follows a rhythmical pattern. Ewes come into oestrus or the breeding season in March, reach a peak of activity in April and go out of oestrus again in August. They then pass deeper and deeper into anoestrus reaching lowest level in November, after which they start coming out and into oestrus again in the early autumn months of February and March. The major influence determining this cycle is the changing ratio of daylight to darkness.

Breed differences do occur, for example Merinos and tropical sheep are less sensitive to the light/dark ratio and can breed almost any time of the year while breeds from the high latitudes of Scotland, Iceland and Scandinavia are very light sensitive and have a short, sharp breeding season in the autumn.

As the ewes are coming out of anoestrus, that is, approaching the breeding season, other factors may hasten or retard the actual start of the season. These are not well defined but such things as temperature, feed supply exert some effect. Farmers are well aware that some years the ewes are earlier than usual in taking the ram and in other years are later than usual. Another factor is the presence of a ram. By some psychological influence triggered by the sudden sight, smell or sound of the ram the ewe can be brought more rapidly in oestrus. This discovery is of relatively recent origin and the application of the discovery forms the material of this paper.

It was first shown by Australian workers over 10 years ago that the introduction of rams into a flock of Merino ewes in December advanced the date at which the ewes came into season and further that the ewes were induced to come into silent heat a few days after the ram was introduced. This was followed up by Dr Edgar and Mr Bilkey at Ruakura who attempted to apply this observation to our Romneys, mainly with the objective of advancing the lambing date. Their work and that of the Australians established the general principles involved. I will be referring a great deal to the Ruakura work and want to acknowledge the very important contribution which it has made. Here at Lincoln we have come into the picture more recently in an endeavour to define the conditions under which responses can be obtained in the South Island and to study the application of the responses in sheep management.

The Principles Involved

Sheep within a single flock vary in their response to the light/dark ratio and to the other factors and so there is quite a wide range of time; probably about a month, over which they come into season. The rate at which they come into season or the distribution of onset of oestrus is shown in Fig. 1. This is believed to be approximately the situation for Romneys in Canterbury. Very few ewes take the ram in February and the first week of March but the tempo increases so that most ewes experience their first heat and take the ram in the
second half of March. Let us assume that the mean date of this onset of oestrus is 25 March.

Now the first true heat period is preceded 17 days earlier by a so-called silent heat in which the ewes ovulate but do not display heat and so do not take the ram. The distribution of this silent heat is shown as a dotted curve. This starts about the middle of February and has its mean at about 8 March. The importance of this silent heat is that it sets the date for subsequent heat periods at 17-day intervals. In other words the normal heat periods are synchronized to the silent heat.

If into this flock of ewes rams are introduced on say 15 February, this sudden presence induces all those ewes which are on the brink of having a silent heat to have their silent heat within a day or two. Maximum response is around the sixth day. Most of the ewes will experience their silent heats from about the third to ninth day after introducing the ram, that is within the period 18-24 February and their first true heat period will follow 17 days later from 7-13 March with a mean of 10 March. This also is shown in Fig. 1. In this way mating and lambing have been advanced about 19 days and the lambing will be concentrated into a relatively short period. This period will be predictable since it is determined by the date of introducing the synchronizing rams, in this case on 15 February.

You may prefer to mate at the second heat which would be from 24-30 March or the third 10-16 April. By choosing the date of synchronization and the particular heat you can mate and lamb at any time you like.
Some Practical Details of the Technique

1. Ruakura has shown that vasectomized teaser rams are much less effective than normal entire rams. Because of this we have used only entire rams. If everything is done correctly entire rams can be safely used and this does away with any need for teasers.

2. Because most ewes will have responded by about the ninth day and because there is some small risk of ewes mating too early we have withdrawn the rams after 10 days. The rams used to do the synchronizing we call the synchronizing rams. Later rams will be reintroduced to do the mating. These we call mating rams. The mating rams should be introduced, 17, 34 or 51 days after the date on which the synchronizing rams were introduced according to whether one wants to catch the first, second or third heat.

3. All rams must be kept well away from the ewes for a month preceding the introduction of the synchronizing rams. This means that there must be at least one paddock separating the ewes from any rams including neighbours' rams, from the beginning of January for Corriedales and from about 20 January for Romneys. It is the sudden introduction of rams which causes the synchronization. Rams in an adjacent paddock can produce synchronization at the wrong time.

4. The introduction of synchronizing rams too late, for example at the end of February, will be less effective because it will not influence those ewes which may already have had a silent heat and there is also the chance of some of the ewes being mated.

5. Likewise introduction of the synchronizing rams too early, for example in January, will be almost ineffective because the ewes are still too deep in anoestrus, they are not near enough to their silent heats to be suddenly triggered into having silent heats. Because of these two considerations there is an optimum time for synchronizing and this is one of the things which we have under experiment now.

For Romneys at Lincoln the optimum date for introducing the synchronizing rams is we think, between about 15-27 February. For Border-cross sheep it is probably three or four days earlier. We are not very sure where it is for Corriedales, it is certainly earlier probably from 25 January-10 February. There is evidence that the onset of oestrus is earlier in the North Island and gets later as the country gets colder or further south. At Ruakura dates would be about a week earlier than those I have quoted for Lincoln, and Southland would probably be a week later. This is something we really want to know.

6. The number of synchronizing rams introduced need not be more than one per 100 ewes and could well be much less than this, say one to 200. Because of the concentrated mating all rams available should be with the ewes over the expected busy period. The concentrated period will be followed by a lull and then a second but reduced burst of activity as those ewes which did not hold to first service return to the ram 17 days later. After 27 days all ewes should have had two chances. Most of the rams could be removed and the few left harnessed to pick out the very late ones and the drys.
7. We have usually put raddle harnesses on the synchronizing rams. During the 10 days which they are with the ewes if no ewes are marked you are probably too early, if 2 to 4 per cent are marked you will be about right, and if 20 per cent are marked you are too late. Very few of the 2 to 4 per cent marked actually lamb.

8. According to Ruakura results two-tooths respond equally well as old ewes and synchronize to about the same dates.

**Lambing Pattern of Synchronised and Normal Mating of Ewes**

![Lambing Pattern Graph](image)

The Effect at Lambing

Fig. 2 shows the pattern of lambing in an average season (the average of several) and in the synchronized lambing at Ashley Dene last year. Points to notice are these. The normal lambing extends over quite a long period with a peak of about 4 per cent of ewes lambing per day. What is not shown is how this peak varies from year to year in a quite unpredictable fashion. In the synchronized system 80 per cent of the ewes responded taking the ram within the space of one week. But as always a considerable proportion, 20 to 30 per cent, of ewes do not hold to service. This means that only 55 to 60 per cent of the ewes lambed within the predicted week, 25 per cent lambed in a predicted week 17 days later and the 20 per cent which did not respond lambed outside these periods. Even so with 55 to 60 per cent of ewes lambing in a week it was a busy time and at the peak 12 per cent of ewes lambed per day. The synchronized lambing gives therefore a very concentrated lambing for about one week followed by a lull of about 10 days, followed by a second week of activity and then the virtual cessation of lambing. (Twenty-eight days after lambing began only four ewes in 1000 remained still to lamb.)
Advantages and Disadvantages

The advantages of the synchronized system are:

(i) That lambing can be advanced by two to three weeks if this is desired and in the dry and early districts this is an advantage.

(ii) The lambing is greatly concentrated. The degree of concentration would be less in districts where mating is normally done late, for example in April or May rather than in March.

(iii) The period of peak lambing is accurately predictable.

(iv) Because the periods of peak mating and lambing are predictable the management of the flock can be made more efficient for example in flushing, in winter feeding and in lamb drafting.

(v) Whether the technique affects lambing percentage is not known. Trials at Ruakura have shown no significant difference so far. It is probably the first, second or third heat period which decides ovulation rate rather than the date of mating. On theoretical grounds therefore if synchronization is followed by advancing the date of lambing little difference is to be expected but if it is followed by the same date of lambing the percentage ought to be increased. If this is substantiated it may well be one of the most important advantages of the technique.

(vi) There is no extra work involved except that one is very busy for a short period of lambing.

(vii) The only real disadvantage is the possibility of a storm occurring during the critical week of very concentrated lambing. This could be very real. Nevertheless the chances of a storm are not increased and over the years these things even themselves out. Further because the period is predictable the necessary preliminary precautions can be made and lastly, different mobs of ewes could be synchronized for different lambing dates.

One doesn't want to become over-enthusiastic about every new innovation so may I repeat that I see no real significant advantages in this technique for those who usually lamb fairly early. For those who lamb late I think the advantages are less and for hill country farmers probably little advantage at all.

I would like to conclude with a very brief summary of what results have been achieved at the College. Last year we had a most effective synchronization of Border-Corriedale ewes at Ashley Dene synchronizing at 10 February, and slightly less effective with Border Romneys at the Research Farm synchronizing on 9 February probably because this date was a little early. This year in an endeavour to lamb a mob of Border-Corriedale ewes at the end of July we have successfully synchronized 1000 ewes at 9 February, mated 450 of them at the first heat to lamb in the last week of July and the balance at the second heat to lamb in the middle of August. In trials to determine dates of synchronization with Romneys we have met with some bother at the Research Farm but on the farm of a cooperating farmer near Irwell we have met with success. Synchronizing rams introduced on 25 January were ineffective being too early, on 10 Feb-
ruary only partially effective again too early, on 19 February very good and on 1 March very good. In the latter case mating rams were put with the whole mob, nothing happened for 12-15 days and then there was a good response. In this case the mating rams acting also as the synchronizing ones.

Attempts to determine the optimum date for synchronizing Corriedales have so far been rather unsuccessful. On one farm near Lincoln all groups were very effectively synchronized to a date which on calculating back came in January. It appears that the whole mob had either been synchronized by the presence of some rams which had been in the yards with the ewes for a couple of hours or by neighbours' rams in January. A somewhat similar misfortune befell our trials at Ashley Dene. It looks as though Corriedales are much more sensitive than Romneys and also very considerably earlier.

Associated with these trials is an endeavour to assess the effect on management practices. Last year the extraordinarily good lamb drafting performance at Ashley Dene was in part due to the early concentrated lambing. This year we hope to push our luck, by lambing a considerable number of ewes in the last week of July. Such early lambing was previously quite impossible.
The studmasters of both hemispheres have during the past 185 years been continually battling with the problem of breed improvement. Ever since the first major advance was made by John Ellman of Lewes, Sussex and Jonas Webb of Babraham, Cambridge, England, between 1780-1821 by defining the breed as a type of sheep for the production of high quality meat; subsequent Southdown breeders have been facing the continual problem of breed improvement.

Not only is this problem a continual one, in that it always exists, but also what is not always appreciated, is that the further along the road of improvement the breed goes it becomes more and more difficult to effect material improvement.

In theory this is due to the margin for improvement lessening as the optimum is approached. Thus the chances of the breeders of today being able to make advances comparable with those made in the past are very limited. Also if we continue to use the same methods for selection with their emphasis on the subjective assessment of carcase value, then progress is likely to be of an almost infinitesimal nature, if indeed any will occur at all.

This is because despite all our modern scientific knowledge and ability to think of exploring and colonizing outer-space, we are still not able to improve on the systems of breeding used by the original improvers who, once they had standardized the breed were limited as we are today to inbreeding, line breeding, or outbreeding as mating systems.

Nor is there any reason to suppose that our eye appraisal methods for selecting the animals to fit into these systems see any better than did the eyes of old.

But we today do have advantages, not available in the past, in our planned marketing systems with all the research analysis of what the market requires constantly being fed to us by various responsible bodies so that we are left in no doubt as to what is the best type of animal to produce. The fact that it may take anything from three to five years, assuming it is possible, to produce this animal and in the meantime the consumer requirements have altered again never seems to worry the responsible bodies. Thus what at first sight appears to be an advantage, is cancelled out by the failure of the responsible bodies to define objectively the animal required, sufficiently far enough ahead to allow for the sheep generation interval.

In fact many farmer-breeders still, like us, await some official pronouncement as to what is the optimum export lamb weight, further, if such a thing exists to see that its production will give optimum returns to the farmer.

It was therefore with these points in mind that we at Lincoln College embarked on a new objective approach to breeding Southdown sheep in 1958. Today we are presenting some of the results of the past seven years' breeding. These are being put before you to invite comment and discussion. We do not claim that the methods used are
the most suitable, or that they represent some miraculous new system of breeding. To some of you the account will possibly be familiar as you may already have interested yourself in what has been going on at the College. I hope it will bear repeating.

Our first problem near the end of 1957 was to attempt to define objectively, in some form of measurable terms, not requiring the use of eye appraisal, the ideal Southdown. This is not simple. After many attempts we finally reasoned along these lines. The purpose of the breed was to produce sires which could be mated with virtually any type of ewe and produce an ideal export lamb under New Zealand conditions. Because the present grading system and schedule fail to differentiate sufficiently in favour of the lamb having the highest quality meat and having it in the right places; emphasis would need to be laid in other directions. Therefore to us it seemed that the next most important factor to consider, was the lamb which reached export weight at the earliest age having consumed a minimum of feed. This description appeared to represent the ideal export lamb which under present New Zealand conditions of the industry would give the best return to the farmer. Translating this into terms of objective measurement can be done as follows. Let us assume for the moment we want an export lamb of 30lb carcase weight. This then means a lamb of approximately 65lb live weight must be produced “fat” off the mother. This total live weight will be produced through the interaction of two criteria, (a) birthweight and (b) daily growth rate to weaning.

Assuming an average birth weight of 10lb this leaves a total weight of 55lb to be accounted for by lamb growth on the mother. In terms of daily growth rate this means 0.55lb per day if we take a suckling period of 100 days (approximating to 14 weeks), or 0.65lb per day if the lambs are weaned at 84 days (12 weeks).

This gives us an objective target to breed our Southdowns for, namely rams of optimum birth weight, capable of maximum growth rate up to weaning and, what is more important, able to sire export lambs of 10lb birth weight which would grow at the rate of 0.65lb per day at least.

Now the Southdown flock of Lincoln College is number 13 in the Flock Book, the second oldest flock in the country, yet in 1958 after 58 years of stud breeding we had no records to show how heavy our lambs were at birth or how fast they grew from birth to weaning! First this information had to be obtained.

Accordingly in 1958 the total ewe flock was randomized on an age basis into four ram groups and mated to four rams, two being home breed and two from outside blood. After mating all ewes were boxed and treated as one mob right through until weaning. At lambing all lambs, alive and dead, were weighed and tagged at birth, weighed again at tailing and weighed finally at weaning. All multiple birth weights were corrected to singles and all two-tooth birth weights to mature ewe singles. Similar corrections for growth rate were made for all lambs reared as twins, also two-tooth singles to mature ewe singles.

The 1958 performance of the progeny of the four rams is shown in Table 1 where the mean of each ram’s total progeny in terms of
birth weight and daily growth rate to weaning is shown. It will be seen that the two rams 187 and X332 were outstanding in birth weight and of these two 187 was superior in growth rate.

Table I.

Selection of Stud Rams on Performance

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<tbody>
<tr>
<td>1958</td>
<td>175</td>
<td>187</td>
<td>X173</td>
<td>X332</td>
<td>7.935</td>
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<td></td>
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<td>8.913</td>
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<tr>
<td>1959</td>
<td>87</td>
<td>187</td>
<td>111</td>
<td>343</td>
<td>9.230</td>
<td>0.438</td>
<td>9.213</td>
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<td>8.851</td>
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<tr>
<td>1960</td>
<td>2129</td>
<td>A165</td>
<td>A330</td>
<td></td>
<td>9.423</td>
<td>0.466</td>
<td>9.898</td>
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<tr>
<td></td>
<td>9.445</td>
<td>0.441</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1961</td>
<td>8.763</td>
<td>8.663</td>
<td>8.387</td>
<td>8.193</td>
<td>0.480</td>
<td>0.481</td>
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<tr>
<td></td>
<td>0.464</td>
<td>0.483</td>
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<tr>
<td>1962</td>
<td>C342</td>
<td>A330</td>
<td></td>
<td>1259</td>
<td>7.94</td>
<td>0.502</td>
<td></td>
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<tr>
<td></td>
<td>7.510</td>
<td>0.461</td>
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<td></td>
<td></td>
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<tr>
<td>1963</td>
<td>C342</td>
<td>685</td>
<td>1006</td>
<td>1259</td>
<td>7.97</td>
<td>0.495</td>
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<tr>
<td></td>
<td>6.88</td>
<td>0.462</td>
<td>0.522</td>
<td>0.462</td>
<td>9.03</td>
<td>0.461</td>
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<tr>
<td>1964</td>
<td>B502</td>
<td>685</td>
<td>B172</td>
<td>1259</td>
<td>7.83</td>
<td>0.571</td>
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<tr>
<td></td>
<td>6.85</td>
<td>0.522</td>
<td>0.531</td>
<td>0.498</td>
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</table>

(All rams with prefix letter are Lincoln bred, rest outside bred.)

This left little doubt as to which sire should be retained. Accordingly Ram 187 (outside blood) was used as the reference ram in the following year 1959. In this year once again the ewes were randomized into four ram groups and three new rams all outside blood were tested alongside 187 from the previous year. This procedure was adopted so that inter-ram comparisons could be made between years.
The 1959 results showed again that Ram 187's progeny were superior in growth rate to two of the other three and as good as all for birth weight. Armed with this knowledge 187's best son in 1958 was retained for use in 1960. In addition the two best sons of 111 who had performed as well as 187 were retained, and in order to speed up the generation interval used as ram lambs. Thus in 1960 three Lincoln bred rams representing two different blood lines were test mated under the standard mating conditions.

As will be seen from Table 1 the 1960 results once again showed one ram Z129 to be superior to the other two although each of these nearly matched him in either birth weight or growth rate but not both. Obviously Z129 selected himself for use again in the following year, but which of the other two? On the basis of growth rate we kept A165. In addition another sample of outside blood was to be brought in. However when the final selection of the ewes for test mating was being made it was thought desirable to use again all three Lincoln rams in 1961 together with one new outside blood line.

