

LINCOLN COLLEGE

UNIVERSITY OF CANTERBURY



The Proceedings
of the
12th Lincoln College
Farmers' Conference
1962

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THE PROCEEDINGS



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Lincoln College.

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OPENING ADDRESS

W. C. Stafford, Timaru.

I am conscious of the fact that, as the first speaker at this, the twelfth Lincoln College Farmers' Conference, I am taking considerable liberty in what I am about to say. Nevertheless, it is a farmers' conference and it is on this fact that I am making my remarks, even if there are present many of the best scientific brains in the country, some of whom you will hear on the three days of the Conference.

Most of you may regard it as just another of those Science fiction stories, so common at the moment. As such there are many flaws in it, and much for the purist to fault. I am, however, hoping that during the days of the Conference, it may provoke some discussion relative not only to the papers you are to hear but also amongst yourselves, in the days you are to be at Lincoln. These hopes are based on the assumption that all the papers have some bearing on the four aspects of fertility, namely the creating of it, the storing of it, and the use and disposal of it. To illustrate my point let me take two subjects which appear to be irrelevant to this—namely "Developments in Dipping Materials" and "Milking Management." If the fertility created in the soil and transferred through the plant to the animal is, in the first case, to be partly wasted by feeding parasites and in the second by poor shed management, which prevents the cow giving its best, then part of the effort is wasted and the whole rendered more costly. Against this, however, and to emphasise my story, I must say that the sheep was not originally evolved to live under its present conditions, while the cow's udder was only intended to provide sufficient milk to rear the calf to the stage that it could fend for itself.

At this stage I would like to say that I am aware of the fact that I am using the words "fertile" and "fertility" at times in a very loose sense. While they may convey the right meaning in some cases, in others, where they have been used, the words "fecund" and "fecundity" would be more correct. I feel, however, that if I did this, I would simply be adding to the confusion I always find myself in when speaking.

Every farming operation has some bearing on the four aspects of fertility. Cultivation and topdressing aims at loosening, adding to, or converting fertility to enable plants to establish and produce, or for it to be transferred to the animal, to produce and fatten. Irrigation and drainage, the use of sprays for weed and pest control, trace elements for soil plant or animal, are all in the same category, as are harvesting and marketing. The farmer who sells store stock and surplus breeding stock, is selling his fertility to another who at the time virtually considers he is working on a higher plane of fertility, sufficient to make the venture worth while. New Zealand is selling fertility with every boat load of meat, wool, butter and cheese that leaves her shores.

I am sure that many of you will give a grin by the manner in which I have introduced the common plant animal story but in order that you may find this well worn subject less boring, I am introducing two other well known characters which although in the forefront for many years, have recently slipped into the background. These are, the one which comes before soil, namely climate, and the other which comes after animal and its name is Man.

Of the five characters, only four have what I am calling power of movement, which under certain conditions becomes power of aggres-

sion. The odd one out in this case, is soil, which does not move of itself, but does move through some action of the other four. They all can, and have changed over the years and each exerts its influence on the other.

As far as age is concerned—Man is by far the youngest and while he may have existed for some time previously—it was not until round about 5000 B.C. that he first began to exert any influence in the relationship. For, as near as can be estimated, it was about 7000 years ago that man first began to till the soil and cultivate crops. In other words, he left the animal kingdom and became a farmer. This doesn't mean that one morning he went outside his cave and started to make a chisel plough out of the tusks of the sabre-toothed tiger; the process was, and still is, much slower than that—in fact he hadn't then thought of the wheel.

Unfortunately, as you know, his influence for centuries on himself, and the other four characters of the story, has been purely detrimental. While in the last hundred years (this is an exaggeration—it is really only one half that amount) and although he has by the realisation of the mess he was making and the aid of science, endeavoured to rectify the position, he still has a long way to go before the close relationship essential to the continued existence of plant, animal and man, is balanced, with soil and climate to the benefit of all.

Considering climate first. It is on the fact that the four seasons follow each other, even if at times we think somewhat irregularly, depends the existence of the other four. It is well known that man can and has changed climates. It is believed by some that plants can change climate and it is well known that animals—like man—can affect climate, soil and plant, by their habits under certain conditions.

Although some soils have been formed by volcanic action, climate in the main has been chiefly responsible for their formation, with its changes of heat and cold, dryness and wetness, wind and calm. Thus climate controls the characteristics and actions of plant, animal and man, and their habits of existing or living.

It is on the cycle of the seasons and the years, that fertility was originally given and since taken from and added to repeatedly under the influence of growth, reproduction, and death, in plants and animals, and latterly by the action of man. Under our favourable climatic conditions, we have been inclined to look at soil as being the most important in our systems of farming, but this is not the case in countries less favoured by climatic conditions. Before getting on to the second member of the partnership, I want to digress a minute or two on climate and its influence on farming by quoting an opinion given as a result of research on climatic conditions. This reads, "While it is accepted that adequate moisture and soil are essential for a particular style of farming, they are by no means sufficient. Grass needs warmth, and we measure it in a unit called 'degree days.' The phrase 'degree days' which in Universities means a pretext for having a celebration, in this connection has quite a different meaning, as follows:—

You cannot judge the suitability of land, say, for dairying, by just taking the average temperature averaged over winter and summer. Farmers and botanists agree that grass stops growing when the average daily temperature falls below 43 deg. F. With 43 deg. F. as the limiting point, it does not matter whether the winter temperature is 42 deg. or —42 deg. In neither case will grass grow. What matters is how much warmth is obtained in summer, and how long it goes on. Degree days are computed by counting the points of the daily temperature average above 43 deg.; thus one day

at 45 degrees will score two points; one day at 53 degrees ten points, and so on. These points are added up over the whole year. Research in other countries, particularly in cold climates such as Finland and Sweden, has shown that the score of any place in degree days, provides a very good measure of what it can grow. According to somewhat austere standards adopted in Finland, land with 2000 degree days per year will grow anything that they are likely to want to grow, including sugar beet. On the other hand, land with 1500 degree days, will not grow much except hay and oats and land with 1000 has no agricultural value at all. It is a fact, however, that commercially successful dairy farming is carried on in Finland, two hundred miles on the wrong side of the Arctic Circle, but here, though it is intensely cold in winter, they have quite a hot summer.

We must remember, however, that in Finland, we have a rather dense population trying to make a living in an inhospitable climate and while dairying can be carried on at these low temperatures it is at costs that are high by our standards" (the writer was speaking of England.) He continues, "In New Zealand, which has only been settled in the last century and where settlers were free to choose whatever style of farming that suited them, dairying commercially for butter and cheese does not begin until there is a score of about 3000 degree days."

Looking at this statement and having gained some idea of farming conditions in other countries, it indicates to me the lavishness of New Zealand farming when compared, and therefore one of the chief reasons why this country is able to compete with the rest of the world in the products of farming. It also indicates the great scope or potentiality that there is for further development of the already developed land in any style of farming. Further it may provide a better measure for future land use than land capability maps, land utilisation surveys or in conjunction with Farm Improvement Groups. I believe it is well worth looking into. However, to get on with the story—and on to the next partner. Soil, besides supplying many essentials for plant and animal growth, soil is also the medium through which many other essentials pass through. It is also the storehouse of fertility and a certain amount of moisture. With regard to the latter, I am going to quote again from the same source as I quoted in regard to climate. "Grass can be expected to grow from moisture stored in the soil. Professor Thornwaite, one of the leading experts on the subject, said that the amount of water which can be stored in the soil and made available for plant growth during a temporary dry period was the equivalent of four inches of rainfall. This figure is now known to be too low for many types of soil. It is also now generally known that the water holding capacity of soil can be increased by building up its content of organic matter. In New Zealand, measurements have been taken over a long period of years of water holding capacities of the soils around Lincoln Agricultural College on the Canterbury Plains. It has now risen to over 9 inches."

Farming, as far as man is concerned, lies in keeping this soil storehouse in sufficiently good order so that it can provide day to day requirements under normal farming conditions and still have a reserve to withstand the demand of adverse conditions, whether they be reasonable or economic, for as long a period as possible. I believe that in the main, this, in New Zealand, has been achieved through the close relationship between the farmer and the scientist either through the close contact between the two or through the farm advisory services. In fact I go as far as saying that nowhere in the world is there such a close contact between these groups as in New Zealand. The difficulty of using this reserve of fertility is that over the period it has been built up, from a large deficit to a large surplus there has not been until the last three years, any serious reasons why it should

be tapped, other than for the opinions which I expressed at this Conference three years ago. At the present time, with the memory of the conditions of the soil in New Zealand of thirty years ago, there is a reluctance to draw on the reserve that has been built up. Even at this College, there is a resistance to do this and I know it will be done only as far as is prudent. But farmers, faced with rising costs or with overdrafts or pressure from other directions, can only remain prudent for so long. To all farmers who are able, I would say, don't wait too long. The farming and scientific knowledge now available, and this knowledge is continually being increased, is such that the land condition of thirty years ago need not arise again in this country. There may be a continuance of the present lean period, but there is no need to feel that the bottom has fallen out of everything, especially when you read in the newspapers, as many of you did last week, that the world's present population is expected to double itself by the end of the century. This, and the related implications, was put very forcibly in my opinion, in an address given by Michael Bradford to the British Farmers' Club on February 14 of this year. This is part of what he said:

"We in the United Kingdom, are not underfed now, but half of the population of the world now is."

You may say that you have heard all this clap trap about world population and hunger before, but so far, science and the farmer have kept abreast of things by increasing production, even sometimes to the level of local over-production in some commodities. That is so, but there is one very significant point, which is often forgotten in these arguments. We are not all mathematicians, but at any rate, most of us know that there are some graphs which rise in a nice steady straight slope and others which rise in curves, slowly at first, but in an increasing angle until finally they are almost vertical. The graph of world population increase is one of these. The last three or four generations have been living in the relatively gently sloping part, but we, Gentlemen, are moving into the part which goes up faster and faster.

Several things can be done to provide salvation. You can organise better distribution of your present harvests. You can increase the present acreages under crops by vast irrigation or clearance schemes. You can start to use more fully the vast, and so far, almost untapped harvest of the sea. You can teach the backward agricultural countries to produce more per acre, and you may even teach man to control his rate of multiplication. China has already started with some success to tackle the latter problem, but it will take a long time and time we have not got because we must not forget that science has already increased man's expectation of life.

We shall have to use to the full, all the weapons at our disposal—education, fertilisers, distribution, seed dressings and sprays to buy time.

Let us now take a look at world population and related facts:

The present world population is estimated at three thousand million. By 1980 which is not far away, there will be four thousand million people on this earth. If you have a son or grandson at the present age of 17—by the time he is 55 there will be six thousand million. By the time his sons (if he is permitted to have more than one) are 50, there could be well over ten thousand million.