The 1961 results could be described as something akin to a mixed grill with Z129 still able to show his slight superiority over A165 and A330. The new outside blood line 1259 scored well in growth rate but rather failed on birth weight, however it was decided to use him again because of the good growth rate score and to continue the Z129 line by using his best son C342 as a ram lamb.

The results from the 1962 matings will be seen to be fairly clear cut with C342 definitely superior and 1259 not able to quite measure up again on birth weight.

In 1963 five rams were mated, three new sources of outside blood being tested against C342 and 1259 and once again 1259 slipped on birth weight so this line had to be considered for discard as a sire source particularly as two of the new lines showed promise.

The line-up for 1964 consisted substantially of the same blood lines as in the previous year except that in three cases the best son of the sire was used as a ram lamb.

### TABLE 2

<table>
<thead>
<tr>
<th>Ram</th>
<th>Lincoln E502</th>
<th>1259</th>
<th>685</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth Weight (lbs)</td>
<td>10.55</td>
<td>9.57</td>
<td>10.15</td>
</tr>
<tr>
<td>Daily Growth Rate (lb)</td>
<td>0.658</td>
<td>0.611</td>
<td>0.614</td>
</tr>
</tbody>
</table>

The results obtained from the 1964 matings look very encouraging with one of the new outside blood lines 1006 showing considerable promise but still closely followed by the ever consistent 187 line representative E502. A new technique for evaluation was introduced in 1964 when in addition to their quota of stud Southdown ewes, three of the rams were test mated each with a balanced sample of Romney stud ewes which had been culled for age. It was felt that the lambs produced by each sire in this way would give as near as possible an
estimate of their commercial export lamb producing qualities. Needless to say once mated all the ewes and lambs were treated as one mob until slaughter. The preliminary results are shown in Table 2 and tend to follow the same pattern as in the case of the pure Southdown matings. Not only do these results tend to confirm the methods used by they also provide a practical proof of the theoretical commercial advantages of this method of selection as a means of breed improvement. Referring once again to Table 2 where, if we compare the performance of 1259 and E502, we see that in birth weight E502’s progeny are one pound heavier than 1259’s and in growth rate they are superior by 0.047 pound per day. If we take a theoretical sample of 100 lambs sired by each ram grown over 100 days then the progeny of E502 would have 470 pounds of extra meat, roughly equivalent to seven extra lambs on the property! In actual fact when these lambs were weaned, the figures were as follows:—

<table>
<thead>
<tr>
<th>Ram</th>
<th>Lamb Mean Weaning Age in Days</th>
<th>Lamb Mean Weaning Weight in Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>E502</td>
<td>105.2</td>
<td>68.8</td>
</tr>
<tr>
<td>1259</td>
<td>106.5</td>
<td>60.0</td>
</tr>
</tbody>
</table>

There should be no need for me to underline what this difference represents in terms of additional cash return to the farmer, or in making just that difference between a mob ready for drafting and a mob still requiring to be finished before this can take place. If these figures are multiplied up onto a farm scale of say 1000 lambs they look more impressive, there would be 8,800 pounds of additional meat equivalent to 135 extra lambs for sale on the property, at no extra cost, all through using rams similar to E502 instead of 1259.
Introduction

As Canterbury is one of the districts about which complaints are often received when overfat lambs are mentioned and as beef production in this area is low at the present time, most of the remarks in this paper relate to lamb production.

We are living in a changing world, and if New Zealand is to uphold its position as the world’s largest exporter of meat, we must maintain our present standards of quality where they are satisfactory, be prepared to meet changing patterns of demand in our established markets where necessary, and be able to produce tailor-made products to suit new markets. Even in our traditional markets, such as the United Kingdom, changes are taking place.

Need for Lean Meat Production

In 1954, the British consumption of poultry meat was six pounds per head of population per year. By 1962 this figure had risen to 15 pounds of poultry meat and is rapidly gaining on lamb and mutton for which the consumption pattern has remained steady at 25 pounds per head per year. If the price of poultry meat, which is lean meat, continues to fall, then we can expect increasing competition with our lamb trade.

Many long held, traditional ideas on meat production are changing quite rapidly. For example, ten years ago the carcasses of bulls were considered to have very poor conformation, to be lacking in fat cover (or finish) and in general to be an inferior product. In fact, according to the “Standard Specification for Meat” bull meat cannot be sold except as manufacturing meat in New Zealand butcher shops. However, if we look overseas we find that recently the highest priced beef on the Smithfield market came from Yugoslavian bulls. The poor fat cover is now regarded as a major advantage and the British producers have been sufficiently impressed with the rate of gain and “quality” of these animals that a limited number of entire bulls were raised on an experimental basis last year. Bull carcasses are a source of lean meat.

Consumer surveys have consistently indicated that in most countries, in situations where people have a choice, fat meat can only be sold at a considerable discount. With overfat carcasses the buyers either have to trim off the excess fat (which means an increase in the price of the remaining saleable meat) or alternatively they may try and get rid of the meat to some unsuspecting customer. You will all know that this is not a good way of retaining customers. It has also been shown that when the customer can see the cut surface of the meat, as in a supermarket, overfat meat does not sell. With present-day high retail prices for meat in most of our overseas markets, consumers don’t want to buy large quantities of fat, in many cases at a considerably higher price than they would have to pay for margarine.
It is often claimed that fat is needed in meat to make it tender. In a recent experiment in conjunction with the N.Z. Meat Industry Research Institute, the tenderness of rib eye muscle samples from 72 lambs ranging in carcass fatness from 20-41 per cent was measured both by means of a trained taste panel of staff members and also by the use of a mechanical shear meter. No evidence was found from these data to support the contention that fatter lambs are any more tender than lean ones and a search of the overseas literature also failed to show any advantage of fatness in enhancing tenderness.

A steady flow of articles is appearing in newspapers and magazines overseas linking animal fats and cholesterol with human obesity and heart disease. Although much of the evidence linking animal fats and heart disease is very poor, there is nevertheless little doubt that overweight people have a higher incidence of heart and artery ailments than do normal weight people. There is also little doubt that high fat diets and overeating—probably irrespective of the type of fat being consumed—will result in excess body poundage. Fear of being overweight and fear of heart disease is making people in the high income countries fat conscious, and lean meat buyers.

In spite of the relatively high fat tolerance of the British consumer (it appears that they will take carcasses regarded as overfat in other countries), our London Meat Producers' Board representatives have estimated that the proportion of carcasses which they would regard as overfat is about 10 per cent of our total lamb exports. These overfat carcasses are euphemistically described by the N.Z. exporters as overprime. Does the figure of 10 per cent seem reasonable or is it too high? I have recently analysed two carcasses graded as overfat by the meat trade. They contained 43 per cent and 44 per cent of fat respectively and a third carcass which did not grade as overfat (the grader indicated that it was a borderline case) comprised 47 per cent fat. If you take as a round figure that lamb carcasses must contain 45 per cent (almost half) fat before they are rejected for overfatness, you will not be surprised to learn that we have an overfatness problem in Britain.

As the North American and Continental European consumers will take considerably less fat than the British public it seems likely that a high proportion of N.Z. lamb carcasses are too fat for sale in these markets. From the "National Provisioner" the main American meat trade journal we learn that 80-100lb lambs (approximately 40-50lb carcasses) are being bought from American farmers at £6-£9 per head. At higher than average schedule prices for woolly lambs this year N.Z. farmers are receiving in the order of £3/10/- to £4/5/- for carcasses from similar weight lambs. The prices quoted are not exceptional ones which make it difficult to understand the procedure which apparently enables our meat exporters to lose money selling lambs on the American market unless our carcasses have to be sold at discount prices, in part because of excess fat.

There are at last, however, some signs that our meat exporters have realised that the overseas market demand is for a meaty lean lamb. As you will all know, the Y grade lamb (old second grade) is the meaty lamb and the Prime grades are the fatter grades which will also include the overfat lambs that haven't been rejected for export. Although since World War II the Y grade lamb has been
periodically fetching higher prices on the Smithfield market than the Prime lambs, this has up till this year never been reflected in the N.Z. meat operators’ schedule prices which have always given the premium for the fatter lamb. Since February of this year, however, the meat schedule has stopped paying a premium for the fatter Prime lambs (the price for Prime and Y’s are the same, at least for carcasses up to 36lb) which means that farmers will now be paid for producing meaty lambs. In saying this I am not advocating that all N.Z. farmers should set out to produce only Y grade lambs as there is undoubtedly also a strong market for Prime grade lambs in the U.K., provided they are not overfat. This is the case with too many Prime grade carcasses at present. What I am saying is that it has appeared unreasonable that the meaty Y grade carcasses which fetch a premium for some of the year in Britain, has been bringing a lower return than a Prime lamb of similar weight to the producer in New Zealand.

Some Reasons for Overfat Lamb Production

Why do we get overfat lambs?

By the very nature of the industry they are to some extent inevitable at the farm level. When the fat stock picker comes into a mob of lambs he may pick 30-70 per cent of the mob. Even if most of the lambs are ideal there will be some that were born earlier than others and some that have grown faster and so even in the best of drafts there are likely to be a few that are overfat. If, however, there has been a good season for pasture growth, or the farm tends to be understocked and perhaps the picker has come in a little late, then a high proportion of the lambs will be overfat and we have the situation that we must try and avoid if we are to improve the reputation of our export lambs. It would seem reasonable that schedule prices should discourage the production of lambs carrying excess fat and encourage the production of muscular meaty lambs, although at the present time this is not the case. At the freezing works we must have the means of recognizing the overfat lambs when they are produced, and be able to prevent their export, at least in the present Prime grade.

Factors which Influence the Amount of Fat in Lamb Carcasses

What are the factors a producer must bear in mind if he wishes to avoid the production of overfat lambs?

(1) Nutrition. On any particular farm this is very closely linked with stocking rate. It is very well known in most Western human societies that overeating is the main cause of overfatness in the human population and unbalanced nutrition is also a contributing factor. Farmers know equally well that overfat lambs are more common on farms that are understocked and are quite rare on farms that are properly stocked or tend to be overstocked. This effect of stocking rate is also influenced by season, as in a poor year for pasture growth (such as a drought year) there will be a lower proportion of overfat lambs and a higher proportion of lean Y grade lambs. Farms that frequently produce overfat lambs are likely to be understocked and should consider increasing their stocking rate as a method for improving the carcass quality of their lambs. Level and type of nutrition is probably one of the most important factors influencing
lamb carcass quality, but it seems to be a field of research which has, until recently, been largely ignored in New Zealand and overseas.

(2) Breed. This is a subject about which very little reliable information is available in New Zealand. Very little experimental work has been done on the carcasses of the pure breeds of sheep that are found in this country. A small amount of experimental information is available on some of the crosses that may be used. Some breeds have the reputation of being early maturing and others are regarded as being later maturing with maturity being judged in terms of the time taken before the young animal is considered suitable for slaughter. However, the results of trials in both the North and South Islands suggest that the differences between at least the commoner breeds used for export lamb production in rate of maturity are surprisingly small. In any recommendations made we must remember that the bulk of New Zealand's export lamb production is based on the use of the Romney ewe. So little factual information is available on the influence of the different breeds of ewe on the resulting quality of the lamb carcasses that at the present any recommendations would be based on other economic factors such as wool weights, lambing percentage and general suitability of the breed to the farming conditions under which they are expected to produce.

In relation to the breed of ram to use, more information is available. We know that in general, the Southdown ram over our main breeds of ewe produces a carcass that is acceptable at light weights. If a leaner lamb is to be produced, then it has been found that a higher proportion of straight Romney lambs fall into this class and it seems likely that quite a high proportion of our present lean Y carcasses come from Romney sires. The Cheviot is another breed which appears to produce lean lambs. Work at Lincoln College has shown that the use of the medium weight sires, the Hampshire, Dorset Down, South Suffolk and Border Leicester X S.D. can increase the weaning weight of the lambs (that is increase the growth rates) and the lambs grade almost as well as the Southdowns. As important is the fact that at the heavier weights, the limited amount of information available suggests that these lambs are less fat than the Southdowns. Lincoln College and Ruakura have shown that the Border Leicester, Suffolk and Dorset Horn rams increase the growth rate of lambs, draft almost as many off the mothers as the Southdown and produce if anything leaner carcasses at heavier weights. Any breeds of sire not mentioned have only been ignored because at the present time experimental evidence is not available for them. However, growth and carcass composition information on the progeny of most breeds of sire at present being used for lamb production in New Zealand, after mating to Romney ewes is now being collected at Ruakura and the results will be made available from time to time.

(3) Strain. Most livestock breeders are well aware that within any breed there exists some strains which may be superior to others for wool production, growth rate or meat production. Unfortunately, up to the present time, no work is available which evaluates the importance of strain differences in the production of high quality lamb carcasses. Suggestions have been made that the use of some strains of sire may be an important contributing factor to the high proportion of overfat lambs produced by New Zealand. Experiments

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to test this possibility are now in progress at Ruakura and other centres. At Ruakura we now have progeny test data on 32 Southdown sires, many of which have been obtained from reputable studs in both the North and South Islands, and also data on 27 sires of other breeds. Under our conditions of high stocking rates we have not yet produced a single lamb which has graded as overfat illustrating that breed and strain effects on overfatness can be controlled by level of nutrition.

(4) Growth Rate. With the recent emphasis in animal breeding on the importance of selecting animals with a high growth rate, a question requiring an answer concerns the carcass quality of lambs from sires which have a high growth rate. An experiment from Kentucky in the U.S.A. using Southdown rams showed that each extra 0.1lb of daily gain by a ram resulted in 2 per cent more lean meat and 1 per cent less fat in the carcasses of their offspring. We are at the present time gathering similar sort of information for a large number of sires to check whether the selection for growth rate will result in the production of leaner lambs under New Zealand conditions.

(5) Liveweight and carcass weight. These factors are also very closely related to the age of the animals as the heavier animals are on average older than the lighter ones. Because of this most of the comments about weight will also be true for age.

It has been shown quite conclusively by work carried out in many parts of the world, than on average within any breed or strain of sheep, as the lambs increase in weight, the proportion of fatty tissue in the carcass increases and the proportion of red meat or muscle decreases. In a group of wether lamb carcasses that were analysed at Massey University it was found that on average the carcasses weighing 25lb contained 21 per cent fat and those weighing 40lb had 30 per cent of fatty tissue. While the proportion of fat was increasing, the proportion of muscle was decreasing by about 6 per cent. As the carcasses were almost certainly of Romney or Romney X Southdown breeding, the results show quite conclusively the dangers inherent in taking our normal type of export lambs through to heavier weights when discrimination against overfatness becomes of economic importance.

(6) Sex. It is a fairly common observation that ewe lambs grade better than wether lambs. In an experiment involving almost 700 lambs at Ruakura last season, approximately four-fifths of the lambs grading Y were wethers and one-fifth were ewes. The lower proportion of ewe lambs grading Y is an indication that they were fatter. When dissection analyses were carried out on some ewe lambs at Massey University the data showed that at any carcass weight they contained just over 4 per cent more fat than similar weight wether lambs and the chemical analyses of almost 700 lambs at Ruakura last year showed the ewe lambs averaged 3 per cent more fat than the wethers. Because of the higher fat content of ewe lambs, it would be desirable to slaughter them at lighter weights than the wethers on farms where overfatness is a problem.

Experimental results have shown that ram lambs are leaner than wether lambs and also that they grow faster. Overseas evidence is available which suggests that the meat from young rams is in no way
inferior to that from wethers, at least up to one year of age. These results indicate another way of producing bigger and leaner lambs on farms which produce carcasses carrying excess fat and which are sufficiently productive to be available to fatten all export lambs for sale prior to the end of the killing season. Non-castration could not be recommended on farms which produce store lambs and on which there is a possibility that some ram lambs may still be on the farm after the end of the killing season.

(7) Conformation. Some evidence is now available which suggests that one of the major factors which commonly make up what is commonly regarded as ideal body and carcass conformation is a good covering of fat. While the market demand is for lean meat it seems desirable to place less emphasis in the selection of breeding stock on conformation and more emphasis on economic factors such as twinning ability and growth rate.

Recommendations

What recommendations can we make on methods for improving the quality of our export lamb?

(1) Producers

(a) Any farmers who consistently produce overfat lambs should increase their stocking rates. This should both improve the quality of lambs produced and increase the farmers' income. This can be achieved by increasing the number of ewes, or by increasing the twinning rate of the normal number of ewes.

(b) If the producer of overfinished lambs is not prepared to increase his stocking rate, he should at least take off his lamb drafts at an earlier date and perhaps more frequently than normal. This will result in lighter, leaner lambs.

(c) If possible, the ewe lambs should be run separately from ram or wether lambs, at least after weaning and should be slaughtered at lighter weights than the male lambs.

(d) On farms producing overfat lambs and using Down breeds of ram for export lamb production and normally selling all their lambs as "fats" the ram lambs should not be castrated, at least for the early lambs docked. This will result in faster growing leaner lambs.

(e) The Southdown sire appears to be very suitable for the production of high quality lightweight carcasses. Preliminary results suggest that some other breeds of ram are also suitable.

(f) On the available evidence, it appears that some of the present strains of Southdown sire are less suitable for the production of heavy-weight lamb carcasses. If we deliberately set out to produce heavier lamb carcasses, the use of the intermediate weight sires (such as Hampshire, Dorset Down, South Dorset Down, South Suffolk) or the heavyweight sires (Suffolk, Dorset Horn, Border Leicester, English Leicester) should be considered. However, the decision as to whether or not to produce heavier lamb carcasses will be largely influenced by the expected schedule prices for the heavier lambs.

(g) All sheepfarmers should own a pair of scales if these can be obtained at a reasonable price, and prime lambs for slaughter should be selected on the basis of weight.
(2) **Meat Exporting Companies.** This is the group who are in a position to prevent the shipment (at least in their present form) of the overfat carcasses now being exported. If you accept the estimates from London that approximately two million overfat carcasses are being sent annually from N.Z. to the U.K., then it would appear that either the works' graders are unable to recognize the overfat lambs on the chain, or else they do not regard as overfat carcasses which are carrying excess fat for present market demands. If more lambs are classed as overfat, the producers will quickly stop growing such lambs because of the markedly lower prices paid for overfat carcasses.

It has been estimated in London that we would be receiving a higher price in the U.K. market for the majority of our lambs if the "overprime" lambs we are at present sending were either eliminated or sent as a separate grade. This could result in a higher price to the producer for the bulk of his lambs. If we continue to export the "overprime" carcasses, it may be desirable to trim them and send them as cuts, or to place them in a separate grade.

For the American market it is likely that we should be using heavier breeds of sire, and the lambs produced from such crosses should not be penalized as heavily for the extra weight, as is the present situation in the meat schedule prices. These were probably designed to discriminate against the excess fat produced by the Romney X Southdown lambs at heavier weights.

(3) **Market Information.** I believe that N.Z. farmers, research workers and perhaps meat exporting companies have a duty to demand more factual information on the proportion of lambs regarded as overfat that are reaching various markets. We also need a definition as to what level of fatness is regarded as overfat for each individual market and which districts and works are exporting overfat lambs to these areas. On several occasions while overseas I heard British butchers stating that they did not want any more carcasses of a particular brand, or from a particular works because of their fatness and the variable standards of grading. It is in the national interest to maintain a uniform and high standard of grading. To assist in accomplishing this we need more factual market information.

(4) **District Competitions for Export Lamb.** These competitions should be based on the results of measurements on the cut carcasses so that the entry with a large eye muscle, low fat covering and fat trim and high proportion of lean meat should win the competition. These are the characteristics of economic importance in a carcass and should not only be estimated by an experienced judge, but should also be measured. Such competitions are a very useful way of indicating to the farmer the type of export lamb we should be trying to produce.
LUCERNE: ITS POTENTIALITY AND METHODS OF ACHIEVING ITS POTENTIALITY

C. E. Iversen, Reader in Agronomy, Lincoln College.

On the thin droughty soils of the South Island with a rainfall of 15-30 inches conventional pastures have not proved very productive nor have they been persistent. In warmer districts subterranean clover has proved a useful addition to the sward and has been responsible for considerable increases in stock production. However, as will be shown below, it has several limitations and other less restricted plants may prove more profitable. Over the past 15 years lucerne has been used in increasing amounts and it is suggested that a continuation of and intensification of this trend could give greatly increased sheep production.

It is proposed in this paper to look briefly at the contribution made by subterranean clover and the limitations of its use; then to consider the potential production of lucerne under different mixtures and managements and finally to consider the management of lucerne for maximum production under dry land farming.

Subterranean Clover

This plant is a very useful pioneer on land of low fertility and is frequently used as the first phase of pasture improvement.

With a low density grass component the subterranean clover sward is very persistent and has several useful features: the ability to withstand severe winter and summer grazing, good recovery from pest damage and, most important of all, high feed quality.

At Ashley Dene for many years such swards have produced the earliest and best lambs. Even in any programme of major improvement it is probably necessary to retain about 30 per cent of the farm in such swards.

The disadvantages of such a sward are threefold: firstly its variability. It is very vulnerable to the vagaries of rainfall and over a ten-year period at Ashley Dene such pastures yielded from 900-7000 lb dry matter. This demands very large reserves of hay for drought years. The second weakness is that production is largely concentrated in the spring period so that careful management is necessary to maintain stock health throughout the year. The third and major weakness is that it is low-producing, with lucerne it is possible to produce 100 per cent more. The question of improvement of the subterranean clover sward with different grasses has been studied at Ashley Dene for many years and is still the subject of study. But the net result of trials to date is that while grasses may spread production and reduce variability slightly the production of the sward is governed by the germination and growth of the clover. A strong grass component reduces overall production.
Potential Production of Lucerne

Initially we believed it necessary for the sake of stock health that lucerne should be introduced in a mixture with low density grasses plus subterranean clover. Such swards were more productive as long as the lucerne component remained strong, yielding about 5000 lb dry matter with a much reduced seasonal variability. However, the retention of the lucerne has required very careful grazing management. Marlborough lucerne tended to disappear fairly quickly, but three Glutinosa swards have survived quite productively for 17 years on the shallowest soils in the area.

Meanwhile on a Wakanui soil at the College we conducted a grazing trial for five years using different varieties. This averaged 15,000 lb dry matter over this period and appeared to be satisfactory for stock fattening when grazed quickly at the hay stage, very good utilization being achieved.

Consequently a further trial was sown at Ashley Dene using pure lucerne. Four varieties were included with six replicates of each and subjected to two grazing managements:

- Lenient—grazed quickly at the hay stage.
- Severe—more or less continuous grazing whenever feed was available—the system generally used by farmers.

By accident of cultivation three replicates were placed on a shallow Wakanui soil and three replicates on a very shallow Eyre soil.

This has complicated the results and they are presented separately in the tables below.

### TABLE 1

**Lenient grazing. Total herbage**

**Pounds Dry Matter per acre.**

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1960-61 E</td>
<td>7,302</td>
<td>8,868</td>
<td>8,608</td>
<td>8,771</td>
</tr>
<tr>
<td>W</td>
<td>11,710</td>
<td>10,380</td>
<td>9,290</td>
<td>9,987</td>
</tr>
<tr>
<td>1961-62 E</td>
<td>6,012</td>
<td>5,970</td>
<td>5,490</td>
<td>5,198</td>
</tr>
<tr>
<td>W</td>
<td>12,230</td>
<td>11,620</td>
<td>10,680</td>
<td>10,670</td>
</tr>
<tr>
<td>1962-63 E</td>
<td>7,209</td>
<td>8,690</td>
<td>6,744</td>
<td>6,656</td>
</tr>
<tr>
<td>W</td>
<td>11,678</td>
<td>12,041</td>
<td>10,845</td>
<td>10,896</td>
</tr>
<tr>
<td>1963-64 E</td>
<td>7,806</td>
<td>8,296</td>
<td>7,145</td>
<td>7,257</td>
</tr>
<tr>
<td>W</td>
<td>12,584</td>
<td>11,736</td>
<td>11,763</td>
<td>12,083</td>
</tr>
</tbody>
</table>

E: Very shallow Eyre soil.

W: Shallow Wakanui soil.

Varietal differences are small and are not significant. Soil differences are considerable and are significant. The Eyre soil is very shallow. In an examination by Mr Charles Harris it was suggested that at some time it had been subjected to wind blow.

Even on this soil New Zealand certified lucerne has produced on average nearly 8,000 lb D.M. per acre per annum with a variability of 79
only 6,000-9,000 lb. This is certainly a great deal higher than we have achieved with any other sowing on this land.

In each variety lucerne contributed about 90 per cent of total production.

TABLE 2
Severe grazing. Total herbage.
Pounds Dry Matter per acre.

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1960-61 E</td>
<td>5,141</td>
<td>5,194</td>
<td>4,265</td>
<td>4,516</td>
</tr>
<tr>
<td>W</td>
<td>5,459</td>
<td>5,734</td>
<td>4,917</td>
<td>4,822</td>
</tr>
<tr>
<td>1961-62 E</td>
<td>4,970</td>
<td>4,840</td>
<td>4,440</td>
<td>4,442</td>
</tr>
<tr>
<td>W</td>
<td>5,384</td>
<td>5,938</td>
<td>4,500</td>
<td>4,164</td>
</tr>
<tr>
<td>1962-63 E</td>
<td>5,199</td>
<td>5,788</td>
<td>5,354</td>
<td>5,356</td>
</tr>
<tr>
<td>W</td>
<td>5,955</td>
<td>5,873</td>
<td>4,840</td>
<td>4,402</td>
</tr>
<tr>
<td>1963-64 E</td>
<td>4,467</td>
<td>4,956</td>
<td>4,206</td>
<td>4,351</td>
</tr>
<tr>
<td>W</td>
<td>5,250</td>
<td>5,682</td>
<td>3,428</td>
<td>3,670</td>
</tr>
</tbody>
</table>

E: Eyre soil.
W: Wakanui soil.

Under severe grazing varietal differences occur. Glutinosa and New Zealand certified have outyielded Italian and Provence.

This has become progressively more apparent on the Wakanui soil where intrusion of other species is encouraged by greater summer moisture. This is shown in the next two tables.

Soil differences have not affected overall yields to the same extent under this treatment.

Comparison with Table 1 shows up this form of grazing in a very unfavourable light compared with grazing quickly at the hay stage, yields being less than two thirds.

TABLE 3
Severe grazing. Lucerne yields.
Pounds Dry Matter per acre.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1960-61 E</td>
<td>3,300</td>
<td>3,270</td>
<td>1,980</td>
<td>2,230</td>
</tr>
<tr>
<td>W</td>
<td>2,550</td>
<td>3,150</td>
<td>1,710</td>
<td>2,260</td>
</tr>
<tr>
<td>1961-62 E</td>
<td>3,125</td>
<td>2,950</td>
<td>2,300</td>
<td>1,710</td>
</tr>
<tr>
<td>W</td>
<td>2,900</td>
<td>3,050</td>
<td>2,250</td>
<td>430</td>
</tr>
<tr>
<td>1962-63 E</td>
<td>2,800</td>
<td>3,100</td>
<td>3,000</td>
<td>2,490</td>
</tr>
<tr>
<td>W</td>
<td>1,800</td>
<td>1,625</td>
<td>1,260</td>
<td>500</td>
</tr>
<tr>
<td>1963-64 E</td>
<td>2,650</td>
<td>3,050</td>
<td>2,500</td>
<td>2,500</td>
</tr>
<tr>
<td>W</td>
<td>2,800</td>
<td>3,400</td>
<td>1,675</td>
<td>750</td>
</tr>
</tbody>
</table>

E: Eyre soil.
W: Wakanui soil.
Significant differences between varieties occur here more particularly on the Wakanui soil where Italian and Provence in particular have been affected by intrusion of other species.

This is shown in Table 4 where plant survival figures are given.

Soil differences have had much less effect on total yield than under lenient grazing.

### TABLE 4

Stand Survival. Plants per square yard.

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Eyre Soil</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At estab.</td>
<td>247</td>
<td>236</td>
<td>224</td>
<td>235</td>
<td>242</td>
<td>228</td>
<td>370</td>
<td>325</td>
</tr>
<tr>
<td>After 5 years</td>
<td>67</td>
<td>67</td>
<td>55</td>
<td>43</td>
<td>62</td>
<td>45</td>
<td>90</td>
<td>33</td>
</tr>
<tr>
<td>% Survival</td>
<td>31</td>
<td>28</td>
<td>25</td>
<td>18</td>
<td>26</td>
<td>20</td>
<td>24</td>
<td>10</td>
</tr>
<tr>
<td><strong>Wakanui Soil</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At estab.</td>
<td>120</td>
<td>113</td>
<td>212</td>
<td>215</td>
<td>227</td>
<td>215</td>
<td>259</td>
<td>257</td>
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<tr>
<td>After 5 years</td>
<td>37</td>
<td>24</td>
<td>57</td>
<td>24</td>
<td>61</td>
<td>21</td>
<td>70</td>
<td>8</td>
</tr>
<tr>
<td>% Survival</td>
<td>31</td>
<td>21</td>
<td>27</td>
<td>11</td>
<td>27</td>
<td>14</td>
<td>27</td>
<td>3</td>
</tr>
</tbody>
</table>

L: Lenient grazing.
S: Severe grazing.

Two different sources of seed were used for the Glutinosa. On the Wakanui soil a partly improved strain was used. Its germination and establishment was inferior. However it has shown the best survival of all four on this soil under severe grazing.

Establishment counts otherwise were fairly even for all varieties. Provence with a smaller seed was sown at a lower rate but still gave the best establishment. Under lenient grazing for five years plant survival showed little differences between soils and varieties.

Under severe grazing there is a marked influence of both soil and variety. Survival on the Eyre soil is much superior to that on the Wakanui. Glutinosa has shown the best survival on the Eyre soil while Provence is markedly inferior on the Wakanui.

To sum up these tables we can use a pasture dominated by grass with a yield of 2,500 lb dry matter per acre and considerable variability.

We can change to a pasture dominated by subterranean clover with a yield of 3,500 lb dry matter but with a very high variability.

We can use lucerne mixtures grazed as for the ordinary sward with a yield of 5,000 lb dry matter and a lower variability or we can take pure lucerne and graze it quickly as a crop at the hay stage and achieve 8,000 lb dry matter on a very thin Eyre stony loam with a very low variability.

If we can devise the management necessary to harvest all the production under the last system increase in stock production should be possible.
Management of Lucerne for Maximum Production

Mixtures. We have three possibilities: lucerne alone, lucerne and a grass or lucerne and clovers. Lucerne alone has many advantages, on light land it is the most productive, it is more simple to manage and it should be more persistent. However, it gives no feed in winter and is not always palatable to stock.

A few farmers sow one or two fields in Hunter River to provide late autumn early winter feed. It is break grazed as standing hay. Lucerne and a grass sown in mixed rows has a better spread of production and gives the stock some choice of feed. This mixture is less productive and is more difficult to manage as one may suppress the other. Lucerne and grass have been sown in alternate rows. This reduces competition and simplifies management but on light land it seriously reduces production. On heavy land the inclusion of a small quantity of a grass of low competitive effect may prevent ingress of very competitive grasses such as browntop, ryegrass or the poas.

Cocksfoot has been the principal grass used but recently some success has been achieved with prairie grass. It is more palatable than cocksfoot, is less competitive and is more winter active. Another possibility is autumn oversowing of lucerne with a cereal or a quick growing short-lived grass such as Italian or Western Wolths can help to overcome winter shortage and provide competition against weed ingress in the dead winter period. This may prove to be a very useful method.

Lucerne and clovers (white and subterranean) give a mixture of high quality feed but total production is likely to be reduced and persistence of the lucerne is threatened by the competition.

If our aim is maximum production then lucerne alone would appear to be the most satisfactory, with about 20 per cent of the area sown in Hunter River or Italian for winter feed and another 20 per cent oversown in autumn with a winter feed such as a cereal or Western Wolths ryegrass.

Grazing System

Agronomists formerly agreed that intensive rotational grazing of pastures woads gave the greatest production. This was considered to be the result of better utilization of light and allowed for the alternating rhythms of accumulation and exhaustion of reserves in the plant. Animal research workers have thrown some doubt on these advantages; but in the case of lucerne the argument for accumulation of reserves is much stronger than it is with say perennial ryegrass and white clover. Likewise the reduction in nutritive value with maturity is very much less with lucerne than with ryegrass. This means that with lamb fattening there is not the same argument for set-stocking lucerne as there is with ryegrass.

Consequently it is suggested that lucerne should be intensively rotationally grazed, i.e. small fields, large mobs and full utilization.

Weed Control

The productivity and persistence of lucerne is greatly affected by competition. It is particularly susceptible in the establishment phase, the seedling being a plant of low vigour and poor competitive ability.
The long dead winter seasons is another susceptible period when winter growing intruders can assume dominance. Lucerne is a poor competitor with twitches and yarrow.

Our first endeavour should be to start with a seedbed as weed free as possible. After emergence, annuals such as fathen, nettles and seedling docks may be troublesome. If heavy, quick grazing fails to control these, spraying with 1lb 2,4-DB may be necessary. In the case of nodding thistle 1lb MCPB can be used. However, do not neglect the value of grazing for this purpose. A lucerne plant three or four inches high has a nine-inch root system and can withstand hoof and tooth treatment much better than most weeds.

Once established we may be troubled with storksbill and grasses such as browntop. One and a half pints of Paraquat affords fairly good control and is much less severe on the lucerne than 5lb Dalapon.

However, again the best control for most intruders is grazing management. Lucerne grazed as suggested above offers very strong competition for light to weed invaders and is capable of withstanding severe grazing treatment. Such weed-control grazing can be done in late winter and in summer.

Half-hearted grazing of lucerne is perhaps the greatest encouragement to weeds. The lucerne receives the greatest check from such treatment and the weeds are encouraged to assume dominance.

The oversowing of winter growing greenfeed can assist in control of winter weeds.

Weed control problems tend to be less severe on light land where summer drought can assist grazing to eliminate many of the competitors.

Renewal

In the past we have tended to leave lucerne stands down beyond their highly productive life.

In the initial stage we have a high population of lucerne. Gradually the population thins due to accident of diseases such as stem and root rots and eelworm. An intruding population of competitors increase and overall production falls. It may be necessary to think of the productive life of a lucerne stand as not more than six to ten years.

This introduces complications of resowing lucerne land to lucerne but gives the opportunity for growing good crops of winter feed such as turnips and Italian ryegrass. For high production such a programme must be envisaged.

Conclusion

On the thin, droughty soils of the South Island herbage production can be greatly increased by the extensive use of lucerne. For maximum production this lucerne should be grazed by the intensive rotational system.

Experimental work is necessary to determine the problems associated with its utilization and the limitations to its use.
PROBLEMS IN ESTABLISHMENT OF LUCERNE

J. G. H. White, Lecturer in Plant Science, Lincoln College.

Over recent years there has been a considerable increase in the area of lucerne grown in New Zealand. In 1963, 160,000 acres were cut for hay or silage, while another 80,000 to 100,000 acres were probably used for grazing. This makes a total of about a quarter of a million acres of lucerne in the country at the present time. However, the full potential of lucerne in the dry eastern areas of New Zealand has been far from reached. In Canterbury lucerne has changed from being a hay crop on the better soils to being a crop for hay and grazing on light shallow stony soils, where remarkable increases in sheep production have followed its use. Even so, the area of lucerne on this light land is probably less than 100,000 acres, only about 10 per cent of the total light land in the province. The potential for lucerne in Canterbury alone, therefore, is very considerable.