About 70 per cent of the earth's land surface cannot be made to support human life. The remaining 30 per cent can be described as potentially cultivatable and comprises the 10 per cent already cultivated and the unexploited balance where many problems have to be

overcome before it can contribute. By the end of the century the necessary annual increase of foodstuffs required to meet the expected rise in world population will be over 100 per cent for cereals and some 300 per cent for animal products. Finally he points out that unless the necessary increase is obtained, we are faced with the spectacle in a few years' time of the nations of the world, their tempers frayed by real hunger, standing on their thresholds—many of them holding in their hands, the power to destroy their neighbour and plunder his larder."

You may consider this is entirely sensational and merely a rehash of the Malthusian theory. Malthus, however, made his predictions when the world was being despoiled by man, and they were tossed aside when science began to make its impact on farming within the last hundred years. Now, the fear is that even the tremendous advantages of science are not sufficient.

You may have noted that in the foregoing, plant, animal and man have been brought together. From now on I want to keep them together for they have in common the basic features of life in that they germinate, grow, reproduce and die, and as such they are users of fertility and also as such, man makes use of plant and animal because they are virtually part of him.

In the centuries that followed after man first became a farmer, hard experience taught him which methods in farming were the best to follow and his knowledge slowly accumulated over the years. You are all aware of the good farmers of Britain in the nineteenth century and how much they contributed to farming in soil, plant and animal improvement—all of which is sound today. It has been said that the advance of science applied to farming methods during the last hundred years has so altered the farming outlook that the farming today as far as soil plant and animal is concerned, is chiefly a science rather than an art. To me, any one who believes that, is making the greatest mistake of his life and if he believes that, and is farming, then he will never be a farmer.

The greatest compliment that was ever made to farming in New Zealand was when the agricultural colleges took the word "husbandry" out of their calendar and replaced it with the word "science."

Science has done a magnificent job for farming and will continue to do so, but to get the best from science, the farmer must continue to be a husbandman as far as his soil, plants and animals are concerned. The closer he gets to them and the more time he spends with them, the better off both he and they will become. I believe that this is one of the chief reasons why science has as yet failed to make much impression on the animal and the reason why the best stud stock farmers are doing such an efficient job.

The one thing that my father impressed on me was that plants, animals and man respond just as much to care and attention as anything that can be given out of a bag, a tin, or a bottle—hence the nursing profession.

Ten minutes sitting on a gate looking at a ploughed paddock—your pasture or your stock—is worth more than weeks of listening to the likes of me.

A poor farmer misses his opportunities. A good farmer takes his opportunities—the best farmer makes his opportunities.

MEAT MARKETING SYMPOSIUM

I. "OPENING SUGGESTIONS"

Professor B. P. Philpott, Professor and Head of Agricultural Economics Department, Lincoln College.

I would like to say a word about the purpose of this symposium and the spirit in which my contribution is framed. The idea of the symposium is to generate discussion and debate on a very important matter which concerns you vitally and which concerns New Zealand.

My contribution is to put forward one or two ideas which have already been circulated to Mr Cameron and Mr Wright for their assessment. Now the suggestions I put forward are only suggestions for discussion and not necessarily guides for policy. It is the function of the University to trade in ideas and it seems to me that this conference is the appropriate place to do this trading.

I have no illusions as to my knowledge or ability in the practical field of meat marketing though I have equally no doubt as to the usefulness and validity of economic research in this sphere. However I shall not be upset at violent disagreement with my ideas from the practical gentlemen who follow me. Indeed I shall expect it as long as discussion is stimulated, for this is our aim.

1. The E.E.C. Question

The whole question of meat marketing is now completely clouded by the prospect of Britain entering the E.E.C. Since we know nothing about the terms on which she may join the E.E.C. insofar as they affect the marketing of our lamb, I shall confine my argument initially to the assumption that if Britain does join there will be no change in the present conditions of free entry of our lamb into the United Kingdom.

2. Saturation of the U.K. Lamb Market

My paper to this conference last year showed that the U.K. wholesale lamb price is related to the total supplies of lamb and mutton on the U.K. market. The relationship I showed last year is such that we do not get as much per extra ton sent from New Zealand as the average price. Last year I suggested that extra lamb/mutton brought in a fifth of the average price or £40 per ton if the average price is £200 per ton. On the basis of further research, I have revised my estimates which were too low. I now find that extra lamb and mutton brings in half the average price or £100 if the average price is £200 per ton.

Three further points must be added:

(I) Retail Prices: Mr W. B. Trotter has pointed to the stickiness of retail prices—that is when the wholesale price falls there is a tendency for the retail prices not to fall in sympathy. I am not too sure of where he got his data but the information I have come across supports his view that retail prices have not fallen as much as they should have done. Of course the effect of this is to restrict expansion in consumption. However the fact is that we have no data on retail prices for our meat.

(II) Total Supplies: The total supply of lamb and mutton comes mainly from New Zealand, Australia, Argentine, and the United Kingdom. If New Zealand supplies go up and the other supplies go down by an equivalent amount then the price stays the same. However the figure of a "half the average price" for extra supplies from New Zealand takes into account the fact that we supply 50 per cent

of the lamb and mutton market and is calculated on the assumption that supplies from other sources are unchanged.

(III) Whose Fault? This brings me to the point on which there has been some public debate. "Whose fault is it the market is over-supplied?" The facts are that in the six years between 1955 and 1961, New Zealand supplies rose 40,000 tons, the U.K. supplies rose 80,000 tons, and the other supplies fell 40,000 tons. This means that the U.K.'s expansion is more at fault than New Zealand. But in economic analysis it is not our task to assess faults, it is our task to assess facts and to find what can be done about it.

There are two courses of action. Firstly the reduction in U.K. supplies and secondly the development of new markets.

3. U.K. Subsidies

U.K. lamb production has risen steeply due to the very high subsidies paid to lamb producers. U.K. farmers realize about 38d per pound—nearly double the wholesale price. A progressive reduction in these subsidies could lead to reduced U.K. production giving a bigger market for us.

Now we should press unremittingly for a reduction in this specific lamb subsidy and with far more vigour than in the past. Remember that its effect is equivalent to a tariff of 100 per cent. We might even offer a quid pro quo of a progressive reduction in New Zealand import controls in return for some stated progressive reduction in lamb subsidies.

But if we can secure no relief from British lamb subsidies—and many people with more experience in these matters than I have assure me that such relief is most unlikely—then all we can do is press on with development of new markets.

4. New Market Development

Since the extra lamb we now sell in U.K. only nets us about half the price, it is in theory worth while selling future supplies of lamb in any new market at a price greater than half the price in U.K. In this way the farm industry would earn higher revenue from lamb than it does at present, for at present extra supplies to U.K. are earning us much less in extra revenue than the price we receive. Now this does not mean that we should sell in new markets at a price as low as that. Obviously we should sell at the highest price we can get. But I do suggest that if the development of a new market requires us selling at a somewhat lower price than we receive in Britain in order to encourage consumption of a type of meat which is strange to many palates then we should go ahead and sell on this basis.

Or it may be that the costs of promotion and market development, freight, cool store erection, distribution, etc., are such that the net return per ton in new markets is less than the average net return secured in U.K. And again I would say we should not be deterred on this account from new market development.

I am not suggesting taking supplies off the U.K. market. This would be very dangerous indeed. But I am suggesting reducing the extent to which we put future increased supplies on the market.

5. Organisation of Market Development.

If this point is accepted then we must ask how is such selling to be arranged and who is going to stand the apparent loss through selling for a lower net return in a new market than can be secured in Britain? We cannot expect the individual meat companies to stand this loss and any one company which adopted such a policy in the national interest would make a loss for it would be forced to pay producers a schedule price based on British realisations which would be greater than the revenue received for the meat when sold. If some

lamb is sold in some markets at a lower net return than in others, then, if meat companies pay a schedule based on U.K. prices, they will make a loss even though it might be a gain for the nation as a whole.

We cannot expect the Meat Export Development Company to bear the loss—at any rate under its present constitution. The company has to buy meat from the meat companies at the ruling British-based price so that if it is to break even in its operation it will need to sell overseas at the ruling U.K. price.

As I see it the only way in which it is possible for our meat to be sold in new markets and secure a lower net return than at present secured in Britain is either for all the meat companies to act collectively in this matter—which would be difficult to arrange—or for the Meat Export Development Corporation to be recognised as an institution that is bound to make large losses if it is to do its job effectively.

I have no doubt this point will be strongly challenged by the two practical men who are to follow me in this symposium. I hope they will challenge it. But as far as farmers are concerned I consider you have got to recognise that you must not judge the success or failure of the Meat Export Development Company according to whether it makes a profit or a loss. The thing that matters is the profit to the whole farm economy that results from new market development and, if this involves using some of the Meat Board's pool funds to cover the development company's losses, then it will be a small price to pay.

A third suggestion which I am sure will be hotly debated is that all marketing responsibilities should be taken over by a Meat Commission as in the Dairy Industry with farmers paid a price averaging net realisations in all markets. I'd like to hear your comments on this.

6. Encouraging Beef Production

Many speakers, myself included, have frequently averred to the good market prospects for beef which have continually faced us since the early 1950's. And yet we have not really had the startling increase in beef production which could have paid us so well. If Britain joins the E.E.C., on terms which involve, as has been suggested, a quota of our sales of lamb in Britain, then the need to develop beef production even at the expense of lamb production is going to become more urgent than ever since it is easier to find new markets for beef than for lamb. This would require paying prices for beef which stand in a relatively higher relationship to lamb prices than is at present the case. I am not at all sure in my own mind just how this can be arranged under our present marketing procedures and this is a matter on which I think we would welcome some comment particularly from Mr Cameron.

7. Some Other Points

There are a host of other points we could discuss. I have no intention of doing anything other than mention them in the hope that you may ask questions from the two industry leaders with us today. The points I shall mention are these:

(a) The desirability of New Zealand producers owning, through the Meat Board, their own retail shops in the U.K. so we can set competitive retail prices for our meat.

(b) The arranging of a better seasonal flow of our lamb to the U.K. to avoid undue gluts and shortages. Our research indicates the need for more lamb in the months of January, February, August and September and less in March, April and May.

I hope there are sufficient ideas in this paper for you to get your teeth into—or should I say “get your knives into”? Having talked about lamb for 10 minutes I almost feel like one about to be slaughtered! However, I hope you will accept my provocations in the spirit they are offered—to stimulate discussion and argument from the floor.