I don't intend to deal with the considerable advantages of lucerne over other forages for feeding sheep, as this will be covered by following speakers. My main concern is with problems associated with establishing the crop, as many farmers are still apprehensive about sowing large areas of lucerne because of the risk of failure. Let me state at the outset that most of the problems met with in the past in establishing the crop have now been solved, and it is a relatively simple matter to establish a first-class stand.

In this paper I intend to cover three main points.

1. Seed inoculation.
2. Liming.
3. Sowing.

There are other factors, such as poor seedbed preparation, inadequate topdressing, or weed infestation, which can cause failure in young stands, but I think that most establishment problems are associated with one or more of the three points I am about to discuss.

Seed Inoculation

Like most legumes, lucerne obtains its nitrogen from nodules growing on its roots. These nodules contain colonies of rhizobia bacteria which convert nitrogen from the air into forms able to be taken up by the plant. If the nodules are absent, the young plants become yellow, stunted and nitrogen-deficient, and usually die a few months after sowing. Lucerne requires a different species of rhizobia from that needed by clovers for nodulation, and this species is absent in most soils in New Zealand. It is therefore essential to supply these bacteria as an inoculum on the seed at sowing. Even when sowing lucerne after lucerne it is a good insurance to inoculate the seed. Today, most inoculums available commercially are concentrated in peat, and Plant Diseases Division, D.S.I.R., has certified those lines which are effective and have a high bacterial count. Only certified lucerne inoculants should be used, and the instructions on the packet followed closely.
Different strains of rhizobia may vary in their effectiveness of nitrogen fixation. Recent work by Dr I. D. Blair of Lincoln College has indicated that strains which form effective nodules on hay-type lucerns such as Marlborough may not be quite so effective on creeping lucerns such as Glutinosa. Dr Blair hopes in the near future to isolate strains that are more effective on creeping lucerns.

Nodulation failure may be due to many factors, but in practice the following are the main causes.

1. Death of inoculum on the seed by desiccation.
2. Death following contact with soluble fertilizers.
3. Death of inoculum following sowing into acid soil.

Lucerne rhizobia are easily killed upon drying, and freshly inoculated seed should not be dried in the sun or under hot conditions. If sowing of the inoculated seed is delayed for several days, death of rhizobia may also be high. The seed should be sown within 24 to 48 hours of inoculation if possible. Nodulation failure due to desiccation of the inoculum can also occur if seed is sown into dry soil, especially when temperatures are high. Seed should always be drilled into moist soil, unless it has been pelleted. This aspect will be dealt with further when I discuss time of sowing.

Contact with soluble fertilizers such as superphosphate can cause complete death of the inoculum on the seed. Inoculated seed is best sown with lime, equal parts of lime and superphosphate, reverted superphosphate, or serpentine superphosphate. I saw a young lucerne stand recently, half of which was yellow and unnodulated, because the farmer had run out of reverted superphosphate and had sown the rest of the seed with ordinary superphosphate.

Lucerne rhizobia are particularly sensitive to acid soil conditions, much more so than clover rhizobia, which tolerate soil pH levels of 5.5 or even less. Nodulation failure in lucerne can occur if the soil pH is less than 6.0 while the optimum pH is nearer 6.5 to 7.0. There is considerable scope for selection of lucerne rhizobia which are more tolerant of acid soils, and work on this problem has already commenced at Lincoln College. Until more acid-tolerant strains of lucerne rhizobia are isolated however, it is essential to raise the soil pH near the seed to 6.5, if good nodulation is to be obtained. This can be done quite easily by the use of lime.

Pelleting of inoculated lucerne and clover seed has received considerable publicity recently and at Lincoln College we are carrying out experiments on the effects of various pelleting materials and stickers. So far we have found that finely-ground lime is the most successful coating for lucerne. Pelleting of inoculated seed can offer several advantages. Pelleted seed can be sown with superphosphate without damaging the inoculum. It can be stored for up to one month after inoculation and will still give good nodulation. The rhizobia bacteria are protected by the pellet against desiccation and can therefore survive longer. Perhaps the most important use of pelleted seed is in acid soils where conventional liming is uneconomic. Here lime pelleting of inoculated seed may be the only way of obtaining good nodulation.

There are disadvantages with pelleting as well as advantages. Pelleting takes much more time than simple inoculation and is more
expensive. Practical difficulties in making the pellets can sometimes occur, and I have seen a number of examples of poorly-pelleted seed. If the pellets are poorly-made most of the advantages may be lost. If liming has been adequate, pelleting should not be necessary on most light land on the Canterbury Plains, so long as normal precautions are observed with simple inoculation.

Liming

Lucerne gives a greater response to lime than almost all other agricultural crops. In Canterbury, most soils on light land are slightly to moderately acid, and application of lime is essential before lucerne is established. Lime has many functions in the soil, but the two major effects in lucerne establishment are these: raising the soil pH in the vicinity of the seed to improve survival and multiplication of rhizobia, and thus obtain good nodulation—and raising the pH of the whole soil mass to obtain good root development and plant growth.

I have already dealt with the importance of raising the pH for good nodulation. This can be achieved by heavy broadcast liming; and on the less acid soils (say between 5.5 and 6.0) by lighter rates of lime drilled with the seed, or even by lime pelleting of the inoculated seed.

Good nodulation does not always mean good establishment of lucerne however. Lucerne roots are particularly sensitive to acid conditions, and when they meet acid soil normal taproot development ceases, and further root growth is poor and in a lateral direction. The resulting stand is often unthrifty and low producing, is open to weed invasion, and may have only a short life. If lime is broadcast on acid soils immediately before sowing the pH is raised in only the top inch or two of soil, and acid soil may still occur just below this. Lucerne may nodulate well under these conditions, but the plants will not thrive due to poor root development. Movement of lime in the soil is relatively slow and it may take many months before lower soil layers are affected by surface application. We have measured pH levels of over 6.0 in the top inch following liming some months previously, but of only 5.1 at six inches depth.

A good example of these effects was shown to me recently. A local farmer had sown his lucerne in spring very soon after broadcasting one ton of lime per acre. Nodulation was good, but six months later the stand was unthrifty and somewhat yellow. Many plants which I examined showed forked, sideways growing roots caused by acid conditions below two or three inches depth.

The best way to combat these effects is to plough lime down with the previous crop, followed by further lime cultivated in before sowing. By this means the pH of lower soil layers is raised, as well as the surface inch or two. Farmers should obtain a reliable soil pH test before sowing lucerne, and this will give some guide as to lime requirement. Lime requirement will vary according to soil texture—for example it will be much less on sandy soils than on those with a high clay content. For silt loams however, I would suggest that if the soil pH is 5.6 or less, then a tone of lime should be ploughed in with the previous crop, and another ton cultivated in before sowing. If the pH is above 5.6 but below 6.0 then a total of only one ton of lime may be sufficient. It is most important to raise the pH to 6.5 by
adequate liming before sowing rather than use a minimum at this time and apply heavier dressings after establishment. Later applications of lime are unlikely to improve a poor stand.

Sowing

Success in lucerne establishment can often be determined by time of sowing especially on light land. Dry soil conditions can occur on light land from mid-October onwards in some seasons, and can continue until February or March. The most reliable time to sow lucerne on light stony soils in Canterbury is in late September or early October, when the soil is still moist and temperatures are high enough to cause rapid germination. Later sowings may be affected by dry conditions, with patchy germination and poorer nodulation due to desiccation of rhizobia on the seed.

Weeds may be less of a problem in spring sown than in autumn sown stands. Much light land being sown to lucerne has previously grown subterranean clover, which volunteers thickly in autumn-sown crops. The subterranean clover and other weeds keep growing during winter when the young lucerne is dormant, and can have a marked smothering effect. Weeds can be a problem in spring sown crops also, but subterranean clover is no problem then, and other weeds can be successfully controlled by a quick grazing with a large mob of sheep, or spraying with the selective hormone weedicide 24DB.

Grass grub can sometimes attack late sown crops and may cause considerable damage. Spring sown lucerne is rarely attacked, however.

Lucerne seed is sometimes drilled too deeply. This usually occurs when the seedbed is loose or when drilling is too fast. The operation should be carried out slowly on a fine, firm rolled seedbed, with the coulters all in one line. The seed should be placed no deeper than half to three-quarters of an inch.

In conclusion I would emphasize once more that most of the problems met with in the past in establishing lucerne have now been solved. If farmers are prepared to observe a few simple precautions in seed inoculation, obtain a soil pH test and lime adequately, and sow the seed at the correct time, then many of the failures which have occurred in the past are unlikely to occur again. The stage is now set for a rapid increase in lucerne acreage on light land of Canterbury and elsewhere.
THE QUALITY OF LUCERNE PASTURE FOR LAMB PRODUCTION


High quality in a single pasture species implies high total production per acre per year, with seasonal variation in production conforming as closely as possible to the seasonal feed requirements of the grazing stock, and a nutritional value appropriate not only to type of animal raised but also to the nature and quality of the product yielded, whether it be meat, wool or milk.

The nutritional value of a pasture species depends first on the composition of its organic matter in terms of protein, non-protein nitrogen, fat, soluble sugar, starch and fibre and the suitability of these as a substrate for the rumen microflora. This determines not only the amount that can be digested (the digestibility) but also the nature and energy value of the end products absorbed (the volatile fatty acids) and the rate of digestion, which in turn controls the amount that the animal can or will eat in a given time (the intake) and these two latter are the major factors controlling the all-important rate at which the animal can grow or produce in any other respect. Secondly, nutritional value is influenced by the content of certain vitamins and the amount and proportions of the various mineral elements required for normal health and production. Thirdly, nutritional value may be markedly influenced by the presence of substances such as oestrogens and goitrogens that disturb the normal functioning of the body, or substances such as certain selenium compounds which in excess render the herbage unattractive to grazing stock.

Our concern in this paper is mainly the nutritional value of lucerne pasture for the purposes of meat production from young sheep and reference will be made to all three of the aspects of nutritional value mentioned. Since nutritional value of any particular pasture species is a relative term, it must be contrasted with that of other species under comparable conditions, if its status or standing is to be assessed. This we are able to do for lucerne with data from our pure-species pasture trials, in terms of the actual yield per animal of the final product, i.e. the amount and, to a limited extent as yet, the composition of the meat produced under a system of free grazing where the quantity of food available is not a limiting factor.

Growth Rates of Lambs on Pure-species Pastures

Table 1 summarizes the growth rate data from three separate trials involving the grazing of two replicates of two-acre plots of five pasture species—lucerne, white clover, timothy, short-rotation ryegrass and perennial ryegrass, by various classes and ages of lambs. Data from five additional trials of a similar nature in general conform to those presented.
TABLE 1

Growth Response in Lambs to Pure-species Pastures.

A. Actual, in pounds live weight increase per day.
B. Relative, compared with perennial ryegrass at 100.

Spring 1962 November 6-January 4 (59 days)

<table>
<thead>
<tr>
<th></th>
<th>First half of trial</th>
<th>Whole period of trial</th>
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<tbody>
<tr>
<td>Clover</td>
<td>.58</td>
<td>161</td>
</tr>
<tr>
<td>Lucerne</td>
<td>.60</td>
<td>167</td>
</tr>
<tr>
<td>Timothy</td>
<td>.47</td>
<td>131</td>
</tr>
<tr>
<td>SR ryegrass</td>
<td>.45</td>
<td>125</td>
</tr>
<tr>
<td>Per. ryegrass</td>
<td>.36</td>
<td>100</td>
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Southdown X Romney Lambs (10 weeks old)

Initial weight 46lb—20 lambs per plot.

Autumn 1963 April 9-June 24 (76 days)

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<tr>
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<tbody>
<tr>
<td>Clover</td>
<td>.57</td>
<td>139</td>
</tr>
<tr>
<td>Lucerne</td>
<td>.53</td>
<td>129</td>
</tr>
<tr>
<td>Timothy</td>
<td>.50</td>
<td>122</td>
</tr>
<tr>
<td>SR ryegrass</td>
<td>.52</td>
<td>127</td>
</tr>
<tr>
<td>Per. ryegrass</td>
<td>.41</td>
<td>100</td>
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Romney Lambs (25 weeks old)

Initial weight 55lb—14 lambs per plot.

Spring 1963 October 2-December 9 (68 days)

<table>
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<th>First half of trial</th>
<th>Whole period of trial</th>
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<tbody>
<tr>
<td>Clover</td>
<td>.71</td>
<td>154</td>
</tr>
<tr>
<td>Lucerne</td>
<td>.66</td>
<td>143</td>
</tr>
<tr>
<td>Timothy</td>
<td>.52</td>
<td>113</td>
</tr>
<tr>
<td>SR ryegrass</td>
<td>.57</td>
<td>124</td>
</tr>
<tr>
<td>Per. ryegrass</td>
<td>.46</td>
<td>100</td>
</tr>
</tbody>
</table>

Dorset Down X (Border-Leicester X Corriedale)

Lambs (6-7 weeks old)

Initial weight 43.5 lb—21 lambs per plot.

Our interpretation of these data is that lucerne in the spring is an unusually high quality feed for lambs, capable of sustaining very high growth rates just below those for clover which are regularly at the top of the scale. This superiority of the legumes over the grasses increases as spring advances into summer and the grasses, particularly the ryegrasses, tend to run to seed and dry off with a marked reduction in both the quantity and quality of the herbage produced.

In the autumn lucerne continues to support relatively good weight gains until about mid-May when some change occurs, probably in its fibre content, leading to a distinct fall in its nutritional quality to a value significantly below that of clover and approaching that of perennial ryegrass. Soon after this, soil temperature normally limits its production, though on one occasion good growth rates in lambs were maintained until 24th June.

Thus the high quality of the herbage, and the high annual production of dry matter per acre, which is approximately double that of the other species, together with the persistence of growth throughout the summer makes lucerne an extraordinarily valuable feed for lambs under our conditions.
It will be appreciated that live weight gain grossly underestimates the real differences in quality of the various pasture species, because it takes no account of the fact that the fast growing lambs are not only bigger but tend also to be fatter. In addition, the weight of the gut contents (fill) of the faster growing lambs on good pasture is actually smaller, thus giving an appreciably higher ‘kill-out’ percentage. When these factors are taken into account, the real differences between pasture species are markedly increased.

Regarding the problem of overfatness, associated with the fast growing lambs—and in this respect it is worthy of note that five of the 42 clover lambs in the 1963 spring trial were over 100lb live weight at slaughter at not more than four months of age, our preliminary analyses indicate that the fat content of such 50lb carcasses is only about 2 per cent higher than that of the 26lb carcasses from ryegrass lambs, and does not exceed 30 per cent fat. The inference, therefore, is that in this kind of cross (Dorset Down rams mated to Border Leicester X Corriedale ewes) good nutrition over the active growth phase of the animal leads to high meat production without excess fat. Carried to higher weights, say 140-150lb, at this rate, such lambs would probably produce an “overfat” carcass. Because of its earlier maturity, Southdown cross lambs at 100lb live weight would almost certainly be overfat.

It is of some interest to note that lambs maintained at a high level of nutrition on good quality pasture into June and July, quickly become susceptible to rickets.

The Mineral Content of Lucerne

Chemical analyses of the various pasture species in our trials for the various mineral elements required for normal production and health, show that lucerne compares more than favourably with all of the other species in respect to the macronutrients calcium, phosphorus, magnesium, sodium and potassium. The iron and copper content is high, but the manganese content of the legumes is lower than the grasses. The selenium content is higher than for clover or perennial ryegrass, ranging from 0.02 to 0.035 parts per million with odd values up to 0.10 p.p.m. In general, there is an inverse relationship between selenium and sulphate; when the sulphate goes up, selenium goes down and vice versa. In both clover and perennial ryegrass, sulphate tends to be highest in the spring and falls off in the autumn, while the converse holds for selenium. These results are in conformity with the growth responses to selenium that we have observed in the grazing lambs. Thus far, these have been greatest on clover and ryegrass, and non-existent on lucerne. As yet we have no results for cobalt or iodine. Other workers, however, have shown that these are normally high in lucerne. Thus lucerne as a pasture species appears to contain adequate amounts and a suitable balance of the mineral elements required for high production and the maintenance of health in the grazing sheep.

Plant Oestrogens and Their Significance

At the time of slaughter of the trial lambs in the autumn 1963, we noticed for the first time the unusually large teats or nipples of the
lambs grazed on clover and lucerne as contrasted with those of the lambs from the grasses. We therefore cut them off and weighed them.

The average weight in gm. of two teats from the lambs on the various pasture species, after nine weeks grazing were: clover 2.68, lucerne 2.07, ryegrass 0.96, perennial ryegrass 0.74 and timothy 0.70.

Such large differences are obviously beyond what could reasonably be attributed to differences in live weight or degree of fatness and were interpreted as evidence of the presence in the legumes of substances with oestrogenic activity; that is substances normally present in the plant which when ingested, digested and absorbed have an effect similar to that of the female sex hormones, which affect not only the reproductive organs including the mammary gland but also the development of the secondary sex characters and thus, among other things, the growth rate and the conformation and composition of the carcass. Since synthetic oestrogens, usually in the form of subcutaneous implants, are known to stimulate growth under certain circumstances, the interesting possibility arose as to whether or not these plant oestrogens were a significant factor contributing to the unusually high average rate of growth observed in the lambs on clover and lucerne. Obviously, too, the possible effects of the level of these substances on the fertility of both ewes and rams could not be overlooked.

Our last two trials therefore, have been designed to give us a measure of the plant oestrogen content of the two legumes and of what effect, if any, it might be having on the growth rate of the lambs.

There are three principal methods of measuring oestrogenic activity of pasture plants: one, by chemical analysis for various known compounds called "pro-oestrogens"; two, by feeding extracts of the plant or the plant itself to laboratory animals such as mice, rats and guinea pigs and noting the response in their reproductive organs; and three, by measuring the response of various organs and tissues in the grazing animal itself. Of the many ways of doing this in the sheep, we chose the rate of increase in teat length, which has been shown to be closely related, within certain limits, to the amount of oestrogen ingested or injected.