II. COMMENT ON PROFESSOR PHILPOTT'S PAPER

L. A. Cameron, General Manager, Gear Meat Company,
Wellington.

It was with a great deal of pleasure that I accepted the invitation to attend this Symposium at Lincoln College. I think we are all indebted to Professor Philpott for his enthusiasm and hard work in making this particular part of a Symposium possible, and for his most interesting and provocative paper.

Studies on this particular subject are of the utmost importance to New Zealand, particularly at this very important moment. As we all know, the past is interesting, the present is important, but the future is vital.

It is an unfortunate fact that in New Zealand too often studies of this subject are carried out in the field of politics, thus introducing much irrelevant discussion; ideas supported by pressure groups and, as always, we see the advocate of the master planner in the background ready and willing to take control of our freedoms and individual enterprise. To be of value, these discussions and studies should be, as they are today, contained within the bounds of an academic atmosphere and reasoned with reasonable men. It is this way that the right answers will and must be found. It is this way that informed opinion may be gathered and informed opinions, we hope, circulated, thus allowing you as farmers to make decisions based upon sound grounds and not, as we so often see, viewpoints and even decisions made, by people who I suspect are motivated from only personal viewpoint, and which is so aptly expressed in this little jingle:

"I hate the guys
Who criticise
And minimise
The other guys,
Whose enterprise
Has made them rise
Above the guys
Who criticise."

I should perhaps at this stage make my position quite clear.

I definitely believe that by freedom and enterprise this meat industry can continue to be one of the most successful industries of its type in the world today. By this, I do not mean that I am opposed to all forms of rationalisation (for instance the N.Z. Meat Producers Board control all shipping allocations of meat exporters in New Zealand today, a form of rationalisation which, with the co-operation of the exporters, works extremely well), particularly where such rationalisation will benefit the national good; but I am directly opposed to any rationalisation or forms of control which would permanently limit the freedoms and enterprise of the individual, as I firmly believe that, although freedom and enterprise can work with the planner, freedom and enterprise to the individual must always be dominant if we are to be successful.

Like Professor Philpott, my remarks on his paper will largely ignore our future position if the United Kingdom should join the E.E.C. Unfortunately I was not present at last year's conference, but I have read and studied Professor Philpott's paper presented on that occasion. Today's paper is largely based upon Professor Philpott's first paper, and it is my view that many of the findings in the

first paper are based on wrong premises, but his case is also very much over-simplified as to be downright inaccurate and it is my opinion that much of what has been written and said today by Professor Philpott is valuable only because it is provocative, not because he has discovered anything new or solved our problems. To my mind, Professor Philpott has only proved one thing so far in his researches, and that is that the price of anything, including our lamb and mutton, depends upon the law of supply and demand. I think Professor Philpott will agree with me that this finding and answer was discovered many hundreds of years ago, and certainly before New Zealand lamb was ever heard of.

I certainly cannot agree that this paper or his last has proved that every extra ton of New Zealand lamb sent to the United Kingdom earns only £40. (As Professor Philpott in his paper today admits, he has changed many of his conclusions which he arrived at from his original paper last year, particularly with regard to the earnings of the extra tonnage, he stating last year that £40 was the figure. He now says after further research that the figure could be £100. I would suggest to Professor Philpott that he should carry out further researches and he might even find that we get the full £200.) For instance, Professor Philpott has made quite clear that he is far from proving that it is only the weight of lamb and mutton that affects our price, and his theory could only be true if this was so. Every trader in the United Kingdom could tell Professor Philpott that United Kingdom home killed beef can play a most dominant factor in the selling of our New Zealand lamb. The same remarks could apply to pork, and even poultry plays a much more dominant part than Professor Philpott might think. He has not measured accurately enough the effects of total supplies; also, as yet he is not sure that he is measuring a short term effect, or whether it is a long term trend. If it is appreciated that in the United Kingdom, New Zealand lamb is for the majority of the people only a once-a-week meal item, then it can be easily seen that all sorts of factors can upset our selling rate and, therefore, our price realisations. It is, of course, true to say that New Zealand's lamb supplies do have a marked effect on selling prices—it is particularly true during the months of January, February and March, but even this statement is subject to exceptions. May I direct Professor Philpott's attention to what I term it, anyhow, the trigger effect on our prices, i.e., some factor which creates a condition or circumstance which changes the entire course of marketing at that particular time. As mentioned previously, this trigger factor in the United Kingdom can be home killed beef, mutton and lamb, pork, poultry, incidence of stocks in store, i.e., imported meats, and other such factors as dock strikes and the weather conditions. These and many other factors would require a good deal of study and research before any sound conclusions could be reached as to the wisdom or unwisdom of some of the suggestions and proposals, not only made by Professor Philpott, but by many New Zealanders connected with our meat industry. (It should be appreciated that certainly the larger companies involved in our meat marketing carry out many of the aspects of market research. In fact, it is of course essential that they should do so, if their investment is to be protected for the future.)

On the face of it, it does appear sound that we should, if we wish to have better prices, keep a market in a slightly short-supplied position. However, this theory can be a most dangerous one when applied to the United Kingdom, as although the United Kingdom may respond on a short-term basis to a contraction or reduction of supplies, it is a fact that it is only a short time before the United Kingdom market attracts alternative supplies from either its own farmers or other countries to make up the shortage. The dangers, therefore, can be

realised of any such action, particularly if at the time it is done consumption is increasing in the United Kingdom. The only effect that could result from this circumstance is that other supplies would replace our own; we would lose a potential market, therefore, without increasing our price. And remember, Professor Philpott has said in his original paper that he has proved a very elementary fact in the United Kingdom, i.e., lower prices tend to increase consumption. The real security in any market is to be able to supply maximum or all requirements at the lowest possible price, i.e. at a price which leaves a profit for the country producing it: the size of that profit is always a difficult question. I think, over the past five or six years' trading, the results shown by companies and co-ops. can fairly prove to farmers that realisations of our actual values of lambs, less reasonable expenses and earnings, have been handed back to our farming community. Therefore, perhaps at this stage, I can be a little provocative by saying that our studies, by concentrating upon only marketing, might well be taking the wrong direction.

It is, perhaps, the cost factor in New Zealand, particularly when related to land values, that requires much further study. The relationship between the prices of our products, land values and our costs would, I believe, make an interesting study and an informative one for all of us, including farmers engaged in the meat industry. (It should not, of course, be forgotten that our industry contains many valuable by-products such as wool and pelts, which contribute large sums to our overseas earnings.) Therefore, it is my contention that unless a good deal more research and study is given to this problem, then any actions on a national basis to control volume to the United Kingdom is highly dangerous; in fact, Professor Philpott has now recognised this in his researches. My own organisation estimates that in the next ten years the United Kingdom could conceivably consume an extra 5 to 10 million lambs. May I pose the question: who should provide these lambs, and who can provide them? New Zealand has the option because, make no mistake, these lambs will be provided by someone.

Now, having said all this, and this is what makes this problem such a difficult one, we must go back to Professor Philpott's paper and say that in essence he is correct, in that New Zealand should find alternative markets for lambs, not because of some of the reasons that are stated in this paper, but because it is sound trading principle that to have all your eggs in one basket is a dangerous practice. This fact was quickly realised by the meat exporters when meat was handed back to them after decontrol in the United Kingdom. I do not think it is really fully realised or appreciated in this country the efforts and achievements of the meat exporters in this direction. Such achievements have been accomplished in the main by individual enterprise and energy of the meat exporting companies. Certainly, shipping companies have provided the services of shipping, the Government has attempted, and has succeeded in many cases, to clear the political field, and the N.Z. Meat Producers Board has given support in the way of promotion and co-operation with the shipping companies; but, it is true to say the meat exporter has led the way until today we have something like 30 per cent of our total export tonnage going to markets outside the United Kingdom. It is when one reflects on these achievements that, despite the short term difficulties that must face us, the long term does appear very bright indeed, and I believe that contrary to many ideas expressed in this country we should and must encourage primary production and a greater export tonnage from this country. If we fail to expand, our primary industry must die.

With regard to Professor Philpott's arguments and statements concerning the effects of the United Kingdom subsidies, again it might well be said that his paper has over-simplified the case and, therefore, conclusions based thereon can be most misleading. I know Professor Philpott fully appreciates that our total supplies from New Zealand to the United Kingdom form only a small part of the total meat imported or produced in the United Kingdom. Therefore, right from the start, we must get our proportions right; we are indeed a very small frog in a very big pool, and I think all meat traders who are engaged every day of their lives in this industry feel a little silly when they discuss ways and means of little New Zealand so controlling its marketing methods to control, finally, the United Kingdom market. It is rather like the tail trying to wag a very big lion, and before proceeding with further discussions on this particular point, I think the traders' feelings are best summed up by a statement made by Charles B. Shuman, president of the American Farm Bureau Federation, at the annual convention in Chicago, where he said, commenting upon controls and regulations which have governed the U.S.A. agriculture policy:

"We would have been much wiser if we had devoted a small proportion of the manpower, time and money spent during the last fifteen years on futile attempts to control production and rig markets, to sustained efforts to improve the operation of the competitive market."

To return to United Kingdom home subsidies, substantially it is true to say that the United Kingdom has artificially built up its production on a subsidised system and, therefore, it follows that if these subsidies were reduced or withdrawn, the uneconomic farmer would go out of existence and there *might* possibly be a reduction in the volume of production. Notice I have emphasised the word "might," mainly because the United Kingdom farmers are rapidly changing, and have changed, many of their old concepts which have held them back for the past two or three centuries. Scientific stall feeding, combined with improved utilisation of pasture and breeding, together with modern management methods such as company financing and organisation, are rapidly making the United Kingdom farmer a most efficient person and it might well be that if the subsidy was only decreased gradually, this would be a greater incentive for the United Kingdom farmer to improve his organisation and management, and thereby increase his production and lower his costs. Certainly, we must face the possibility that the United Kingdom may well become self-supporting as regards beef supplies, particularly if tariff protection is given; it certainly does not appear that New Zealand will be given any special consideration under the E.E.C. negotiations with regard to beef, but I cannot help at the same time sharing a little of the optimism of Professor Philpott that our lamb marketing might well benefit and, therefore, again at this stage to plan to divert regardless of cost lamb supplies away from the United Kingdom, or perhaps even talk in this vein to the United Kingdom customer, might well be treading on most dangerous ground. Certainly it is vital that the way be left open for us to expand lamb sales in the United Kingdom.

It is here, with regard to developing new markets, that I find it most difficult to accept Professor Philpott's principle that we must at all times be prepared to receive lower prices for our lamb from other markets than what we receive from the United Kingdom. I think today I have shown the weakness in this argument, in that it might never obtain the ultimate goal of a higher price in the United Kingdom. I know, as a trader dealing with an international com-

modity, that eventually a fixed policy of selling at a low price to one particular market can only have disastrous results on your other market or markets. However, it is true to say that traders do at times accept prices from outside markets lower than current United Kingdom prices, particularly if the United Kingdom market looks a little shaky, but it would be true to say that all our markets to date, i.e., 30 per cent of our meat, have been developed on the basis that we should sell at equal or higher prices than the United Kingdom, and in the case of ewes and beef this has been achieved. (I believe the only sound way to do business is on a profitable basis; remove the incentive of reward and the misery of failure and you have little or no prospect of enduring success.) It would have been a very poor outlook for these products, and a poorer one for the farmers, if this had not been done, and this has simply been due to the efforts of the meat exporters. The policy of selling continually at a lower price than the United Kingdom is not only achieving little or nothing in the way of improving prices in the United Kingdom, it also achieves little as to improving our overseas earnings. As I have already stressed, it is one of these dangerous ideas that our master planners make look so appealing.

It is terribly naive and most unrealistic to think that in this modern world today, when news is flashed from one international centre to another at the speed of light, that New Zealand could inaugurate a continuing policy of price favouritism in any one or a number of markets. Such policy could only ultimately destroy the very market which the master planner is attempting to protect. "Goodwill" is a word we hear little of in New Zealand. Unfortunately in our own internal business it has been too often destroyed by protective Government policies, but goodwill in the international sphere plays an important and vital part. Destroy your goodwill and your trade is non-existent. Therefore, again, if we can rationalise, keep our freedom and enterprise and encourage and retain the goodwill of our customer, then we are achieving something. I have not yet worked out how you can retain the goodwill of your customer by running him short of his supplies. You, as farmers, should know this better than I, as you have had to face over many years in New Zealand the frustrations of protected manufacturing industries and import controls.

Therefore, I arrive at my main conclusion, that developments of new markets by New Zealand must be done without harming our present markets, and this has been and is being achieved by the meat exporters, particularly in relation to beef and mutton. Lamb, of course, presents a more difficult problem for us all. Naturally, as it is a product for a highly developed country to buy, our thoughts and energies have turned to the U.S.A. market. Unfortunately, the U.S.A. political scene made it imperative that New Zealand should proceed most cautiously on this market. The Development Company was formed for this reason to deal with countries whose political barriers make it almost impossible for the private trader to expand his sales. With regard to the Meat Export Development Company, may I quote from the Dairy Information Board's statement last week, when replying to Press correspondents. (I should make clear that the Development Company's work is only possible because of the full co-operation which is being received from all meat exporters in this country, including what is often termed here as "overseas companies." These larger companies in fact, because of their size, must provide the Development Company with the greater proportion of the lambs which are to be sold in the U.S.A.) I quote:

"He (the correspondent) will readily appreciate the unwisdom, in a difficult marketing period such as the present, of publicly disclosing too many details of our sales."

I also support Mr John Ormond of the N.Z. Meat Producers Board, who has recently stressed the importance of the N.Z. Government in concluding diplomatic arrangements with the U.S.A., which will allow New Zealand to develop its trade with the U.S.A. However, I would comment and say that whatever the political barriers are, whatever the difficulties we face, we must give each individual problem with regard to the rationalisation of marketing a most close, a most careful study. At all times we must measure the advantages of rationalisation against the losses sustained through removing the vigour and enterprise of the individual, and we must always guard against the danger of those who would exaggerate the short term difficulties of trading merely to gain greater power and control over the freedom of the individual. Perhaps it might well be asked, and I believe this is the answer to our marketing problems, we should see an atmosphere of confidence is created for private enterprise so they can plan and develop their marketings and investments accordingly. No company can do this while threatened with legislation of a restrictive type. The New Zealand Government and Meat Producers Board should give close co-operation to the meat exporters where the meat exporters require it, but I believe the best judge to decide whether this assistance is required is the meat export trader. I would certainly like to see the New Zealand Meat Producers Board working closely with the traders. Today there is little or no close liaison between the trader and the Producers Board. This, I feel, is because the Producers Board is not isolated from the pressures of the extremist, particularly those of political opinion. The New Zealand Meat Producers Board themselves must find a way so that they can listen and act on the practical advice of its farmers and traders. Strong Government leadership would, I feel, achieve this.

I think I might well conclude by quoting Samuel Johnson, speaking to Boswell, when he was discussing this very problem in October, 1769:

"We see now, if corn be dear and butchers' meat cheap, the farmers all apply themselves to the raising of corn till it becomes plentiful and cheap, and then butchers' meat becomes dear, so that an equality is always preserved. No, Sir, let fanciful men do as they will, depend upon it, it is difficult to spoil the system of life."

III. FURTHER COMMENTS ON PROFESSOR PHILPOTT'S PAPER

A. C. Wright, Provincial President, North Canterbury
Federated Farmers.

I am not here to represent anybody in particular, but I am speaking as a primary producer and to some extent as president of the Federated Farmers.

Lamb Prices in Britain. I agree with Professor Philpott that the price of our lamb in Britain is determined by the total supplies of lamb and mutton produced in the U.K. and imported each year, and that the decline in prices in recent years is a result of a rise in supplies. But he should have said total supplies of all meats. If there is an oversupply of beef for instance the price of lamb or any other meat will inevitably fall.

Sheep Meat and Beef Exported in the U.K. and Effect on Imports. The production of sheep meat and beef has greatly increased in recent years and still seems to be increasing in the U.K. Not since 1954 have the U.K. meat imports been at a lower level than they were last year, when her imports were 1.3 million tons—a considerable decrease on the previous year's total of 1.8 million tons.

Last year's imports of lamb and mutton into the U.K. from all countries were 347,000 tons—a reduction on the previous year's total of 375,000 tons. New Zealand supplies to the U.K. went down from 308,000 tons to 289,000 tons, whereas the U.K. production of mutton and lamb increased from 224,000 tons to 264,000 tons.

The same picture applies to beef when her imports were 288,000 tons, by far the lowest figure in recent years and her own home production rose from 820,000 tons in 1960 to 902,000 tons last year.

U.K. Subsidies. So, if the total supplies of meat, and more particularly mutton lamb, have risen in recent years—and risen they have—the question of over supply, if there is one, rests with the U.K. Government, whose subsidy policies in respect of agriculture, including meat, now amount to the enormous sum of £345 million which is greater than New Zealand's total export income; and this I contend is the primary cause of the present setback to our New Zealand economy. It is the home producer who is over-supplying the U.K. market, not New Zealand or any other exporting country.

Supply of New Zealand Meats to the United Kingdom. New Zealand supplies only 10 per cent of the total U.K. supply of meat, so if we were to drop our supplies by 10 per cent it would only amount to 1 per cent of the British supply. This decrease in our supply would most certainly be taken up by our competitors, Australia and Argentina, who were virtually driven out of the U.K. market in 1958-59 when we were shipping over 17 million lambs at an average return of £2.21 per head, to be followed next year by an export into the U.K. of over 18 million lambs for an average return of £2.4 per head.

It will be remembered that 1958-59 season was the drought year in the U.K. and 1959-60 was the year of high profits by the freezing companies.

Political Issues and Reciprocal Trade. Our problem in meat marketing is a political one, not one of trade promotion, in which New Zealand is a long way ahead of other competing exporting countries. To develop other markets we must have a two-way trade; we cannot have a one-way traffic, even taking into account multi-lateral trading. While we are the largest meat exporting country in the world with a very great tonnage of exports, we have in seven years since the end of

bulk purchases built up our sales to markets other than Great Britain to nearly 30 per cent of our tonnage of meat exports and to over 30 different countries, which accounts for over one-third of our meat export earnings. But the U.K. is the only country at present in need of large imports of meat. There are other prospects, but they are long term ones.

Little Hope of Britain Reducing Agricultural Subsidies. I feel that there is no hope of any substantial reduction in British lamb subsidies, or in any of her other agricultural subsidies for that matter, while the U.K. Government's policy of cheap foodstuffs for her people and her aim of more self-sufficiency exists.

I fail to follow Professor Philpott's line of thought or reasoning for that matter—after sending Britain X tons of lamb at £200 per ton, we only receive £40 for the quantity above X tons. That might be right in theory but could work out another way in practice. As happened in 1958-59 when a huge supply of lambs was sent to the U.K. at an average net return of £2.21 per head to be followed in 1959-60 by an even larger number of lambs with an average higher net return of £2.4 per head—an obvious case of extension of the market for lamb.

New Markets for Mutton and Lamb. In regard to new market development, I think that our future lies in the Great Pacific Basin, where already great strides have been made. I refer to Japan, whose total imports of New Zealand meat last year exceeded 26,000 tons of which more than 23,000 tons was mutton. Her standard of living is rising rapidly, but I feel it would be a pity to try and put lamb into Japan at this juncture as it could quite easily mess up our sales of mutton; but eventually as her standard of living rises there will be an opening for lamb. Countries with a low standard of living start by eating the cheaper meat and as their standards rise, eat more of the expensive cuts. Ewe mutton is an attractive meat, rich in proteins, at an inexpensive price. There are also regular sales of mutton to Greece, Jordan, Pacific Islands and the West Indies and elsewhere.

The Meat Export Development Company was set up to do exactly what Professor Philpott sets out in Clause 5: Organisation of Meat Development. The North American market is the only one designated as an undeveloped market in which the M.E.D.C. operates and it can only operate in lamb—all other markets are mutton and beef. It has long been recognised by the Government, the Meat Board and others that in its initial stages the Development Company would make losses and for that reason it was decided not to bring down a balance sheet for five or six years. Any loss that the M.E.D.C. might make should be viewed in the light of a promotional campaign. At the same time one could not make a case for selling lamb at a loss of X/- per carcase for an indefinite period.

Organisation of market development is not just a matter of trade promotion and market research. This work is already well developed. Our future will be determined, not only in the U.K. market, but for markets elsewhere, by political negotiations—and the way will not be easy.

Beef and Lamb Meat Production. While I agree with Professor Philpott that it is easier to find new markets for beef than for lamb, I do not agree that it should be encouraged at the expense of lamb, but complimentary to it. An intensive fat lamb farm is a highly organised efficient producer of lamb meat and very serious changes in market prices for lamb would have to occur before lamb production was reduced in favour of some other source of revenue. There could be a reduction in numbers of lambs fattened on marginal fattening

units where the growing of fattening feed is an expensive item and these places may well be better off with more emphasis on wool production and cattle raising. From the individual farmers' point of view, lamb or mutton with its wool is still the best paying proposition, but when a property is developed to the stage where cattle can be run at no extra cost in regard to topdressing, labour, etc., it may well be that the production of beef is a very payable proposition.