The two groups of 21 lambs on each of the clover, lucerne and perennial ryegrass pastures were divided into three subgroups for no oestrogen (control), low oestrogen and high oestrogen treatment by injection once a week, at which time also the length of both teats was measured with special calipers. This continued for four or five weeks.

By contrasting the growth responses of the teats obtained on the three pasture species, we were able to demonstrate that perennial exerts little or no oestrogenic activity, either in its spring or autumn growth. Clover, on the other hand, has a relatively high activity in the spring and a low but significant activity in the autumn, while almost exactly the converse is true for lucerne.

The levels of activity for clover in the spring and lucerne in the autumn, according to our assay, are of an order capable, we believe, of upsetting to some degree the reproductive processes in breeding
ewes. Whether or not such a disturbance would in fact occur, however, would depend upon the amount of herbage eaten per day and the length of the grazing period. The level in autumn lucerne might be sufficient to depress the fertility of ewes, but as yet we have no evidence that it does. Much more work is necessary to establish its true significance in this respect.

As to the possibility that the relatively high level in spring clover is a significant factor contributing to the very high rates of growth of lambs on this particular species, our data this far, are inadequate for a clear demonstration, but they contain at least a suggestion that somewhat higher levels are necessary.

Conclusion

To conclude, therefore, our investigations show that, from the point of view of nutritional value, lucerne is one of the best single pasture species that we have, second only to pure white clover, for the purposes of promoting high rates of growth in lambs. This quality together with its other important attributes of high production per acre, resistance to seasonal influences and versatility in conservation implies surely a remarkable potential for increased production from its wider use in those areas where it can be successfully established and maintained. It must be appreciated of course, that the relative superiority of lucerne and clover shown in our trials will not necessarily be observed in other areas.

While the value of lucerne for other kinds of animal production has been demonstrated to be high, certain reservations must be made regarding the possible effects of oestrogens and goitrogens, unexplained sudden deaths in sheep which may or may not be due to bloat, diseases of the feet and perhaps photosensitivity. These and other problems are surely not beyond the capacity of the plant scientist and the animal scientist working together to solve and to produce new and improved strains of lucerne for various and special kinds of animal production.

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MANAGEMENT CONSIDERATIONS IN FARMING LUCERNE ON LOW-RAINFALL LIGHT LAND

Professor J. D. Stewart, Professor and Head of Farm Management Department, and N. W. Taylor, Research Assistant, Agricultural Economics, Lincoln College.

1. Introduction

The scope of this paper is confined to those light land areas of the South Island, subject to low rainfall (20 inches to 30 inches) on which there is no physical impediment to the growing of lucerne. On areas such as this we have found in our survey work that the area of lucerne actually being grown on farms tends to be less than 10 per cent of the total. We naturally view this with some surprise, since it has been clearly shown by Iversen experimentally at Ashley Dene, and by leading farmers such as Topp at Waipara, Jolly at Tarras, Wardell at Pukaki, Watson at Kirwee and others that the productivity of lucerne in these environments is substantially higher than conventional pastures.

Since the agronomic factors associated with the successful establishment and maintenance of lucerne have been covered by Mr Iversen and Mr White, and its nutritional aspects by Dr McLean we are going to assume that you have been fully convinced on these matters. This leaves us free to discuss lucerne in the context of farm management alone.

Not only does the level of production of lucerne differ from that on conventional pastures on light land, but also its seasonal pattern of growth. It follows that a management system which is best for a ryegrass-subterranean clover economy will not necessarily be best for a lucerne dominant economy. In this paper we attempt to review the more important management factors, when a high proportion of a light land farm is in lucerne.

2. The Level and Pattern of Lucerne Production

In Figure 1 we have plotted the characteristic seasonal production pattern of lucerne, against that of a perennial ryegrass-subterranean clover pasture. The respective annual production levels which these curves represent are 7,500lb D.M. and 4,500lb D.M. The curves are based on data supplied to us by the Plant Science Department of the College and by Winchmore Research Station. 7,500lb D.M. of lucerne has been consistently produced at Ashley Dene under experimental conditions with optimal grazing management. 4,500lb D.M. of pasture represents the level of production which can be expected under similar conditions. Whether 7,500lb D.M. can actually be harvested on a farm basis we are not certain and we are currently trying to find out on a 30-acre farmlet. If we can this would represent a theoretical carrying capacity of over five ewes per acre. But to illustrate the relationship between these production patterns and the requirement of
breeding ewes we have plotted in a third curve representing the seasonal demands of four and a half ewes.

Features of the comparison are the superior production of lucerne in the autumn, late spring and summer, and of ryegrass-sub. clover in the late winter and early spring. This early boost from the ryegrass-sub. clover pasture, followed by its early falling away in October and November has led to the efficient system of early lambing, and early drafting of light-weight lambs, which has been the key to success on light land in recent years.

In Figure 2, the possible variation from the average spring and summer production in the Ashley Dene experiments is shown, again with the D.M. requirement of four and a half ewes included. Only in the extremely dry year does the potential productivity of lucerne fall short of that required by four and a half ewes. But we may note in passing that if the ewes were weaned two or three weeks earlier, even this discrepancy would disappear. If the variation in lucerne production seems high, it must be stated that it is substantially less than that for conventional pastures.

It is clear that a large area of lucerne on the class of country we are discussing yields an opportunity for an increase in carrying capacity. But it is also evident that the behaviour of this plant requires a fresh look at the pattern of farm management if it is to be fully exploited.

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3. The Integration of Lucerne into a Management System

3.1. Amount. If lucerne is such a superior plant, the first matter to discuss is the maximum area a light-land farmer should aim for. For example should it be the whole farm. We think that this is likely to create a number of management problems. The first is the provision of standing room, particularly in a wet winter. Lucerne paddocks do not provide a good platform so there can be problems with the sheep's feet. There may also be problems in spelling lucerne paddocks adequately in rotation, in order that they may approach their potential productivity. There is in addition the likelihood of a depression and a delay in lambing due to high oestrogen intake when ewes are fed entirely on lucerne prior to tupping. Our present view, which at this stage is a fairly arbitrary one, is that an area of over 70 per cent of a farm in lucerne can lead to this kind of imbalance.
3.2. Utilization. Greatest efficiency in the utilization of pasture plants requires that a maximum amount to be grazed “in situ.” Wherever it is necessary to transfer its use from one season to another there is a loss of technical efficiency. This applies particularly to lucerne which is made into hay. We can generally reckon on a loss of 30 per cent of feeding value even when the hay is moderately good. To the extent that one-third of our hay is generally poor, one-third fair and one-third good, the loss in technical efficiency when large quantities of hay are made is high.

It follows that the less hay we make from lucerne, and the more we graze it “in situ” the more technically efficient it will be. But of course, this precept needs to be compatible with the vital need to preserve flexibility in the feed supply, by having adequate reserves of hay to meet the demands of poor seasons. We can hardly expect to follow the revolutionary dairy farmers of South Taranaki who seem to be intent on abandoning hay and silage making altogether. But nevertheless we believe there may be a lesson to be learned from them.

With this good principle in mind we turn to the seasonal management of a lucerne farm.

3.3. Winter. Let us assume that an adequate range of machinery is available for producing hay and turnips on a light-land farm. It is then interesting to estimate the cash costs of producing sufficient of either of these to winter one ewe. We don’t suggest that this is an entirely valid way to look at winter feeding economics, but it will give us a useful indication.

Turnips:

<table>
<thead>
<tr>
<th>Direct Costs/acre</th>
<th>s.</th>
<th>d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivation 5 hours at 3/-</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Seed—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 lb turnips at 4/6</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>½ bushel Italian at 15/-</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Fertilizer 1 cwt at 9/8</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Cartage 1 cwt at 1/-</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>TOTAL DIRECT COSTS</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

Based on 1 ac/250 ewes/week and winter of 90 days or 12.8 weeks the carrying capacity per acre

\[ \frac{250}{12.8} = 20 \text{ ee/acre} \]

Therefore cost to winter one ewe on turnips

\[ \frac{£1/17/8}{20} = 1/10 \]

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Lucerne Hay:

1. **Establishment Costs**
   - Cultivation 6 hours at 3/-: 18 0
   - Seed 12lb at 5/-: 3 0 0
   - Lime 1 ton at 60/-: 3 0 0
   - Fertilizer 2cwt reverted super: 18 2
   - Cartage: 1 10

   **Total Establishment Costs:** £7 18 0

   Estimated life of sand 6 years.
   Therefore annual average establishment costs
   \[
   \frac{\text{£7/18/-}}{6} = \text{£1/6/4/acre}
   \]

2. **Maintenance**
   - Fertilizer 2 cwt: 16 4
   - Spreading: 4 6
   - Cartage: 1 5
   - Lime: 1 0 0

   **Total Maintenance Costs:** £2 2 3

Therefore annual average Total Cost
\[
\text{£1/6/4} + \text{£2/2/3} = \text{£3/8/7}
\]

**Haymaking Costs/acre**
- (1 cut at 50 bales/acre)
- (1 cut at 25 bales/acre)
  - Mowing 1 hour at 3/-: 3 0
  - Raking 4 x ¼ hours at 3/-: 3 0
  - Baling 1 hour at 3/-: 3 0
  - Twine 75 at 3d: 18 9

  **Carting—**
  - Contract 50 at 9d: 1 17 6
  - Self ¾ hour at 4/-: 2 0

**Total Cost of Baling 75 bushels hay:** £3 7 3

**Cost of making lucerne hay/acre**
\[
\text{Annual average cost} + \text{Cost of baling} = \text{£6 15 10}
\]
Therefore cost/bale
\[= \frac{\£6/15}{10}\]
\[= \frac{75}{10}\]
\[= 1/10\] per bale

Cost of wintering one ewe
3 bales at 1/10 = 5/6

This arithmetic is somewhat hard on the lucerne hay. It does not credit the lucerne for example for the hay grazing it provides over and above the 75 bales of hay (one medium cut and one light cut). However the turnip yield is conservative at 250 sheep/acre/week. All that we claim for these figures is that they lend some weight to the view that a low-cost winter feeding system on light land would put more emphasis on turnips than it would on lucerne hay. We still keep in mind of course that reserves of hay, conserved in good seasons remain the buffer against droughty seasons.

A third possible basis of winter feeding is grain, in which there is increasing interest. The equivalent cost of wintering a ewe on purchased barley grain is over £1, so that this can hardly be regarded as economically feasible. However the possibility of including barley or oats in a forage cropping rotation on light land, handling it in bulk and conserving in bins is worth consideration, since the direct costs will be in the vicinity of 3/- per bushel.

3.4 Early Spring. With 70 or 80 per cent of a farm in lucerne and some of the remainder under cultivation, August becomes a critical month. How can this be met? First, by later lambing. An early to mid-September lambing would be much more compatible with the pattern of production of lucerne than an early August one. And since the lucerne will grow on in November and December, the role of early lambing is not as vital as with conventional pastures. A later lambing need not necessarily be a protracted lambing. Indeed it is likely to be better lambing (apart from the question of oestrogens) and with a synchronization procedure it can be a concentrated lambing.

Further than this there is scope for oversowing of lucerne with greenfeed cereals and Italian ryegrass in the autumn, to provide pre-lambing feed in August. Also we now feel that a fairly rapid renewal programme of lucerne will be desirable on a high-lucerne farm, possibly one-eighth of the area. This will give the opportunity for greenfeed in the first year of a renewal rotation followed by turnips.

3.5 Spring-Summer. If we could guarantee to make 40-50 bales of hay from lucerne closed up after mid-November on light land, we could proceed with confidence on a high stocking rate policy. We could synchronize lambing for mid-September, stock up to the capacity of our September-October-early November production, draft and wean at eight to ten weeks, tighten up the ewes, and use late November, December and January production for lamb fattening and hay production. But it is only rarely that we can be assured of a reasonable cut of hay from lucerne closed in early November. Hay making is therefore a direct competitor with ewe carrying capacity in the spring and early summer.
But, if we refer to Figure 2 it is clear that there is scope for a stocking rate which is aimed at utilizing a high proportion of the average lucerne production in situ, conserving hay from the surplus in the good years and adjusting stock management in the poor years. This implies a reliance on turnips as the basis of winter feeding, with hay providing the flexibility and balanced nutrition which is needed to supplement the turnips.

Another feature of the management of lucerne with ewes and lambs is that we shall have to reconsider our attitude to rotational grazing. It is clear from Iversen's work that if we are going to get the most out of lucerne it is required to be periodically and systematically spelled. In the past trials have shown that lamb growth rate is retarded by rotational grazing under moderate stocking rates. We are not certain that this will be the case under high stocking rates on lucerne.

3.6. Autumn. If the principle objective of sheep management in February and March is to increase body-weight of ewes lucerne can meet this requirement. But this does face us squarely with the possible depression of lambing performance due to the presence of oestrogens. There seems to be two ways to face up to this. First to accept it as part of the cost of high-lucerne farming, to be measured against the benefits. All farm management innovations must be analysed in this way. Second, provide a special purpose flushing feed which will avoid oestrogen intake at the critical time, and at the same time spell lucerne, which may then be ration grazed in the late autumn. Such a crop is York Globe turnips sown in November and fed in February-March. The risks of desiccation are quite high of course, and it may be that such a policy would be more likely to succeed in the 30-35 inch rainfall area than the 25-30 inch belt. However a similar policy is being successfully used by farmers in Mid-Canterbury.

4. Summary

We have attempted to review some of the management considerations involved in farming large areas of lucerne on light-land farms in the 20-30 inch rainfall belt. The problems are quite complex as they always are whenever a substantial technical innovation is put into practice. But we believe that the rewards for the innovating farmer are high. For he can achieve four and a half ewes per acre quite comfortably, five ewes with less comfort, and perhaps even six is not beyond our imagination.
LUCERNE IN PRACTICE

E. C. Topp, Waipara.

It is just 26 years since we decided to sow a 50-acre paddock in lucerne to be used as a pasture and we continued sowing 50 acres each year. It was a radical thing to do, for, at that time, it was generally believed that the grazing of lucerne, especially by sheep, was a sure way to kill it. But fortunately I had seen a small patch of lucerne sown on light land, which was very harshly treated during the winter, and then it grew into a very good crop in the spring. So I had great faith in the experiment right from the beginning, and I was very pleased indeed to have the opportunity, at this conference 10 years ago, of relating our experiences of this new practice of sowing straight lucerne instead of the customary grass/clover mixtures. I was able to prove conclusively that the use of lucerne as a pasture plant was an unqualified success. What I said then is recorded in the booklet which is printed after each conference and after perusing it again, just a few days ago, I feel there is no need to retract anything from it, and no need to cover the same ground again.

But I feel from my more recent observations and experience, I may be able to give some useful advice, on a few problems associated with an all-lucerne farm to those of you who may eventually turn towards adopting this lucrative lucerne pasture practice.

Now when we set out on this radical idea of using lucerne for pasture we set a goal of sowing half the farm in lucerne. You will note that the goal set was half the farm. I suppose I was afraid to divorce myself completely from the traditional grass and clover pasture. But when we attained our goal it was quite apparent that half the farm was producing more than twice as much as the other half, so I cast off the restraining shackles of custom and tradition and there and then I decided to go the whole way, and so our aim is to grow as much lucerne as it is possible to grow. There are only a few small holding paddocks about the homestead that have not been sown in lucerne.

In the early stages of this new practice we were able to farm the lucerne, that is, we were able to nurse it to some extent and it seemed that the useful life of a lucerne stand on our property would be from 15 to 18 years, according to whether the particular land was good or not so good. Lucerne lasts longer on the lighter land as it is generally freer from intrusion. But as the acreage of lucerne gradually increased we had to consider the sheep and not the lucerne, with the result that in difficult times we were forced to graze the lucerne rather harder than was good for it. Because of that treatment we found that the useful life of the lucerne was shortened by three or four years. The succession of dry years in North Canterbury since 1958 has helped to further shorten the life of the lucerne and so we find ourselves at the present time with more run-out lucerne paddocks than we should have. But we have set out to rectify this situation. Last spring we sowed 100 acres in lucerne and we intend to resow about 100 acres each year from now on. We feel that we have been prone to hang on too long to the stand that is getting progressively thinner and is losing the battle against intrusion.
The production from the first seven or eight years of a lucerne stand is so much greater that we have come to the conclusion now that it is more profitable to resow a stand soon after it shows signs of weakening, and that brings us to the resowing of lucerne. We feel it is better to keep the paddock out of lucerne for two years as there is a better chance of eventually getting a cleaner seed bed. We plough the selected paddocks in the spring for rape and then sow a white crop in the late autumn. By delaying the sowing until the end of May many of the weed seeds will not strike and may rot during the subsequent winter. In the late summer green feed is put in and the lucerne resown the next spring. And I may point out here that it is surprising how well a grain crop will do after lucerne even on light land. Lucerne is certainly a wonderful fertility builder.

This is the point that I have been working up to and wish to make. To attain the maximum potential production from our 1,250 acres of light, stony land we plan from now on to have 1,000 acres in lucerne ranging from one to 12 years old, with 200 acres under the plough in preparation for resowing 100 acres of lucerne annually. The area under cultivation will comprise about 100 acres of forage crops and the balance in cereals. And then according to what Mr Iversen said at the last Ashley Dene field day, we should have no trouble in carrying 6,000 sheep. Everybody will be happy, especially the Hon. Mr Lake.

Now I would like to say something about the grazing of lucerne to the best advantage. It is generally known now that lucerne attains its maximum production when it is mown at intervals of five or six weeks, so grazing should be correlated as near as possible to the action of mowing; that is, it should be eaten off quickly and hard. The ideal set up would be to rotate a mob of sheep around a number of paddocks so that each paddock would be cleaned up in about a week. And here comes in one of the finer points of management—to know the day on which to shift the sheep. The paddock needs to be cleaned up and the sheep go off unchecked. Now if sheep are put on a mature crop there is considerable wastage through tramping, and there is a hardening of the stalks and also a slackening of growth so we like to put our sheep on at the three or four weeks stage of growth, so that a quick and clean eat-off is facilitated and we believe that is the all-important point in grazing lucerne. We generally apportion four paddocks of an aggregate acreage of about 100 acres to about 600 or 700 ewes with their single lambs. The ewes with twins are run in smaller mobs. If the season is a favourable one for growth one paddock may be skipped for grazing and cut for hay. If the season is an unfavourable one a hay paddock may be thrown into the circuit.