Prices for Beef. I do not see how the beef price can be subsidised in any way, for immediately that happens, you would block the export of any beef to U.S.A. as they will not allow the imports of any subsidised foodstuff.

To sum up, we have to look at production of meat as a whole, not any particular class of meat singularly by itself.

IV. QUESTION TIME

Now these are my views and I personally would like to hear yours.

Chairman: Would Professor Philpott like to reply to the criticisms made by Mr Cameron and Mr Wright?

Philpott: Not at this stage—I would like to hear what everyone else has to say first.

Question (Mr Stephens, Isle of Wight): I am an English butcher and handle 4000 tons of New Zealand meat each year. New Zealand is not a small frog in a big pool but the backbone of the United Kingdom meat market. I would like to ask Mr Cameron if he thinks that the decline in price of New Zealand meat has been due to the New Zealand traders being afraid to ask a higher price on the U.K. market? Further hasn't the promotion and advertising of New Zealand meat been rather neglected in the U.K.?

Cameron: Mr Stephen's question and comment demonstrate the goodwill for New Zealand which exists in the U.K. market. However I feel it would be hard to convince the U.K. butcher that New Zealand meat was worth more particularly as it represents only a small percentage of total meat supplies.

I agree with Professor Philpott that U.K. butchers tend to hold their retail prices steady when wholesale prices fall—but they do the same thing when wholesale prices are high making less profit at this stage. The purpose of this is to keep the price of a product to the customer at a stable price.

An aggressive selling policy is certainly one of the answers to New Zealand's marketing problems. This I believe, is being achieved today by private enterprise.

Question: Wouldn't Mr Cameron agree with Professor Philpott's suggestion that to meet the costs of developing new markets that a Meat Commission might be desirable?

Cameron: I believe that commission marketing would directly oppose any attempts at diversification. Diversification cannot be achieved by centralised control.

Question: Since the meat companies market 80 per cent of the New Zealand meat, why should the New Zealand farmer meet the

cost of advertising and promotional expenses from which the meat operators benefit—rather than the farmer?

Cameron: A broader concept is involved. I believe that there is a need for more co-operation between the Meat Board and the Meat Companies for promotion campaigns. To my knowledge, the Meat Board has never called a meeting along these lines so that plans can be keyed together.

If there is a need for a marketing commission there is equally a need for commission of production. At the present time the killing pattern is extremely costly. If a commission of production were able to control the flow of lambs to the works to avoid high peak loads, then there would be considerable savings. However, I doubt if a commission controlling the activities of farmers would be any more successful than a commission controlling the activities of meat operators. In both cases there are too many difficulties presented by the human element.

Philpott: I am not sure of the true worth of a meat marketing commission but I am more favourable to it than Mr Cameron. The present marketing set-up does not meet all the criteria of a good marketing system. The outstanding example of successful monopoly marketing is the Dairy Producing Marketing Commission (now amalgamated with the Dairy Board as the N.Z. Dairy Production and Marketing Board). It has been able to control the production of cheese and use its influence to swing dairy companies into casein production if the U.K. cheese market showed signs of over-supply or vice versa if there appeared a good market for cheese.

The crucial point upon which Mr Cameron and I disagree is the part of the U.K. meat market with which we should compare our supply of lamb and mutton. Mr Cameron says that compared with total meat of all types on the English market, our supply is a mere drop in the bucket. However, I have not been so naive in my research work as to neglect the influence of variation in supply of beef, poultry and pork on the price of lamb. I have taken all these into account in arriving at my conclusions on the value of extra New Zealand lamb on the British market as being half the average price. I would like to ask Mr Cameron what he thinks the market is for extra lambs in the U.K.?

Cameron: Our research has shown that the U.K. market can take 5 to 10 million more lambs in the next few years.

Philpott: Have your researches indicated the price at which these extra lambs can be sold?

Cameron: If New Zealand can produce lamb profitably at 1/8 pound landed in the U.K.—then we can sell a lot more lambs than we are selling at the moment. Can farmers increase their efficiency and sell profitably at 1/8 per pound? I believe that in the long run prices will rise rather than fall as has been the case in the past.

DEVELOPMENTS IN GRASS GRUB CONTROL

J. M. Kelsey, Entomology Division, D.S.I.R., Lincoln.

Farmers often comment that they are not always getting the grazing hours expected from their improved pasture. This applies probably more to good composition pastures on better type soils than to poorer soils. There are several reasons for this reduced grazing value, one of the most important being need for fertilisers other than superphosphate, but I am concerned here only with grass grub influences on pasture length. Sampling of nearly 70 paddocks closed to grazing for varying periods in the North and South Islands has indicated that farmers cannot afford to have even one grass grub per square foot of pasture. By their feeding on pasture roots, grubs slow down or stop growth in length of leaves. The work showed that whereas in grub-free areas the leaf length could be as much as six to eight inches in four to six weeks, areas of the same paddocks harbouring one to nine grubs per square foot had a leaf length of only one to three inches with the average reduction being over three inches in any four to six weeks over the period from end of January to end of August. This average three-inch reduction in leaf length means a loss of approximately 1500 lbs dry matter or 6750 lbs green matter grazing per acre, so it is obvious that grass grubs are one of the main reasons for reduction in stock grazing hours. This series of sampling was confined to well established, continuous pastures of good composition that at no stage showed what farmers usually consider to be typical grass grub damage.

To stop the above inroads by grubs on productive value of pastures there are DDT-super preparations and pelleted forms of DDT. The former are really only suitable for application in winds of less than five miles per hour by box-type ground topdressers with sacking aprons behind to prevent wind drift. Spinners and 'planes are not suitable methods for applying present forms of DDT-super. Tests indicate that at altitudes of up to 120 feet the loss off the target is close to 10 per cent for each mile of wind velocity, and losses at higher altitudes would be greater still. Pelleted forms of DDT are suitable for spinner or 'plane application at winds of up to 10 miles per hour according to unofficial tests, but such materials would not give as quick grub control as the dry-mix DDT-super. I understand that some fertiliser works are considering preparation of pelleted DDT-super so that the topdressing and grub control could still be carried out in the one operation. Such materials would be similar to DDT pellets in that there would be a great reduction in wind loss when applied by spinner or 'planes, but control of grass grubs would be slower than with dry mix DDT-super.

The effects of recent legislation tend to overlook grub control and place emphasis on materials such as the organophosphorus group which is safe from a produce residue aspect but practically useless for grub control. In general most of the insecticides and formulations that are safest from a residue angle are those least effective in controlling grass grubs. Because of this it was necessary to introduce withholding periods after treatment and before grazing took place again, so that rainfall and new pasture growth produced the insecticide residues on pasture and in export produce. These withholding periods at first glance may appear unpractical but they are worked out on the basis of actual analyses, so they must be adhered to. The farmer is given the full 12 months in which to plan his grub control programme and I strongly advise him to look on grub control as a

routine annual treatment of one third of his farm in the same way that he uses fertilisers annually on the whole farm.

Though new materials are under test, DDT is still the most promising of the insecticides for grass grub control, and as hundreds of farmers have shown in the past it can, if correctly applied, give a spectacular increase in farm returns and at the same time result in no residues in meat or dairy produce.

In conclusion our surveys over a period of 15 years have shown that the whole of the more than 18,500,000 acres of sown pastureland in New Zealand is subject to grass grub damage and the estimated theoretical annual loss in production due to grass grub damage is in excess of £21,000,000.

Question (Mr Slater): What does Mr Kelsey think of the prills so widely advertised by some commercial firms?

Answer: Prills are pelleted materials. They give good cover. The speed of action is as fast as wet mix, though slower than dry mix DDT-super.

Question: What about spraying of DDT for grubs?

Answer: If used on dry pastures this is dangerous! If applied during continuous rainfall, as little as a quarter of an inch rainfall is sufficient to wash the spray off the leaf, but if the spray is allowed to dry on the leaf then at least six inches of continuous rainfall are necessary to make the pasture safe for stock.

Question: How much irrigation is necessary to leach DDT from the soil and make it ineffective?

Answer: There are few figures available but the rainfall required would be at least over 100 inches. The ideal situation is for the DDT to be dispersed through the top three inches. Over the years the loss from leaching is small—as much as six years' protection has been noted on irrigated pastures.

Question: Would Mr Kelsey care to comment on the practice of applying DDT with lime at five hundredweight per acre?

Answer: In the only trials to date satisfactory results were obtained with dressings of two hundredweight per acre. However thorough mixing is essential. This is hard to achieve when large dressings are involved. Furthermore, recent work had shown that DDT tended to break down when stored with lime over long periods.

Question: Is there any evidence to suggest that immunity to DDT is occurring?

Answer: No. There is no evidence to suggest resistance to DDT. In some areas grass grub becomes infected with a Gregarian parasitic worm. This tends to slow down the metabolic processes so that the next generation of beetles does not emerge until the middle of winter. These beetles carry over from one winter to the next. This tends to suggest a resistance to DDT, which in fact is not the case.

DEVELOPMENTS IN DIPPING MATERIALS

P. L. Thomas, Parasitologist, Tasman Vaccine Laboratory Limited, Upper Hutt.

In considering the essential requirements of an insecticide to be used in a sheep dipping preparation, the following points are of paramount importance.

1. The insecticides must kill lice and keds and preferably also kill the larvae (maggots) of the blowflies which attack sheep.
2. It must persist on wool long enough to kill young lice or keds hatching from eggs or pupae which are present in the wool at the time of dipping, if these are unaffected by the insecticide. Preferably it should persist longer, in which case some protection against blowfly strike and against reinfestation by lice and keds from undipped sheep can be expected.
3. It must diffuse down the wool fibres if more than a straight out kill of parasites present at dipping time is required.

A slowly-diffusing material may be used in plunge or shower dipping preparations which are used to saturate the sheep. It only has to move slowly to keep the new growth at the base of the fibre pest proofed.

A material which diffuses rapidly is essential for use in spray race preparations, since it must move from the tips of the wool staple to the base and then keep up with the growth of new wool.

4. If a material is to be used in plunge dipping baths it must remain stable for long periods in the presence of a large volume of (usually) excessively dirty water. This is particularly true in the case of sheep dipping baths in New Zealand which are frequently left unemptied for several weeks, even though this should be condemned as a most unwise practice.

The ideal insecticide from the manufacturer's point of view, is one which is highly effective as a pest destroyer, is stable under all conditions, diffuses rapidly in wool grease and is versatile from the formulating angle.

Aldrin and dieldrin were such materials and could therefore be offered for use in spray races, dusting machines, shower dips or plunge dips and, in the case of the latter, could be made available as liquid dips or powder dips whichever the user desired.

None of the insecticides currently available are so versatile.

Some of the virtues of aldrin and dieldrin were, however, associated with the features which led to their condemnation, which is, that small amounts become dissolved in the body fat.

When applied with spray race these insecticides moved rapidly down to skin level and some went into the fat layer immediately under the skin. Some was then re-excreted through the wax glands and out on to the wool again. Thus, parts of the fleece missed by the spray when it was first applied, soon became impregnated with the insecticide.

In this way any deficiencies in the application were covered up.

The organophosphorus insecticides now in use are destroyed if they enter the body. They cannot be absorbed and re-excreted elsewhere on the fleece. **Parts of the fleece not covered in the initial spraying remain free of the insecticide.** Any deficiencies in the treatment soon show up when conditions become conducive to fly strike.

The new insecticides, therefore, because of the fact that they do not leave residues in fat, demand much more care in the way in which they are applied.

EVALUATION TRIALS WITH AVAILABLE INSECTICIDES

The insecticides currently offered are asuntol, delnav, diazinon and nankor. The initial trials were carried out using saturation methods of application, that is, by plunge or shower dipping.

Blowfly Strike Protection

Laboratory comparative tests have been made at Upper Hutt on sheep exposed throughout the period of the experiment to the Hutt Valley's summer weather, after dipping in all four of these materials used at a concentration of 0.01 per cent. To determine how long they would be protected against fly strike, attempts to induce strike were made each week after treatment, using maggots produced in an insectary. Strikes were achieved on undipped sheep every week.

In these tests, diazinon always well outlasted the others, followed by nankor, asuntol and delnav in that order.

Remember, however, that in these tests all of the insecticides were used at the same strength. When they are sold as sheep dips, for fly protection, diazinon and nankor are recommended for use at twice the concentration used in the comparative tests. Asuntol and delnav are used at five times the trial strength.

In our field trials with plunge baths and shower dips, diazinon has usually given the longest protection, with asuntol and delnav a close second. Nankor gave very variable results though it should be stated that in our trials made some years ago we used a wettable powder formulation made overseas.

Where results with diazinon were less satisfactory than normal, fleece rot or mycotic dermatitis infection was usually found to have left the wool devoid of grease and unable to hold the insecticide in the affected areas.

Results with asuntol and delnav were extremely consistent.

Lice and Ked Control

We have done less detailed work with lice and keds using saturation methods of dipping since we have good reason to believe that while an insecticide will prevent fly strike, it will also remain lethal to lice and keds. Only diazinon, delnav and asuntol have been examined from this aspect.

A complete initial kill and at least three months' protection against reinfestation from undipped sheep infested with either lice or keds can be absolutely relied on. If exposure to reinfestation is severe, some lice or keds may successfully transfer to dipped sheep after three to four months, but it is unlikely that a noticeable infestation will develop in under six months. This applies to all three dips used at the recommended strength.

At the half-strength sometimes recommended it is most unlikely that dipped sheep will become reinfested within three months, but it would not be wise to expect much longer protection.

Importance of Correct Application

These results can be, and regularly are, achieved using the appropriate materials in the manner directed by the manufacturers.

Unsatisfactory results mostly follow non-adherence to the instructions. Admittedly some directions are not too easy to follow. If you are using a product for the first time read the instructions before purchase if you can. The man who is selling the material should be able to explain any points on which you are doubtful. If you can't follow the directions, and the agent cannot help you, go to another agent or get another brand of dip.

If you don't get a chance to read the label before the dip is delivered, then read it and make sure you understand it at least the

day before you start dipping. It is no use looking at the tin for the first time just when you are about to start dipping—finding you can't understand it—making a guess at how to use it—getting poor results and then complaining that the instructions weren't clear.

The recommendations for diazinon, delnav and nankor all include instructions for regular reinforcement. Reinforcement is the addition of extra dip concentrate without extra water at specified intervals. These instructions must be observed particularly with diazinon which is used in an extremely dilute form (one gallon of concentrate mixed with one or two thousand gallons of water). Accurate calibration of the dip bath or the shower dip sump and strict adherence to the reinforcing recommendations, are imperative if the very best results are wanted.

The stripping out, or exhaustion rate, of asuntol is surprisingly low and if the directions are followed closely reinforcing is not necessary, which means that there is one less place to go wrong.

The Use of Bacteriostats

A complication has followed the switch to organophosphorus compounds for plunge dipping. Bacteriostatic agents to prevent the development in the bath of the bacteria which cause after dipping lameness and blackening of the dip on standing, cannot be readily or safely incorporated with most of the insecticide concentrates. This means that the use of a bacteriostat additive is involved.

Once again read the label and use the material exactly as the maker recommends that it should be used. The directions on some bacteriostat additives indicate that they will only keep the bath "sweet" for a limited period, and the same applies in those cases where a bacteriostat has been successfully incorporated into the dip concentrate. You should know the limitations of the preparation you use and stay within the limits. If the directions say discard the dip after a week, do so. Don't be tempted to hold on to it a day longer.

In my opinion, arsenical bacteriostats are the only ones which will stand up to the conditions which some users expect of their dips. Others obviously think differently as alternatives are available, but arsenicals have the added advantage of being valuable in the control of itch-mite.

Bacteriostats are not required in shower dips if they are emptied and cleaned out daily. The same should apply to plunge dips, but this is seldom possible. The state of the bath or the water is rarely as clean as could be desired and I prefer to recommend the use of a bacteriostat every time right from the beginning with a plunge bath.

Conclusions From Spray-race Trials

I have mentioned the need for good diffusion properties in any insecticide used in spray races. In my opinion, diazinon is the only available material which will fulfil these requirements at any time between August and April on sheep with up to three months' wool growth.

For lice and ked control spraying off-shears is to be highly recommended. However, it will not give the degree of protection against reinfestation attained if the spraying is done four to six weeks later when there is sufficient wool to hold a lot more insecticide.

For fly protection, four to six weeks after shearing is again the optimum time to spray.

I have also previously mentioned the need for paying the careful attention to detail now necessary in using spray races for fly strike prevention. It cannot be over-emphasised, particularly as the farmer has a tendency to blame the dip rather than the spray machine (or himself).

I shall make further mention of spray-race treatment later.

WHEN TO DIP AND HOW TO DIP

Pre-lamb Shearing:

For lice and ked control, as previously mentioned, spraying off-shears is normally recommended. However, if you are pre-lamb shearing, this will not be enough unless you shear and spray everything on the place that has wool on at the same time. Follow this up by keeping all stragglers out and shear and spray anything that you buy in.

It is no use spraying the ewes and forgetting the other sheep on the place. If the neighbours don't practice pre-lamb shearing you will always run the risk of reinfestation. If your flock is lousy, spray after pre-lamb shearing by all means—it will help to keep the lambs free, but follow up with a thorough saturation dipping as soon after weaning the lambs as possible. Dip everything on the place at the same time.

It is impossible to get adequate control of itchmite in sheep which are treated after the pre-lambing shearing. Spray race treatment is not adequately effective and the ewes cannot be safely plunged or shower dipped until well after lambing when there is too much wool to get good results.

Pre-lamb shearing is in fact very difficult to work in with any easy inexpensive dipping programme. If it is worthwhile, then the difficulty and expense of plunge dipping or shower dipping later in the year when the sheep have several months' wool, must be balanced against the benefits of the early shearing.

Normal Shearing

Lice and ked control and a good measure of protection against reinfestation can be achieved with any of the plunge or shower dipping materials available or with diazinon used on sheep with about six weeks' wool in a spray race. Arsenic/derris dips give little protection against reinfestation by keds, but otherwise three months' freedom from lice and keds can be expected.

Blowfly strike protection for a short period (probably about one month) can also be expected from the treatments just mentioned (apart from arsenic/derris), when used on sheep with four to six weeks' wool.

Those of you who are looking for blowfly strike protection with spray races should consider carefully when the danger periods are and then plan to give the sheep the benefit of immediate treatment just before trouble is expected. A common pattern in the northern part of the South Island is for strike to be most prevalent around the beginning of December and towards the end of February. Under these conditions it is better to give two treatments at the insecticide concentration recommended as giving short-term protection just when trouble is expected, or even when it first starts. With luck and a poor season for flies, you will only need to treat once. In any case, you will get better protection at the most critical periods, for no greater material expense, than if you tried for long term fly protection at the beginning of December. Such long-term treatment is bound to be getting a bit unreliable by the end of February and should be avoided if possible. Don't forget that shearing is a good method of preventing fly strike. Well shorn sheep with any cuts properly treated should remain unworried to any extent for three to four weeks, so don't waste expensive material putting it on off-shears. Put it on a month later when it will be much more necessary and far more effective.

Longer Fly-strike Protection by Plunge or Shower Dipping

Fly-strike protection by plunge or shower dipping can be achieved by taking your choice of the materials offered, following the directions and remembering the points made earlier. Again, dipping when

the sheep have about one month's growth of wool is preferable to dipping closer to shearing time. According to the mixing rates followed, it should be possible to get good protection for one, two and sometimes three months.

Itchmite

Treatment should be applied by plunge or shower dipping using an arsenical dip or an organophosphorus dip in association with an arsenical bacteriostat used at the appropriate concentration for itchmite control (normally twice the strength recommended for bacteriostasis only). The time to do it is as soon after shearing as possible after allowing all shear cuts to heal properly.

The use of diazinon alone will prevent the spread of infestation in lightly infested flocks, but the extra arsenic to give much improved results can be added at little extra cost, so there appears to be little point in relying on the diazinon alone.

PROBLEMS ASSOCIATED WITH DIPPING PRACTICES

More arsenic has been used in dipping this year than for quite a few years past. Deaths after dipping have been encountered more frequently this year than for quite a few years past. Arsenic has therefore been blamed. However, a lot of sheep have died after dipping with materials other than arsenic; quite a few have died after drenching and many have died after not having any sort of treatment.

This year, a high proportion of these deaths were due to what is termed *Pasteurella pneumonia* or Southland pneumonia because it tends to be more prevalent there. This is a low grade form of pneumonia which causes a slow decline in health. Recovery is usually gradual. In sheep not obviously affected, the stress of any such operation as dipping, drenching, crutching or sometimes only mustering will frequently result in the death of a number of animals.

The prevalence of *Pasteurella pneumonia* in some years and relative absence in others is apparently related to seasonal weather conditions. Perhaps its frequency this year is due more to atom bomb tests than to the use of arsenic in sheep dips!

Deaths from pneumonia due to exposure to adverse conditions following dipping are a well recognised hazard associated with dipping. This needs no comment except that it will always be with us while farmers continue to dip their sheep in the face of a weather forecast indicating a cold snap, or as long as cold snaps develop in the face of a forecast for settled warm weather.