And talking of unfavourable seasons, I am sure you will all agree that Canterbury farmers experienced one of the most trying and worrying seasons for many years during the spring and summer just passed. Our rainfall was a meagre 14 inches for 1964, and a good deal of that rain evaporated almost immediately. I myself never imagined for one moment that I would see the day when lucerne could not grow to hay in the springtime on our property. If ever the farmers of the South Island had an arresting demonstration of the remarkable tenacity and the ability of lucerne to grow in such adverse conditions as we have had in the last couple of years.
condition, they had it during the last summer. We had the extra grazing of the 200 acres that was shut up for hay and with very watchful shepherding, and careful apportioning of our meagre food supplies to the best advantage we managed to put all the wether lambs through the freezing works at quite reasonable weights and to present our surplus ewe lambs for sale in very good condition. To maintain our carrying capacity and to obtain the foregoing results, is due solely to the lucerne. It would have been impossible with the alternative grasses and clovers.

Perhaps I should mention another situation which often occurs in a hot dry summer, that is, the wilting of a young growing crop. If that happens there will be little further growth, even if rain or cooler weather follows for the plants go into the ripening stage prematurely with the consequent weakening of the growing urge. In these circumstances we find it is advisable to eat it off as soon as possible and thereby stimulate the growing urge once more. I believe that the lucerne is at its best for fattening when in the wilting state. But perhaps we had better check up about that one with the scientists.

Now a talk on the practical use of lucerne would not be complete without mention of its remarkable ability to grow hay, both as regards quantity and quality. The dairy farmer on well drained heavy land can capitalise to good purpose on the hay aspect of growing lucerne for it means a great weight of good quality winter feed from a relatively small area. In “The Press” of April 3 there is a write-up of an interesting field day held on the property of Spreydon Lodge Ltd., at Halswell, and from the figures given concerning the hay crop the 20 acres of three-year-old lucerne would produce about six tons per acre in this dry season with no irrigation. Who wouldn’t grow lucerne? It is also an extremely lucrative crop to grow for sale if the land is good enough to grow it reasonably well through the summer. I have noticed a few paddocks on the outskirts of the city being used in this way and from the five cuts during the year, the return, especially this year, would be very satisfactory and the crop is still there for quite a number of years without the recurring expense of cultivation. Let us pause a moment and think. What other plant is there that can approach anywhere near the diverse performance of lucerne in the field of fodder production? No! There isn’t any; lucerne is surely the “King of Fodders.”

On the medium and light land sheep farms the making of hay from the surplus spring growth for winter feeding is an important integral part in the organization of an all-lucerne sheep farm. We aim to arrange our sheep numbers so that there will be enough surplus spring growth to feed the sheep during the winter. Of course in a season similar to the one just past, our aim is very wide of the mark, but in an average season we can anticipate the balance near enough. As far as we can judge we regard three bales of hay per sheep as a good liberal ration for the winter with just a pick on supplementary green feed. And speaking of hay making, always build the hay shed first.

I realised early in my observations in growing lucerne that the greatest relative increase in production from lucerne is procured on the lightest soils. We have many examples of that on our own farm and quite a few years ago I realised that there were many thousands
of acres of light land in Canterbury which were producing next to nothing, but which might grow lucerne reasonably well. One of the areas I often thought about was the Mackenzie Plains. Viewed from the main road much of the area does look to be practically useless and that impression was backed up by the fact that until just recently there were no signs of development, no signs that any of the tussocks had been disturbed since Mackenzie's day. But just recently I paid a visit to Mr Ian Wardell’s property at Pukaki and what a thrill I experienced to see the large area that he has brought into cultivation and sown in lucerne and to see how extremely well the lucerne is doing. And what surprised me more was the quick method adopted in establishing the lucerne. The virgin tussock is knocked into shape with a chisel plough and heavy harrows and the lucerne drilled on the newly-worked tussocks. An indication of the robustness of the lucerne is the fact that off two cuts from 200 acres he has 17,000 bales in the sheds. I do not wish to start a pilgrimage to this farm but a visit to it would be very worthwhile. I have not the time here to enlarge on my pleasant impressions on the visit, except to mention that until two years ago Mr Wardell was the genial host of the Pukaki Hotel for many years. Now I have never heard of a man giving up a good stand in the licensed trade to go growing lucerne on uninviting virgin country. That in itself speaks volumes for lucerne. I am sure that Mr Wardell is showing what a great potential for more production is waiting to be tapped on the Mackenzie Plains and I trust that some day he may see the drab grey of the hard tussock changed to the bright, pleasing green of the lucerne on many acres of that wide tract of country.

Now I want to speak of another example of lucerne flourishing on very light land. It is a part of the farm of Mr R. Black situated on the right of the main road to Culverden and adjoining the north boundary of the Balmoral forest. When it was first suggested by the Government that the land north of the Hurunui River should be planted in trees there was much criticism of the project on the grounds that the land was too poor to grow trees and the money would be wasted. But the Balmoral forest was established and the trees struggled and grew slowly and the Government's action was justified because at that time the area was practically useless. Much of Mr Black's land that bounds on the forest is much the same but with the judicious use of subterranean clover initially and then the lucerne some very good stands have been established. Even during this last year dry as it was there was a substantial amount of hay made and I would anticipate that Mr Black will be increasing his acreage of lucerne considerably. I also have noticed that lucerne has been sown on several of the fire breaks in the forest and it will be interesting to watch how it develops. Of course lucerne diminishes considerably the grass fire risk wherever it is grown in any quantity.

A few days ago I spent a few interesting hours at a field day on Mr Robinson's newly-developed farm at Te Pirita. I was certainly impressed with the extraordinary response to modern technique in management on what was hitherto neglected and poorly-regarded land. My chief interest was to see the 150 acres of lucerne recently sown and my impression is that the lucerne promises well on that country. A liberal amount of subterranean clover seed was included.
in the initial sowings on the property and that is the predominant plant in the pastures at present. There seemed to be some anxiety as to whether the lucerne would survive the strong competition of the sub. clover. From our experience the lucerne will eventually win out, provided the stand is grazed fairly hard especially when the clover is commencing to flower so that as little seed as possible matures to strike in the next autumn. When the clover ripens and dies the lucerne should be nursed along so that it will be in good heart to withstand the next threat of intrusion. After two or three years of grazing on these lines the clover will practically disappear.

Now I have cited three areas, widely diverse in character and each of them sadly uninviting, and I have seen the lucerne thriving on each area. Again I recommend the sowing of lucerne on the lightest of land.

Now for the last shot in today's "bombardment." The longer I work and live with lucerne the more enthusiastic I become concerning its great potential for contributing tremendously to our desperate need for increased primary production. If we could change on our medium to very light land, say, half of our predominantly grass pastures into straight lucerne pastures (and that should not be impossible) the boost in production would bring about a wave of prosperity to this island comparable to the discovery of gold in the first instance and the exportation of frozen meat in the second instance.

Why there has not been a greater realisation of the value of lucerne during the last ten or fifteen years is very hard to understand. Lucerne has been talked about, it has been written about in the press and the farm journals and all along our roads it can be seen in a very favourable light in comparison with other pastures, especially during dry periods. Yet at this late hour, the acreage sown in lucerne is disappointingly low. I have a suspicion that farmers generally cling too much to grass as the foundation of all pastures. It seems to be something of a traditional custom as grass does not measure up very favourably when pitted against many other pasture plants both as regards quantity and quality. About eighteen months ago, I was fortunate to have the experience of a bus ride from Venice to Rome, and I was agreeably surprised to find that on the two-day journey I never saw any grass sown on cultivatable land. The only forage crop grown was lucerne and around every farmer's homestead there were spire-shaped stacks of lucerne hay. Although a big percent of the farmers in the areas we passed through seemed to be poor and relied on the primitive bullock for power they certainly know their lucerne.

And on our farm we get along very well indeed without grass. I don’t know whether I’m back with the Italians or whether they are up with me. Anyway except for some H1 grass-seed for sowing with turnips we haven’t sown a pickle of grass-seed for twenty-six years and still I’m on the right side of the fence that surrounds the Sunnyside Mental Hospital.

It is my earnest wish, ladies and gentlemen, that this concerted drive at this conference to encourage the growing of more lucerne will bring good results in the very near future.
OVERSEAS MARKET PROMOTION FOR NEW ZEALAND MEAT


Marketing and market promotion as we see it is essentially a job of carefully planned public relations. In the old days it was the man who shouted the loudest and had the most liquor at the back of the booth who made the most sales. Then there was the personality man with the carpet bag. Later advertising became highly developed and sophisticated. The man with the biggest budget was the winner. Today, the budget has lost little of its significance, but there is a lot more to marketing.

Today, marketing is an exercise in public relations, and more and more in the larger centres overseas, public relations firms are the consultants and planners in marketing. This is so because marketing begins and ends in study of the consumer—a study of human beings and human motivations and requirements.

Marketing begins with examination of consumer resources, tastes and needs. Then it moves through its several stages—the preparation of the product to meet those needs, the packaging of it, transport to market—in our case right across the globe—the organization of channels of distribution through to retail, and then the promotion, at which stage advertising is brought in to service the requirement of the public relations programme.

The marketing operation is completed with the measurement of results—the results both for the marketer and the consumer. Here public relations skills are used to interpret and apply the experience that has been gained.

I mention these stages in marketing because I think it important to emphasize the significance of planning. Marketing has become a scientific operation, succeeding or failing no longer according to the personality of the salesman or manager, but according to the degree of skill and thoroughness which has been put into the overall public relations plan.

I would like now to refer specifically to the promotion of our trade in Japan and Canada, which I think illustrates our methods. We have had many compliments upon the success of these projects, which have already been the subject of study by various parties from other parts of the world, as well as from New Zealand.

I should give you briefly the background of our trade and the Meat Producers Board's part in it. You know only too well that New Zealand's economy depends almost entirely upon the products of two animals—the sheep and the cattle beast. Two-thirds of every pound we earn overseas comes from the produce of the sheep and beef cattle industry and about one-third from dairying. Between £120,000,000 and £130,000,000 is drawn from meat and its by-products.

Whereas our wool is sold at auction, and our dairy produce is marketed by the producers' organization right through to overseas
outlets, our meat and by-products are sold by the private trader. This has been so for the last 11 years, since Government-to-Government bulk sale and purchase ended in Britain in 1954. Many hundreds of traders, of many different nationalities, are working today in the markets of the world, each contributing his part to and earning his living from the movement of New Zealand meat to the consumer.

The Meat Producers' Board does not buy or sell a pound of meat. The Meat Producers' Board is the authority in the industry with responsibility to ensure the best results for the producer and exporter, to ensure that the product is prepared and shipped efficiently and presented to our various customers to the best advantage and in accord with their requirements.

In recent years there have been revolutionary changes in market requirements and a very great need for the development of new markets. Promotion of trade has become one of the major interests of the Board, and with it of course, all the attendant detail of preparation and transport.

But the most important aspect of public relations at the base of the planning for the New Zealand export trade in meat was to build a strong public opinion, which would demand that every resource be directed to the expansion of marketing effort—resources of both Government and trade as well as Board in the promotion of our product. I think it can be claimed that we see today the results. Processing and exporting companies are themselves active in the public relations field, alert to public opinion and measuring their own performance against it.

But individual companies cannot alone engage in the public relations and promotion work which must be done on a national scale. The contribution of the trader is his skill in trading. The responsibility of the Board is the overall promotional planning in the interests of the product, whoever may be selling it.

There have been limitations in this position, of course. The Board cannot promote without assurance that the product will be present in the marketplace when the publicity is brought to bear. The trader gets the best result when there is adequate tie-in with the promotional activity of the Board. A great measure of coordination between Board and trade is necessary. And the appreciation of both Board and industry of the essential principles of public relations has been the strongest factor ensuring that cooperation is achieved.

All who have followed the progress of the meat export trade will know that in the international marketing of mutton and lamb New Zealand is the only large exporter. We are specialists in these products and we have the opportunity and the very real need as specialists to fashion for ourselves our future in this trade.

There are three principal exporting countries of mutton and lamb. They are (with approximate annual export figures):

<table>
<thead>
<tr>
<th>Country</th>
<th>Approximate Annual Export Figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Zealand</td>
<td>350,000 tons</td>
</tr>
<tr>
<td>Australia</td>
<td>80,000</td>
</tr>
<tr>
<td>Argentina</td>
<td>35,000</td>
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</tbody>
</table>

In 1959 a long, dry summer in Europe and Britain sent meat prices sharply downward. New Zealand farmers in provinces most affected set up committees to consider introducing mobile boiling-down units for ewe mutton carcasses which could not be profitably
sold overseas. A total of £934,000 was expended in 1959-60 in deficiency payments including £377,000 for lamb in nine weeks. Ninety-six per cent of our lamb and about 70 per cent of our mutton was going to Britain.

The Meat Producers' Board was already convinced that a sound basis for the future was the establishment of new areas of demand for New Zealand lamb and mutton could be created. Even if our competitors took advantage of our promotion, we would undoubtedly be the principal beneficiaries.

That phrase "new areas of demand" correctly defined our need. We saw the world, for the purposes of marketing, as in three parts:

1. Countries of high individual incomes;
2. Countries of low individual incomes;
3. Countries described as mid-way and improving their living standards significantly.

The first group included Britain, Europe, and North America. In the second group were the poorest of the African and Asian countries. In the third were such areas as Japan, the Middle East, the West Indies, Malaya and Singapore and parts of South America.

At that stage it appeared that the best prospects for mutton lay in Japan, the West Indies and the Middle East, and for lamb our traditional market Britain, but also Canada.

So we set out on study of means by which we could persuade the people of Japan of the very real merits of mutton as a high protein food. It is here that I talk of the detail of a public relations campaign that I think we can say has definitely been an outstanding success.

To test its theory that a strong outlet for mutton could be created in Japan the Board had in 1958 sent carcasses of ewe mutton to the Nutrition College in Tokyo, to the traders and to the Housewives' Association for experimental purposes. In the initial stages we had the cooperation of an enterprising Canterbury freezing company, and very soon of all companies.

The Japanese trade found mutton a suitable ingredient for its greatly increasing volume of processed meats—luncheon sausage, frankfurters. By 1960 it became apparent that the market from New Zealand's viewpoint would be greatly strengthened if mutton could be introduced to housewives as a meat in its own right.

Our then Deputy Chairman, Mr F. C. Johnston, and Director of Public Relations visited Tokyo in 1960, at a time when all meat processors were apprehensive. Someone had found a fly in a can of processed meat—it was not mutton. This raised the question of what was in fact in the sausage.

An enterprising European firm set up an exhibition of the contents of meat sausage—including horsemeat, whale meat and New Zealand mutton. Here was our high-quality product about to be exhibited alongside and on an equal basis with horsemeat and whale meat. We had to prevent this association in the public mind if we were to maintain acceptability of mutton in the sausage, let alone establish retail sales of mutton. We were in the situation of needing to introduce to the public a product which was almost entirely unknown to the housewives and if known at all was regarded unfavourably, since the Japanese-type mutton produced from about 800,000 sheep in the northern island of Hokkaido was not popular.
Some sectors of the retail trade were prepared to stock our mutton, but only when we could produce some custom for it. Yet customers were not aware of the product that was strange to them. We therefore set about our project in these stages:

First, we appointed a public relations counselling firm as liaison representative.

Second was a study of income levels, eating habits, meat consumption and availability. This was followed by an examination of resources of potential customers for preparation and cooking of our product. Large-scale ovens and cooking of the meat on the bone are almost unknown in Japan. The methods of cooking and types of dish to which most Japanese are accustomed are very different from those of the Western countries.

Third, we had to study trade reaction to the problem. It had to be ensured that the trade could make a profit—an adequate profit to give incentive—and that distribution was feasible on the basis required by retailers. We had many conferences with importers, wholesalers and retailers and discussions with housewives' groups.

Fourth was the selection of a Japanese advertising agency and a close study with them of strategy. We were fortunate in that the leading agency in this field in Japan had staff available of imagination and initiative and equally so that we had been able to secure as our liaison representative a very well known and highly regarded journalist and public relations counsellor who with his staff was very well qualified to work with us.

Policy has at all times been determined in New Zealand after consultation in Japan. The New Zealand Meat Producers' Board became the first foreign organization to embark on an advertising programme in Japan from a base elsewhere. It has proved, we think, a successful precedent. Today we have an office in Tokyo.

We determined to sell as our general target to the young and middle-aged housewives, mainly of the medium to higher income groups. Our strategy was to establish mutton as a meat of quality and prestige. After careful study of media we determined that home science sessions on each of two television stations weekly in Tokyo would give the widest and most efficient introduction of New Zealand meat to housewives. In addition, for this purpose we engaged two home science experts; one intended to address herself in the main to the younger housewives and the other to the somewhat older ones. Our chief television demonstrator, Mrs Hisako Arai, is already widely known in New Zealand for the work she has done on our behalf.

Mrs Arai and the second demonstrator, Miss Marie Hagiwara, have used their weekly sessions to introduce mutton in Japanese, Chinese and Western-style dishes. Leading personalities have been introduced as guests at a meal cooked in front of the TV cameras.

Point-of-sale publicity has been provided for butchers' shops and colourful posters designed for use in the suburban transport system, which carries about 10 million passengers every weekend, often to stations within the department stores. Coloured, illuminated signs are provided for butchers stocking our mutton regularly.

We determined to build on a prestige basis through the higher quality women's magazines, aiming our programme at the younger middle and upper class housewives. At the same time our demonstrators developed demonstrations to women's cooking schools and educa-
tional authorities. Later this was extended to the dietitians in industrial canteens. Today there is quite a substantial usage of New Zealand mutton in school lunch programmes and in industrial canteens.