Pneumonia may also be caused by the accidental aspiration of dipping wash into the lungs. In this instance, arsenical preparations may be more severe than some others, but as distilled water can give the same end result it is difficult to judge the relative risk, which in any case should not exist. Dip on the lungs is the result of careless dipping, and it is worth noting that the correct use of the dipping crutch seems to be a disappearing art in some places!

There are other problems which arise following dipping, but it happens only very rarely that a material offered by an experienced dip manufacturer and used in accordance with directions can be justly blamed. If you do have trouble, shout out, not all over the neighbourhood, but to your supplier or direct to the manufacturer. The manufacturer will usually ask your local veterinary surgeon to make an independent examination at their expense, and provide any additional technical help which may be required should more detailed investigation be necessary.

Toxicity

The toxicity of organophosphorus compounds to humans has been very much publicised and wrong impressions have been created with regard to some of the insecticides in this group. The confusion arises

because the group contains some extremely deadly materials and also some very safe materials. Without going into details, it can be said, however, that the materials used for sheep dipping are less likely to give rise to poisoning than were aldrin and dieldrin. Moreover there are effective antidotes. It would be quite a good idea if all farm first-aid boxes were equipped with an organophosphorus antidote in the form of atropine tablets which can be obtained from your local chemist. Provided reasonable care is taken the need to use them should never arise.

Dipping Costs

Much has been said on the increased cost of dipping now that aldrin and dieldrin are no longer with us. While some increase in cost cannot be denied, several sound ways of economising are frequently ignored.

I have recommended, for example, in the use of spray race treatment for protecting sheep against fly strike, a programme of providing for two treatments at the level recommended as giving short term protection. This takes advantage of the fact that shearing usually provides a fair degree of protection for a few weeks without the need for an overall treatment with insecticide, provided that shear cuts are kept to a minimum or are properly treated. Frequently, a second treatment will be unnecessary—thus halving the cost. Remember, however, that one treatment must be given within three months of shearing if it is to be recognised as dipping as required by law.

Plunge or shower dipping within six weeks of shearing is recommended on the grounds of maximum efficiency and greatest economy. It is frequently overlooked how much the cost of dipping increases when sheep with several months' growth of wool are treated. With diazinon used at the short-term fly protection rate in a plunge bath for example, 2500 sheep dipped within six weeks of shearing could be treated for approximately £30. If the sheep are dipped with three or four months' wool the price goes up by £10.

Those of you with shower dips should find out all you can about the continuous replenishment method of operation, and anyone having one of these installed should insist on it being constructed to utilise this new method of use. It takes very little to modify existing showers and actually saves money on the installation of a new shower. Up to £5 per 1000 sheep treated can be saved in operation costs and better results obtained with less effort.

In short, there is a lot of room for economy in the use of these new materials which you can get without cutting down the efficiency. In many cases this will off-set the increased cost of dipping materials.

Question (Prof. Coop): Are copper sulphate and zinc sulphate (used for the prevention of mycotic dermatitis) compatible with present insecticides?

Answer: Though copper sulphate is incompatible with diazinon, zinc sulphate is compatible. I can only speak for diazinon. I have no knowledge of the properties of the other organophosphorus preparations.

Question (Mr Cavanagh): Has any effort been made to get the price of dipping materials below the price of £10 per gallon? If we use greater quantities, will the price decline?

Answer: One gallon of diazinon makes one to two thousand gallons of wash, whereas one gallon of the older dips only makes two to three hundred gallons of wash. Therefore the price differential is not very great. There is no possibility of a reduction in price as diazinon does not have the wide range of uses associated with aldrin and dieldrin, which enables low cost production because of high output.

DRUGS FOR THE CONTROL OF INTERNAL PARASITES IN SHEEP

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Anthelmintics or anti-worm drugs have been widely used to control internal parasites which constitute one of the major problems of the sheep industry in New Zealand and in other sheep-raising countries. With the development of more effective products together with a better understanding of the parasites concerned, it is probably that drugs will play an even more prominent part in the future.

To use anthelmintics most effectively it is necessary to know as much as possible about the different kinds of parasites, their life cycles, seasonal changes in population, how they injure the host animal, what numbers are usually required to produce symptoms of parasite disease, and the factors such as good nutrition and immunity production, which help the sheep to offset the injurious effects of the parasites and ultimately to get rid of them.

Types of Round Worms

There are about a dozen different types of round worms in sheep, of which perhaps six or seven are of importance as common causes of trouble. In the fourth compartment of the stomach, there are three species which are commonly called the large (*Haemonchus*), the medium (*Ostertagia*) and the small (*Trichostrongylus*) stomach worms; in the small intestine there are the black scour worms (*Trichostrongylus* species), *Nematodirus*, *Cooperia*, *Strongyloides* and the hook worms (*Bunostomum*); and in the large bowel *Chabertia*, *Oesophagostomum* species and *Trichuris*, which in general are rather unimportant in New Zealand.

The Life Cycle

The life cycle of all these types is approximately the same. The adult females lay enormous numbers of eggs which pass out in the droppings. The larvae which hatch from these eggs in 24 to 36 hours reach the infective stage in about five to seven days. These infective larvae, which can survive for many months in the soil and on pasture, are ingested, penetrate the lining of the gut where they develop for a while, pass into the cavity of the stomach or intestine, grow to adults, mate and the females commence egg laying about three weeks after the infective larvae have been ingested.

From this cycle two things are clear. Firstly, every worm the sheep has must have been picked up from the pasture—they do not, like bacteria, multiply within the body—and second, even if by treatment it were possible to remove all the parasites, both larval and adult forms, from the body of the sheep, in three weeks' time it could be heavily infested again if placed back on highly contaminated pasture.

The Effect on the Host

Because they affect the host animal in different ways, it takes more of some species of parasites to produce disease than of others. For example, 1000 large stomach worms, because they are such active blood suckers, may lead to a severe anaemia with heavy losses in a matter of a few weeks. Fortunately this particular species is not common in the Canterbury plains, but it does occur where there are warm summer rains, as for example in some parts of the foothills and in much of the North Island.

On the other hand it may take 20,000 medium stomach worms and perhaps 30,000 black-scour worms in the intestine to produce symptoms of worm infestation, usually in the form of scouring and

unthriftiness. These types, living on the food digested by the host animal, deprive it of a significant amount of its mineral and other food requirements and in effect starve it to death. These types are two of the most important causes of trouble in the South Island.

Thirdly, as an example of another way in which a worm parasite may cause disease we can take the case of *Nematodirus*. Under certain seasonal conditions, a massive infestation of the mucous membrane of the intestine by the larvae of this species can cause severe symptoms in unweaned lambs even before many of the parasites have reached the stage of egg laying. To be effective against this type of infestation, therefore, a drug has to kill the larval or immature forms while they are embedded in the mucous membrane.

These three examples serve to illustrate some of the ways in which these types of parasites bring about disease. What one finds in the field, however, is not a pure infestation with any one of these species, but a mixed infestation with all the species mentioned, usually with one or more types predominating according to region, climate, season of the year, husbandry practice and management. The influence of these environmental factors on the build up and decline in numbers of the various stages of the parasites, both within the host and on the pasture, requires intensive investigation. It is important to remember that the effects of parasitism can be markedly reduced by good feeding and management and the avoiding of stress of any kind.

Finally it should be noted that, with time and exposure to parasites, the host animal develops a resistance or partial immunity which leads to a state of affairs often described as "a happy parasite in a happy host." This is the situation in most adult sheep unless their resistance is reduced by any stress. Apart from *Haemonchosis*, parasitic disease in New Zealand is thus a condition principally of young sheep up to the age of about one year.

Anthelmintics

The ideal drug would be one which removes or prevents the development of both the adult and immature forms of all the parasite species present, is completely non-toxic to the host, is easy and safe to administer, leaves no harmful residues in the tissues when the animal is used for meat, and has no other deleterious effects, such as staining of the fleece, and at the same time, does not suppress the development of immunity. Such a drug at the moment is highly theoretical but progress is being made towards this ideal.

The drugs available at the present time can be broadly classified into two categories—special purpose drugs with high activity against one, or at most, a few species, and general purpose drugs with usually a lower over-all activity against a wide range of species.

Phenothiazine

The advent of Phenothiazine, the first of the broad-spectrum anthelmintics, marked a turning point in the control of worm parasites by the use of drugs. Before this, reliance had to be placed on such things as bluestone, bluestone and nicotine, with and without arsenic, carbon tetrachloride and tetrachlorethylene, all of which had the disadvantage of a narrow spectrum of activity, in that they controlled only a few of the important species, a low or variable activity against immature forms and high or erratic toxicity.

Phenothiazine, on the other hand, now that marked improvements have been made in its quality by increasing its purity and fineness of grinding, has a relatively high activity against many of the important species of parasites. Against this, of course, must be put the disadvantage that, being a fixed dye, it can lead to staining of the fleece, unexplained toxicity occasionally occurs, the effective dose is rather large for easy handling and there is evidence in some parts

of the world—not in New Zealand—that certain species of parasites have developed a resistance to its activity, perhaps as a consequence of the widespread local practice of low level feeding in stock feeds or mineral licks. Despite these handicaps phenothiazine still remains a valuable general purpose worm drench.

Its greatest weakness, perhaps, and this is shared with certain other drugs, is its somewhat erratic activity against the medium stomach worm and the black-scour worm, an aspect improved somewhat by increasing the dose rate or "dose area", since it is now becoming the practice to assess anthelmintic activity in terms of both weight and particle size. The cost per lamb dose is about fourpence halfpenny.

The Organo-Phosphorus Compounds

Belonging to this remarkable group of compounds are tetraethylpyrophosphate (T.E.P.P.), parathion, malathion, ronnel (also known as Trolene and Korlan), coumaphos (Co-Ral, Asuntol, Bayer 21/199), diazinon, Bayer L 13/59 (Neguvon, Dipterex, Dylox), Ruelene (Montrel) and many others.

Once considered as a group to be too toxic for use on animals, certain organo-phosphorus compounds have now been developed to allow their remarkable insecticidal and parasiticial properties to be used with relative safety in the control of both external and internal parasites of sheep. Many people are now familiar with the use of compounds such as diazinon, Korlan and Asuntol for the control of the common external parasites of sheep. It is perhaps not so widely known that some of them have provided, for the first time, effective means of controlling other insect parasites of sheep, for example, the sheep nostril fly.

Of the compounds developed or being developed for use against the worm parasites of sheep, Montrel (Ruelene, Kempak, Salisan), Neguvon, Co-Ral and Neguvon A, a combination of Neguvon and Co-Ral, are perhaps the best known.