The programme has included the establishment of a body which I think can reasonably be described as unique. This is our New Zealand Mutton Promotion Council. This body brings together representatives of the producers of mutton, the wholesalers, the retailers, the Japan Nutrition College and the Housewives' Association. At monthly lunches we have discussed problems at each stage of the trade. We have also had frequent and fruitful meetings of the organizations of retail butchers and a recent visit to New Zealand by them.

Public relations work, which directs and enlightens the programme, has embraced a great range of activities in both Japan and our own country from the giving of mutton parties for young people to the entertainment of the Prime Minister of Japan on a New Zealand sheep farm and the dispatch of a pair of New Zealand Romney sheep to the Tokyo Agricultural University.

The results of this exercise have been apparent. Mutton, from a position behind scratch, is well forward in the race. It is wholly acceptable as a high-protein ingredient of processed meats, recognized in its own right as desirable. An increasing percentage of sales has been made across the counter to housewives and to canteens and schools for use in mutton dishes. Our total annual sales to Japan rose to 40,000 tons in 1964. About 20 per cent goes across the counter at retail. One department store, handling a total of more than 200,000 customers in one peak shopping day, has been selling mutton through its meat department at the rate of two tons in the day—all of it cut into fine pieces, without bone. Our total mutton sales to Japan reached last year more than 50 per cent of our total ewe mutton exports. Throughout the period of growth of sales, prices have steadily risen. Competition from various markets round the world has strengthened price.

The creation of new areas of demand has, then, been effective in this field. New Zealand has lately supplied about three-quarters of Japan's meat imports and last year our problem was that our volume of mutton was not enough to meet the demand. Competitors are beginning to copy our promotions and augment our supply. The market value of lamb is considerably higher than that of mutton, particularly this year, and demand from Britain has left the Japanese market with only a small availability of product. Under present arrangements promotion might not likely be accompanied by presence of the product, but the potential in Japan for parts of the lamb carcass is good.

I mentioned earlier the necessity to inform the people and have full understanding of the work that is done in the public relations field. You may remember that in 1963 we determined upon a two-way operation in regard to Japan in public relations. Our distinguished home economist and television demonstrator, Mrs Arai, is an enthusiast for our product and for New Zealand. To give her fresh material for her television sessions, and to give New Zealanders an awareness of our work in Japan, we brought Mrs Arai and an interpreter assistant to New Zealand. The toured the country demonstrating some of the 400 methods she has devised for the cooking of New Zealand mutton suitable to the Japanese housewife.
Her visit generated an enormous amount of publicity of New Zealand and New Zealand meat, over television and radio and in the newspapers and women’s journals. It also generated much publicity in New Zealand.

In this public relations work the Board had the advantage of full and energetic cooperation from the New Zealand Government representatives, the ambassadors, and in the initial years the former Trade Commissioner, Mr John Scott and Mrs Scott. The Board has the continued full cooperation of the New Zealand Embassy today. The growth of our trade has necessitated the opening last year of our own office in Tokyo.

Our campaign for lamb in Canada was also launched in 1960. I shall tell you only briefly about this project, as time is limited. At the outset there was the difficulty that, because of generally stronger demand in the United Kingdom and higher prices on Smithfield market, London, private traders with responsibility to their shareholders to get the best return, would not necessarily maintain the flow of supply to the Canadian market. Furthermore, there were unfortunate situations in which people not sufficiently experienced in the trade became involved in unsatisfactory operations, and timing of supply in relation to domestic production was often bad.

The Board nonetheless embarked upon a programme of public relations, including prestige advertising in women’s journals, trade papers and in-store promotional material. Since then supply on a regular basis has been assured by the Meat Export Development Company—the organization in which freezing companies and the Board have cooperated to give assurance to Canadian and U.S. Governments trade and producers of orderly marketing of New Zealand lamb.

The Board and the Development Company have planned concentration of lamb sales in the off-peak season of domestic supply. This has been the method of operation all through the years in the United Kingdom. We believe it is appreciated by Canadian producers that for lamb to regain its place in the Canadian diet, which it is achieving, there is need of our lamb to supplement the small domestic supply. Canada, despite the vast size of her country, has only a little more than 1,000,000 sheep. This compares with our 50 million.

Public relations has been a primary consideration in Canada—that is, relations with Government, trade and producers, on the one hand, and with consumers on the other. Our traders and the Board have cooperated in meeting the official requirements of the Canadian Government as to packaging and presentation. At one stage at which the Canadian Government had bought in a large number of domestic lambs under a guaranteed price system, we diverted part of our radio advertising budget to assist in the sale of these. We were publicly congratulated by the Minister of Agriculture in Canada on our cooperation.

We consider it at all times important to increase the total offtake of lamb, whether it is always our own lamb or not, since as the only really large operator in world markets the greater the usage of lamb, the better must our prospect of expansion be.

The great problem confronting domestic lamb producers in Canada and the United States has been the declining interest of the public in lamb and the consequent falling away of sheep numbers.
With lamb not regularly before them in supermarkets, housewives have not developed the habit of regular buying. Lamb has become a special item, often at bargain prices, when offered intermittently on the meat counters. The American sheep producers took the advice of a leading American firm of management consultants. They asked this firm the question, "What's wrong with the sheep industry?" The consultants pointed to the failure of the industry to maintain lamb supplies constantly in the supermarkets and pointed to New Zealand as having promotion know-how and regular supply. We have since had consultations with the American sheep producers and have offered to invest in a joint programme of promotion and research in specific areas.

As I have already said, in Canada we have proceeded with promotion on behalf of Canadian lamb as well as our own, and we believe Canadian producers, with whose representatives we have conferred, have appreciated that to maintain and increase demand for lamb all-the-year-round supply is necessary. New Zealand is now supplying about one-third of all lamb consumed in Canada.

I repeat, the first essential to sound development of the Canadian market has been to obtain more constant stocking of lamb in the supermarkets. The primary aim in our public relations programme has been to persuade stores to stock lamb continuously. This objective we achieved in cooperation between the Board and Development Company in 1964. Development Company representatives arranged with supermarkets supplying 93 per cent of the food sales in the Vancouver-Victoria area that they would maintain New Zealand lamb on the meat counters constantly for the three months, February to April.

The stocking programme was supported by a public relations project involving newspaper articles, newspaper advertising, television demonstrations, radio, and a very full range of in-store material.

At the end of the three months retailers reported very good business and expressed an interest in maintaining their continuous stocking through into the summer until the arrival of domestic lambs. To this the Board agreed. Over a total of five months, retail sales were more than doubled. In the last of the five months, sales increased fourfold over those of the comparable month a year earlier. Since then, stores themselves in their own advertising have continued the selling drive and lately we have again assisted the domestic industry with advertising for their lamb in their selling season.

An important part of our programme in Vancouver was a consumer study programme designed to discover consumer attitudes to lamb and in particular to the New Zealand product. This has yielded information of great value for future promotions. The Vancouver programme is being repeated this year and a similar marketing project in Toronto-Hamilton in Eastern Canada is also running at present.

I do not want to suggest to you that we have had nothing but success. We have learned a great deal along the way, and there is a great challenge to the industry in many parts of the world, to develop sales of lamb. But I do want you to realise that carefully planned public relations and promotion have been the basic concept of our successes in the new markets so far, and we believe that this will be true of our marketing development in the future.
Introduction

Barley grass is an annual weed of high fertility land. It seeds prolifically, is unpalatable to stock and grows readily from shed seed. The increasing importance of barley grass as a weed is illustrated by its more and more widespread appearance and by the mounting numbers of lamb pelts suffering damage by seed-perforation.

Current recommendations for eradication of barley grass on a farm scale rely on the premise that it is an annual grass, the seed of which has very limited viability in the soil. If this is true, the complete prevention of seed formation—or introduction of seed from outside—for say two years should result in eradication. In practice this has proved difficult to achieve but should still be the basis of any attempt at barley grass control.

Sites of Infestation

The method of control adopted is governed by the situation in which the barley grass is growing. In other words, we are restricted in our choice of treatment by what might be growing with the weed. For this reason the situations in which barley grass is encountered can be listed as—

(1) Pasture.
(2) Lucerne
(3) Waste areas.

Control

(1) Pasture. Cultural practices which prevent formation of barley grass seed are useful but for eradication they must be supplemented by some form of chemical control. The grass killing herbicides available are T.C.A., 2,2-D.P.A. (dalapon) and paraquat. Control in pasture and lucerne implies selective control, that is, the destruction of the weed with little or no damage to useful companion plants. In the case of pasture the problem is complicated because we are faced with killing one grass and preserving others. To do this, we make use of the fact that, at certain times the useful grasses are present as mature plants while the annual barley grass is in the seedling stage.

Seedlings are more readily killed by herbicides but at the same time vigorously growing pasture is easily damaged. Barley grass germinates in spring and autumn and unfortunately, to treat it at the seedling stage we cannot avoid treating the pasture during the flush of spring or autumn growth. So a compromise is necessary. We choose, therefore, the seedling stage for the barley grass and keep the rate of chemical to an absolute minimum.

The result is that the pasture does suffer a check and at times some of the larger barley grass plants survive. To try to overcome
this—and the problem that all barley grass seeds do not germinate at the one time—a "split" application is sometimes made.

Of the three chemicals mentioned, T.C.A. is not now widely used and paraquat cannot be used selectively on pasture. This leaves 2,2-D.P.A. for pasture and it is generally employed at two to two and a half pounds of commercial formulation per acre in autumn and spring, the spring treatment sometimes being "split" into two pounds in August-September, followed by another pound about four weeks later.

(2) Lucerne. Selectivity is more readily achieved in lucerne than in pasture. We can therefore employ treatments which are more reliable in giving control of barley grass. These can take the form of 2,2-D.P.A. at four pounds per acre in winter or early spring, or paraquat at one and a half to two pints per acre in June or July.

At four pounds of 2,2-D.P.A. per acre, lucerne and any companion clover will be noticeably checked but barley grass control should be complete. Paraquat on the other hand does not harm lucerne but must be applied under favourable conditions to give good barley grass control. In particular the barley grass must be grazed very short. This is one reason for recommending winter treatment, as this seems to be the only time when stock can be induced (or forced), to graze barley grass closely and uniformly.

(3) Waste Areas. Barley grass thrives under shelter belts, about sheep yards and stock camps, and along fence lines. Here the weed is often the only vegetation and the question of selectivity does not arise. We need, therefore, a treatment which will give a reliable kill and certainly prevent seed formation.

The best time for treatment is the seedling stage and 2,2-D.P.A. at five pounds per acre (one pound to 12 gallons for spot treatment), can be used. However, once the plant has reached the flower-head stage, 2,2-D.P.A. will no longer prevent the setting of viable seed. This is often the stage when many barley grass plants are first noticed and the question is asked—"Is it too late to do anything?"

There is a solution up to a point; paraquat applied at the soft "dough" stage at the rate of five to six pints per acre (three-quarters fluid ounce per gallon for spot treatment), to give thorough wetting, will prevent the setting of viable seed.

The aim should always be to provide alternative ground cover and exclude barley grass if possible by competition. We are thus in need of acceptable plant species which will tolerate the so-called waste places inhabited by barley grass.

In this connection, perhaps fence lines should not be included among waste places, for useful vegetation can be encouraged on these sites. If eradication is the aim, fence lines must be treated and one or two approaches are possible. The treatment used for pasture could be employed with the aim of maintaining a grass-clover cover, or, alternatively, paraquat could be used with the intention of maintaining a clover-dominant ground cover.

Application

Because barley grass seedlings are not easily seen in company with other grasses, infested areas should be marked out the previous
summer. This will go a long way towards achieving the object of complete seed prevention.

The foliage of barley grass is not easy to wet. Care must be taken to see that spray coverage is efficient and in this regard spray pattern as well as volume must be considered. The application of the recommended amount, say 15 to 20 gallons per acre, is of little use if achieved with excessively large nozzles and high speeds.

Conclusion

Barley grass can be successfully controlled with chemicals in lucerne and waste areas. The position regarding pasture is not really satisfactory but this is no excuse for neglecting the problem. Damage to pelts is causing alarm—to say nothing of the suffering to the animals—and I suggest that this manifestation of barley grass would disappear if the treatments that are available were conscientiously applied.

One inducement might be for the freezing companies to identify rejected pelts so that the particular owner bore the loss. At present it is shared by all lamb producers, whether they harbour barley grass or not.

The importance of plant ecology is emphasized by the knowledge that barley grass establishes more readily in the absence of competition. Bare ground, brought about by stock trampling or dry conditions, is an open invitation to barley grass establishment. Already I’ve mentioned the need for species which thrive under the special conditions created by stock camps, etc. Of more immediate importance is to use, where possible, available pasture species, introduced perhaps by overdrilling, to minimize the opportunity of barley grass to gain entry. The seasonal growth pattern of ryegrass offers little competition over the summer. The incorporation of other species to help even out the pattern of pasture growth over the summer, could be very useful in reducing barley grass infestation.
New Zealand's economy is dependent on good pastures. This is as true today as it has always been since the early days of settlement. Much information on the principles of good pasture development has been built up in the past and will still be forthcoming in the future.

Today's modern dairy farm pastures have been developed to meet the requirements of intensive farming and most important of all the grazing animal. Basically such pastures will consist of a combination of grasses and clovers that are palatable, productive and permanent, that incorporate a good measure of drought and disease resistance and above all that contain species that are compatible.

In recent years considerable progress has been made towards developing pastures that encompass most of these qualities. Many people including the grassland research worker, machinery and fertilizer manufacturers, farm advisers and the farmer himself, have all worked closely together to evolve and integrate improved methods of obtaining and maintaining the maximum productivity from our grasslands.

The purpose of this paper is to make some recommendations on pasture mixtures for dairy farms and to outline methods of renovating clover dominant swards into useful feed for the herd.

Selection of Pasture Species

Some years ago preliminary pasture species and palatability trials were carried out on the properties of Mr R. G. Humm, Tai Tapu, and Eggleston Bros., Greenpark. They were conducted by the Department of Agriculture in association with Mr H. W. McIntosh, consulting officer of the N.Z. Dairy Promotion and Marketing Board.

The findings of these trials indicated that several grasses performed better in the absence of high ryegrass seeding rates and confirmed the earlier work of N. A. Cullen at Invermay Research Station. Individual grasses were not only found to be highly palatable, but were equally if not more productive on a dry matter basis than our basic ryegrass white clover pastures.
The next step was to confirm the performance of various combinations of these grasses on a number of dairy farms. This paddock evaluation is still in progress and was one of the subjects discussed at this year's dairy farmers' field day at Messrs Jones and Pickering's farms, Springston.

Pasture species being evaluated in sowings made since 1963 include:

**Grasses**

New Zealand short rotation ryegrass—"Grasslands Manawa."
New Zealand Italian ryegrass—"Grasslands Paroa."
New Zealand cocksfoot—"Grasslands Apanui."
New Zealand timothy—"Grasslands Kahu."
Aberystwyth tall fescue S.170.
Prairie grass.
Phalaris tuberosa.
Crested dogstail.

**Clovers**

New Zealand white clover—"Grassland Huia."
New Zealand Montgomery red clover—"Grasslands Turoa."
Palestine strawberry clover.

**Pasture Mixtures Being Evaluated**

As portions of the dairy farms involved are irrigated and also consist of dry and moist ground, the following broad groupings have been made:

A. High fertility—non-irrigated (dry).
B. High fertility—irrigated (moist).
C. Medium fertility—non-irrigated (dry).
D. Medium fertility—irrigated (moist).

**A. High Fertility (Dry)**

<table>
<thead>
<tr>
<th>No. 1</th>
<th>No. 2</th>
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<tbody>
<tr>
<td>10lb S.170 tall fescue</td>
<td>5lb short rotation ryegrass</td>
</tr>
<tr>
<td>4lb timothy</td>
<td>5lb timothy</td>
</tr>
<tr>
<td>5lb cocksfoot</td>
<td>5lb Phalaris tuberosa</td>
</tr>
<tr>
<td>2lb white clover</td>
<td>4lb cocksfoot</td>
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</table>

21lb Total

| 25lb Total |

116
### B. High Fertility (Moist)

<table>
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</tr>
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<tbody>
<tr>
<td>15lb S.170 tall fescue</td>
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</tr>
<tr>
<td>4lb timothy</td>
<td>5lb timothy</td>
</tr>
<tr>
<td>2lb white clover</td>
<td>2lb white clover</td>
</tr>
<tr>
<td>3lb Palestine strawberry clover</td>
<td>3lb Montgomery red clover</td>
</tr>
<tr>
<td></td>
<td>2lb Palestine strawberry clover</td>
</tr>
<tr>
<td>24lb Total</td>
<td>22lb Total</td>
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</table>

### C. Medium Fertility (Dry)

<table>
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<th>No. 1</th>
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</tr>
</thead>
<tbody>
<tr>
<td>8lb short rotation ryegrass</td>
<td>10lb prairie grass</td>
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<tr>
<td>5lb timothy</td>
<td>5lb cocksfoot</td>
</tr>
<tr>
<td>4lb Phalaris tuberosa</td>
<td>2lb timothy</td>
</tr>
<tr>
<td>4lb cocksfoot</td>
<td>2lb white clover</td>
</tr>
<tr>
<td>2lb white clover</td>
<td>3lb Montgomery red clover</td>
</tr>
<tr>
<td>3lb Montgomery red clover</td>
<td></td>
</tr>
<tr>
<td>26lb Total</td>
<td>22lb Total</td>
</tr>
</tbody>
</table>

### D. Medium Fertility (Moist)

<table>
<thead>
<tr>
<th>No. 1</th>
<th>No. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>4lb cocksfoot</td>
<td>6lb S.170 tall fescue</td>
</tr>
<tr>
<td>3lb short rotation ryegrass</td>
<td>4lb timothy</td>
</tr>
<tr>
<td>2lb timothy</td>
<td>4lb cocksfoot</td>
</tr>
<tr>
<td>2lb Montgomery red clover</td>
<td>3lb Italian ryegrass</td>
</tr>
<tr>
<td>1lb white clover</td>
<td>2lb white clover</td>
</tr>
<tr>
<td></td>
<td>3lb Montgomery red clover</td>
</tr>
<tr>
<td>12lb Total</td>
<td>22lb Total</td>
</tr>
</tbody>
</table>

The interesting thing to note about these mixtures is that timothy figures in all of them. We found that as long as timothy, normally a slow establisher, was not suppressed—the guilty species usually being ryegrass—it was remarkably persistent and palatable under a wide range of conditions. Cocksfoot also followed a similar pattern and being slightly more aggressive was more conspicuous.

It is important to note that all ryegrass seeding rates have been kept low between three and eight pounds, and even at these levels, ryegrass is still making a useful contribution. Palestine strawberry clover should only be included on the wetter soils and in these situations is to be preferred to Montgomery red clover. By the same token
prairie grass and Phalaris tuberosa will tend to thrive only on well-drained soils. Cocksfoot and S.170 tall fescue have a degree of tolerance to both moist and dry conditions.

Management

The following points have been observed from a study of the growth characteristics of these pasture mixtures. In this context timothy and crested dogstail are considered to be useful bottom grasses, keeping the sward tight and weed free. It is assumed that annual fertilizer applications and control of grass pests will be maintained.

1. S.170 fescue mixtures—Graze close at all times, to avoid development of tuftiness and rank unpalatable herbage.
2. Prairie mixtures—Never graze hard and try to leave about four inches of ungrazed stubble. This will protect exposed crowns from severe injury.
3. Cocksfoot mixtures—Graze less severely than for fescue, but not too leniently otherwise tuftiness may develop.
4. Ryegrass mixtures—As hard and as often as required, without causing severe pugging and tiller injury.

All of the grasses used may be made into hay or silage of high quality provided cutting of the crop is carried out at the correct time. This means cutting at the first signs of seed head emergence. Of course some compromise will be necessary with grasses in the mixture which flower earlier than others.

It is important to remember that the leaves are the carbohydrate factories of the plant, producing energy for conversion by stock to milk and meat. If all the available leaf area is removed by hard, continuous stock grazing, recovery of the pasture will be extremely slow. It is good business to let the cows take what grazing they can easily, and the sooner they will be back for more.

Under irrigation clover will grow well, and grazing management must be arranged to allow for the maximum fixation of nitrogen by the clover, to promote good growth of grasses. Therefore, neither hard graze to encourage excessive clover dominance nor conversely graze too leniently, otherwise the source of your nitrogen—clover—will be suppressed by excessive shading from grasses.

Renovation of Clover Dominant Pastures

Frequently many dairy farm pastures in Canterbury revert to clover dominance after a few years, due to a variety of causes, and as a consequence become dangerous to stock—bloat. Drought, insect pests, infrequent topdressing and overgrazing are usually the main reason for this premature reversion to almost pure clover.

Fortunately such pastures can now be easily and efficiently rejuvenated without the loss of the production which results from
ploughing. Suitable overdrilling equipment is now available from local machinery manufacturers and has been specifically designed to deposit seed and fertilizer banded together in uniform continuous drills, with a minimum disturbance of established species.

The following outlines the main points to be considered for any farmer contemplating renovation by overdrilling. Further detailed information on this subject is available from the Department of Agriculture, Christchurch.

1. Preparation

The time to do this work is during the period from February to April. It is essential to graze paddocks bare, or trim with a mower or forage harvester to remove thistles and tufty growth. This will also assist with the most important function of reducing competition from established species, if young seedling plants are to be given a good start. In addition, the removal of any trash or debris will facilitate the passage of the drill, and result in good coverage of seed with the tracking harrows.

2. Drilling

Several types of drills can be used for overdrilling, but the main limiting factor for disc seeders is their inability to penetrate hard, consolidated soils. A hoe seeder fitted with sharp, penetrating points and rolling skeiths is able to cope with a wide range of hard soils. For dairy farmers who have irrigation equipment, the answer is simply one of softening the topsoil to a depth of one inch. This will overcome any penetration problems and will allow an immediate strike of seedlings. In extreme cases for disc seeders in particular, it may be necessary to surface cultivate with disc harrows or chisel plough, prior to introducing a new grass mixture. This method, unfortunately also favours a rapid strike of weeds and at the same time partially destroys the valuable clover base.

3. Fertilizer and Seed Requirements

This is perhaps the most important factor associated with the technique of pasture renovation and strict attention paid here will yield dividends in the speed of establishment and quality of seed grown.

Numerous trials have demonstrated that in the great majority of cases, a combination of nitrogenous and phosphatic fertilizers is the key to success, and like baking powder in a housewife’s cake, the results will be flat without it.

The following Table 1 sets out the various fertilizers and seeding rates recommended for soils of different fertility levels in Canterbury.
TABLE 1

<table>
<thead>
<tr>
<th>Variety</th>
<th>Seeding Rate Bus./ac.</th>
<th>Fertilizer Requirements/Acre</th>
<th>Medium Fertility</th>
<th>High Fertility</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.R.D. ryecorn</td>
<td>2</td>
<td>2cwt P / 2cwt N</td>
<td></td>
<td>1cwt P / 1cwt N</td>
</tr>
<tr>
<td>Arawa wheat</td>
<td>3</td>
<td>1cwt P / 2cwt N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wong barley</td>
<td>2½</td>
<td>2cwt P / 2cwt N</td>
<td></td>
<td>1cwt P / 2cwt N</td>
</tr>
<tr>
<td>Carlsberg barley</td>
<td>2</td>
<td>„</td>
<td></td>
<td>1cwt P / 1cwt N</td>
</tr>
<tr>
<td>Research barley</td>
<td>2</td>
<td>„</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cape barley</td>
<td>2</td>
<td>„</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. Onwards oats</td>
<td>2½-3</td>
<td>1cwt P / 2cwt N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Russet oats</td>
<td>„</td>
<td>„</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>„</td>
<td>„</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>„</td>
<td>„</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dun Oats</td>
<td>„</td>
<td>„</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italian ryegrass</td>
<td>„</td>
<td>„</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short rotation rye</td>
<td>„</td>
<td>1cwt P / 1cwt N</td>
<td></td>
<td>1cwt P / ½cwt N</td>
</tr>
</tbody>
</table>

TABLE 2

<table>
<thead>
<tr>
<th>Grasses (No clovers)</th>
<th>Seeding Rate lb/ac.</th>
<th>Fertilizer Requirements/Acre</th>
<th>Medium Fertility</th>
<th>High Fertility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prairie grass</td>
<td>10-20 lb</td>
<td>1cwt P / 1cwt N</td>
<td></td>
<td>1cwt P / 4cwt N</td>
</tr>
<tr>
<td>Welsh tall fescue</td>
<td>8-12 lb</td>
<td>„</td>
<td></td>
<td>„</td>
</tr>
<tr>
<td>Cockfoot</td>
<td>4-6 lb</td>
<td>„</td>
<td></td>
<td>„</td>
</tr>
<tr>
<td>Phalaris tuberosa</td>
<td>4-6 lb</td>
<td>„</td>
<td></td>
<td>„</td>
</tr>
<tr>
<td>Timothy</td>
<td>3-5 lb</td>
<td>„</td>
<td></td>
<td>„</td>
</tr>
<tr>
<td>Crested dogstail</td>
<td>2-4 lb</td>
<td>„</td>
<td></td>
<td>„</td>
</tr>
</tbody>
</table>

When overdrilling a new grass mixture, include from one to one and a half bushels of wheat or oats as a protective cover crop.

NOTE: P = Superphosphate  % P = 9
N = Calcium ammonium nitrate  % N = 21

It may be necessary to substitute potassic or molybdic super for superphosphate in some districts. The increasing use of ready mixed or compound fertilizers while slightly more expensive is often found to be more convenient for some farmers. Because of variable levels of available NPK contained in the various grades of those fertilizers.
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5. A substantial reduction in amount of hay required.
6. The method allows, through rotation, better controlled utilization of the accumulated fertility on the farm.

References

Davies, D. J. G. Department of Agriculture Notes. June 1960—“Renovation for Winter Greenfeed.”
CANTERBURY DAIRY FARM PASTURE SPECIES

Their Management and Renovation

J. D. G. Davies, Farm Advisory Division, Dept. of Agriculture, Christchurch.

New Zealand's economy is dependent on good pastures. This is as true today as it has always been since the early days of settlement. Much information on the principles of good pasture development has been built up in the past and will still be forthcoming in the future.

Today's modern dairy farm pastures have been developed to meet the requirements of intensive farming and most important of all the grazing animal. Basically such pastures will consist of a combination of grasses and clovers that are palatable, productive and permanent, that incorporate a good measure of drought and disease resistance and above all that contain species that are compatible.

In recent years considerable progress has been made towards developing pastures that encompass most of these qualities. Many people including the grassland research worker, machinery and fertilizer manufacturers, farm advisers and the farmer himself, have all worked closely together to evolve and integrate improved methods of obtaining and maintaining the maximum productivity from our grasslands.

The purpose of this paper is to make some recommendations on pasture mixtures for dairy farms and to outline methods of renovating clover dominant swards into useful feed for the herd.

Selection of Pasture Species

Some years ago preliminary pasture species and palatability trials were carried out on the properties of Mr R. G. Humm, Tai Tapu, and Eggleston Bros., Greepark. They were conducted by the Department of Agriculture in association with Mr H. W. McIntosh, consulting officer of the N.Z. Dairy Promotion and Marketing Board.

The findings of these trials indicated that several grasses performed better in the absence of high ryegrass seeding rates and confirmed the earlier work of N. A. Cullen at Invermay Research Station. Individual grasses were not only found to be highly palatable, but were equally if not more productive on a dry matter basis than our basic ryegrass white clover pastures.
The next step was to confirm the performance of various combinations of these grasses on a number of dairy farms. This paddock evaluation is still in progress and was one of the subjects discussed at this year's dairy farmers' field day at Messrs Jones and Pickering's farms, Springston.

Pasture species being evaluated in sowings made since 1963 include:

**Grasses**

New Zealand short rotation ryegrass—"Grasslands Manawa."
New Zealand Italian ryegrass—"Grasslands Paroa."
New Zealand cocksfoot—"Grasslands Apanui."
New Zealand timothy—"Grasslands Kahu."
Aberystwyth tall fescue S.170.
Prairie grass.
Phalaris tuberosa.
Crested dogstail.

**Clovers**

New Zealand white clover—"Grassland Huia."
New Zealand Montgomery red clover—"Grasslands Turoa."
Palestine strawberry clover.

**Pasture Mixtures Being Evaluated**

As portions of the dairy farms involved are irrigated and also consist of dry and moist ground, the following broad groupings have been made:

A. High fertility—non-irrigated (dry).
B. High fertility—irrigated (moist).
C. Medium fertility—non-irrigated (dry).
D. Medium fertility—irrigated (moist).

A. High Fertility (Dry)

<table>
<thead>
<tr>
<th>No. 1</th>
<th></th>
<th>No. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>10lb S.170 tall fescue</td>
<td>5lb short rotation ryegrass</td>
<td></td>
</tr>
<tr>
<td>4lb timothy</td>
<td>5lb timothy</td>
<td></td>
</tr>
<tr>
<td>5lb cocksfoot</td>
<td>5lb Phalaris tuberosa</td>
<td></td>
</tr>
<tr>
<td>2lb white clover</td>
<td>4lb cocksfoot</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3lb white clover</td>
<td></td>
</tr>
<tr>
<td>21lb Total</td>
<td>3lb Montgomery red clover</td>
<td></td>
</tr>
<tr>
<td></td>
<td>25lb Total</td>
<td></td>
</tr>
</tbody>
</table>

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B. High Fertility (Moist)

No. 1

15lb S.170 tall fescue
4lb timothy
2lb white clover
3lb Palestine strawberry clover

24lb Total

No. 2

10lb S.170 tall fescue
5lb timothy
2lb white clover
3lb Montgomery red clover
2lb Palestine strawberry clover

22lb Total

C. Medium Fertility (Dry)

No. 1

8lb short rotation ryegrass
5lb timothy
4lb Phalaris tuberosa
4lb cocksfoot
2lb white clover
3lb Montgomery red clover

26lb Total

No. 2

10lb prairie grass
5lb cocksfoot
2lb timothy
2lb white clover
3lb Montgomery red clover

22lb Total

D. Medium Fertility (Moist)

No. 1

4lb cocksfoot
3lb short rotation ryegrass
2lb timothy
2lb Montgomery red clover
1lb white clover

12lb Total

No. 2

6lb S.170 tall fescue
4lb timothy
4lb cocksfoot
3lb Italian ryegrass
2lb white clover
3lb Montgomery red clover

22lb Total

The interesting thing to note about these mixtures is that timothy figures in all of them. We found that as long as timothy, normally a slow establisher, was not suppressed—the guilty species usually being ryegrass—it was remarkably persistent and palatable under a wide range of conditions. Cocksfoot also followed a similar pattern and being slightly more aggressive was more conspicuous.

It is important to note that all ryegrass seeding rates have been kept low between three and eight pounds, and even at these levels, ryegrass is still making a useful contribution. Palestine strawberry clover should only be included on the wetter soils and in these situations is to be preferred to Montgomery red clover. By the same token
prairie grass and Phalaris tuberosa will tend to thrive only on well-drained soils. Cocksfoot and S.170 tall fescue have a degree of tolerance to both moist and dry conditions.

Management

The following points have been observed from a study of the growth characteristics of these pasture mixtures. In this context timothy and crested dogstail are considered to be useful bottom grasses, keeping the sward tight and weed free. It is assumed that annual fertilizer applications and control of grass pests will be maintained.

1. S.170 fescue mixtures—Graze close at all times, to avoid development of tuftiness and rank unpalatable herbage.
2. Prairie mixtures—Never graze hard and try to leave about four inches of ungrazed stubble. This will protect exposed crowns from severe injury.
3. Cocksfoot mixtures—Graze less severely than for fescue, but not too leniently otherwise tuftiness may develop.
4. Ryegrass mixtures—As hard and as often as required, without causing severe pugging and tiller injury.

All of the grasses used may be made into hay or silage of high quality provided cutting of the crop is carried out at the correct time. This means cutting at the first signs of seed head emergence. Of course some compromise will be necessary with grasses in the mixture which flower earlier than others.

It is important to remember that the leaves are the carbohydrate factories of the plant, producing energy for conversion by stock to milk and meat. If all the available leaf area is removed by hard, continuous stock grazing, recovery of the pasture will be extremely slow. It is good business to let the cows take what grazing they can easily, and the sooner they will be back for more.

Under irrigation clover will grow well, and grazing management must be arranged to allow for the maximum fixation of nitrogen by the clover, to promote good growth of grasses. Therefore, neither hard graze to encourage excessive clover dominance nor conversely graze too leniently, otherwise the source of your nitrogen—clover—will be suppressed by excessive shading from grasses.

Renovation of Clover Dominant Pastures

Frequently many dairy farm pastures in Canterbury revert to clover dominance after a few years, due to a variety of causes, and as a consequence become dangerous to stock—bloat. Drought, insect pests, infrequent topdressing and overgrazing are usually the main reason for this premature reversion to almost pure clover.

Fortunately such pastures can now be easily and efficiently rejuvenated without the loss of the production which results from
ploughing. Suitable overdrilling equipment is now available from local machinery manufacturers and has been specifically designed to deposit seed and fertilizer banded together in uniform continuous drills, with a minimum disturbance of established species.

The following outlines the main points to be considered for any farmer contemplating renovation by overdrilling. Further detailed information on this subject is available from the Department of Agriculture, Christchurch.

1. Preparation

The time to do this work is during the period from February to April. It is essential to graze paddocks bare, or trim with a mower or forage harvester to remove thistles and tufty growth. This will also assist with the most important function of reducing competition from established species, if young seedling plants are to be given a good start. In addition, the removal of any trash or debris will facilitate the passage of the drill, and result in good coverage of seed with the tracking harrows.

2. Drilling

Several types of drills can be used for overdrilling, but the main limiting factor for disc seeders is their inability to penetrate hard, consolidated soils. A hoe seeder fitted with sharp, penetrating points and rolling skeths is able to cope with a wide range of hard soils. For dairy farmers who have irrigation equipment, the answer is simply one of softening the topsoil to a depth of one inch. This will overcome any penetration problems and will allow an immediate strike of seedlings. In extreme cases for disc seeders in particular, it may be necessary to surface cultivate with disc harrows or chisel plough, prior to introducing a new grass mixture. This method, unfortunately also favours a rapid strike of weeds and at the same time partially destroys the valuable clover base.

3. Fertilizer and Seed Requirements

This is perhaps the most important factor associated with the technique of pasture renovation and strict attention paid here will yield dividends in the speed of establishment and quality of seed grown.

Numerous trials have demonstrated that in the great majority of cases, a combination of nitrogenous and phosphatic fertilizers is the key to success, and like baking powder in a housewife’s cake, the results will be flat without it.

The following Table 1 sets out the various fertilizers and seeding rates recommended for soils of different fertility levels in Canterbury.
### TABLE 1

<table>
<thead>
<tr>
<th>Variety</th>
<th>Seeding Rate Bus/ac.</th>
<th>Fertilizer Requirements/Acre</th>
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</thead>
<tbody>
<tr>
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<td>2cwt P/2cwt N</td>
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<td>Cape barley</td>
<td>2</td>
<td>&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. Onwards oats</td>
<td>2½-3</td>
<td>1cwt P/2cwt N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Russet oats</td>
<td>&quot;</td>
<td>&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milford oats</td>
<td>&quot;</td>
<td>&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mapua oats</td>
<td>&quot;</td>
<td>&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dun Oats</td>
<td>&quot;</td>
<td>&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italian ryegrass</td>
<td>½-2</td>
<td>&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short rotation rye.</td>
<td>&quot;</td>
<td>1cwt P/1cwt N</td>
<td></td>
<td>1cwt P/½cwt N</td>
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