Neguvon A has been most widely tested and used in South Africa where it is generally regarded as effective against the large stomach worm and hook worm and *Nematodirus* in the small intestine. In South Africa it is recommended that for greatest efficiency, dosing be preceded by giving a small dose of bluestone to cause the drug to pass straight to the fourth stomach. Having to do this is a disadvantage. This drug is not on the market in New Zealand.

Neguvon is on the market in New Zealand where, for sheep, it is recommended for the control of the large stomach worm. At the dose rate recommended, however, it gives a measure of control of the sheep nostril fly. It is best regarded, therefore, as a special purpose drug.

Co-Ral, which is undergoing trials in New Zealand at the present time, apparently has a wider spectrum of activity.

These drugs have the advantages of low cost and non-staining, but the disadvantage that the margin between the effective dose and the toxic dose is relatively narrow, so that more than the usual care must be taken to adjust the dose to the liveweight of the animal. Furthermore the risk of toxicity is increased by conditions tending to throw a strain on the liver.

Montrel (Ruelene) is now being marketed in New Zealand under the name of Kempak and Salisan in a new formulation developed in Australia for use in sheep, in which the active agent is dissolved in an oil base. Montrel has a somewhat lower toxicity than other commonly used organo-phosphorus compounds and this has been further reduced by formulation in the oil base which apparently has the effect of slowing up the rate of absorption.

This compound has now been fairly widely used in Australia and New Zealand. In general, it may be said to have an efficiency re-

sembling that of phenothiazine but with a narrower spectrum, in that it has little activity against *Nematodirus* and the species found in the large intestine. As a precaution against untoward effects, it is recommended that sheep be brought in, dosed and returned immediately to pasture, thus avoiding periods of fasting and other forms of stress imposed when drenching is combined with operations such as crutching, shearing and footrotting. Hand fed sheep which are housed or penned should not be dosed and since the dose is rather small, care should be taken to check the delivery rate of the drenching gun and to avoid squirting the drug into the trachea. At normal dose rates, the drug is about the same price as phenothiazine and, in common with the other organo-phosphates, there is a specific antidote—atropine—in the event of accidental overdosing.

Bephenium Compounds

Bephenium embonate (Frantin) was developed in England specifically for the control of *Nematodirus* species—both adults and larvae—which are such a serious problem in lambs in certain parts of the United Kingdom. These species can also cause trouble under certain conditions in New Zealand, particularly in parts of the South Island.

In addition this drug is quite effective against the large stomach worm, *Haemonchus*, and *Cooperia*, but its efficiency against other important worms in the stomach and intestines is generally low or erratic. Its spectrum of activity, therefore, is rather narrow and further the price at the moment is relatively high, about 14 to 16 pence. It is perhaps best regarded as a special purpose drug to be used when *Nematodirus* is the major problem.

A similar compound, bephenium hydroxynaphthoate (Franten) is now tending to replace the original embonate, in that it has a somewhat wider spectrum.

Methyridine

This compound is being sold at present under the trade names of Promintic and Mintic which differ only in that the former is formulated for injection under the skin while the latter is for oral administration. After absorption respectively from the site of injection or through the rumen wall into the blood, the drug is excreted into the gut along its whole length from the stomach to the large intestine. It is highly effective against most of the parasites, both adults and larvae, found in the small and large intestines. Any weakness it may have is restricted to its low or erratic activity against the large and medium stomach worms, in that the acidity of the stomach interferes somewhat with its anthelmintic action. It is more expensive than phenothiazine—about 10 to 12 pence, has the disadvantage of attacking the rubber and metal parts of dosing equipment if left in contact with them and there is no specific antidote in the event of accidental overdosage other things being equal, the drench formulation is to be preferred for general use in sheep.

Arsenic Compounds

Cestagon, the active ingredient of which is arsenic is a special purpose drug designed specifically for the control of the sheep tape worm, *Moniezia expansa* and, while it is effective against the large stomach worm, it has little or no activity against the other round worms. Its use, therefore, is rather restricted to those areas, mainly in the North Island, where tape worm is a problem. A similar compound called Monekil S is used for the same purposes.

Thiabendazole

This new product which was first placed on the market in New South Wales a few months ago under the trade name of Thibenzole has been fairly widely tested in New Zealand. All the evidence indicates that this drug will prove a distinct advance in the practice of

worm parasite control by anthelmintics. It is highly effective against all of the important species found in the stomach and small and large intestines, in both adult and larval stages. It is non-staining, palatable, easy to administer and has a wide margin of safety even apparently when given to ewes in advanced pregnancy. It is anticipated that the price per lamb dose will be about sixpence and that limited supplies will be available in New Zealand later this year.

This brief account of the newer anthelmintics shows that we have now, for the first time, drugs that are capable of giving almost complete control of the round worms infesting the gut of sheep. We can be certain that equally or even more effective products of this type will be developed in the future. We can be reasonably certain too that equally significant advances will be made in other methods of parasite control, particularly in these of vaccines to augment the development of immunity and possibly also in ways of attacking the free living stages—eggs and larvae—on the ground.

What we lack at the present time, in my opinion, is adequate fundamental knowledge of the epidemiology of the different species of parasites in the various regions of New Zealand to permit us to see these highly efficient agents to best advantage. In the past, we have concentrated too much on what is called "tactical drenching"; in other words, when sheep showed signs of parasitic disease, we have treated them. Organised preventative measures or "strategic drenching" have of necessity been haphazard and based largely on faith, hope and tradition. This is not good enough. If we are to use these drugs effectively and economically, we must know more about the effects of environmental factors such as climate, season, pasture management and husbandry practice on the regional distribution of the various species and on the changes in parasite populations both within the animal and on the ground. Only then will we be able to devise a soundly based strategic worm control programme for any given sheep-producing region in New Zealand. Some information of a general nature is available but I believe it is inadequate for our purposes. We need accurate data that can come only from an intensive local study of the problem. If you share this view, I am sure you will be anxious, perhaps through this organisation of farmers, to consider ways of providing funds to finance an adequate research programme for this area.

In the meantime, since parasite control by drugs has become a highly technical procedure, farmers are well advised to consult their local veterinarians on these matters so that each drug is used to best advantage from the point of view of efficiency, cost and safety.

Question: Is there any wool staining with products other than phenothiazine?

Answer: Phenothiazine is the only product to cause wool staining.

Question: Under what circumstances would you suggest a mantic or promintic drench instead of phenothiazine?

Answer: It is better for farmers to drench rather than use materials requiring injection. If the trouble is due to the large stomach worm (*Haemonchus*). Phenothiazine is best because mantic and promintic are erratic in their control. On the other hand if the black scour worm is causing trouble then promintic is a little better.

Question: Does the dosage of Thiabendazole have to be regulated according to body weight (as others have to be)?

Answer: Thiabendazole is very safe at five to six times the therapeutic dose, but economic considerations suggest using as little as possible. It must be stressed however that this drench has not been tested extensively in New Zealand.

FERTILISERS ON CEREALS

C. C. McLeod, Farm Advisory Officer, Department of
Agriculture, Timaru.

This paper on the fertiliser requirements of the cereals, wheat, oats and barley, outlines the results of Department of Agriculture's cereal manuring trials conducted on farmers' properties throughout Canterbury, Marlborough and North Otago, and gives recommendations for cereal manuring.

Introduction

From the time of arrival of the early pioneers until the turn of the century, almost no manure was sown with wheat, oats, and barley. Arable farmers during this period were cashing in on the natural fertility of the soil.

By 1900, however, the depletion of much of this native fertility, the absence of fertiliser usage, and the lack of any rotational system of farming, had caused a rapid decline in cereal crop yields.

Shortly after 1900 the availability of fertilisers, particularly from freezing works, the advent of seed drills with manure boxes attached which enabled seed and manure to be sown together, and better crop varieties, gave an impetus to the yields of cereal crops.

From approximately 1900 until the 1914-18 war, the fertiliser most popularly used was a mixture of blood and bone, guano and Japanese superphosphate. This mixture was drilled with the seed at the rate of one to two hundredweight per acre.

After the Great War the use of imported superphosphate and freezing works' fertilisers for sowing with cereals declined very rapidly. In their place, locally manufactured superphosphate assumed a more and more dominant role until at the present time it is almost the only fertiliser applied to wheat, oats, and barley.

Autumn Wheat

As mentioned previously the drilling of superphosphate with cereals became almost standard practice after the 1914-18 war. At that time one hundredweight of superphosphate was recommended for wheat in Canterbury.

In 1923 the Department of Agriculture commenced an intensive series of autumn sown wheat manuring experiments on farmers' properties.

By 1934, after eleven years of investigation, in 124 trials one hundredweight of superphosphate had given an average yield of 4.1 bushels per acre compared with no manure. Only 16 of the 124 trials did not give a statistically significant yield increase. The range of yield increase was 0.2 to 13.8 bushels per acre. In the same trials the increase in yield comparing one and two hundredweight of superphosphate was only 0.2 bushels per acre.

As a result of these investigations the sowing of one hundredweight superphosphate per acre with wheat was recommended. The 1923-34 wheat experiments also showed that:

- (1) One hundredweight of superphosphate gave these yield increases regardless of the previous crop, for example, grass, wheat, peas, rape or potatoes.

- (2) 44/66 superphosphate was superior to all other forms of phosphate including reverted and serpentine superphosphate.
- (3) The application of potash gave no significant increase in yield and frequently depressed germination and establishment.
- (4) There was no yield increase where superphosphate was top-dressed in the spring.
- (5) The application of one ton of lime per acre at drilling gave very slight yield increases.
- (6) In 129 trials, the spring application of nitrogenous fertilisers to autumn sown wheat gave an average increase in yield of 4.1 bushels per acre but the results were extremely variable.

Since 1929, wheat yield increases due to the use of phosphates have fallen appreciably. About 1930 increases were in the order of four to six bushels per acre.

From 1940 to 1946 the increase dropped to about one and a half bushels per acre. Vastly improved farm management practices, large increases in stock carrying capacity, a rapid build-up in soil fertility and the decline in wheat acreage caused this fall in wheat manuring responses.

In 1952 a five-year wheat manurial project was commenced by the Department of Agriculture. During the next five years 58 autumn sown trials were conducted in Canterbury and North Otago and gave the following results:

- (1) The average increase in yield with one hundredweight of superphosphate compared with no manure was 0.9 bushels per acre. The range was minus 2.9 to plus 8.3 bushels per acre.
- (2) The average increase in yield with two hundredweight of superphosphate compared with no manure was only 1.2 bushels per acre. The yield range in this case was minus 4.8 to plus 11.5 bushels per acre.

In 196 trials between 1927 and 1951 the average increase in yield with one hundredweight of sulphate of ammonia both drilled with the seed and top-dressed in the spring was 2.8 bushels per acre. Wheat after grass showed little response and the main increase was when wheat followed wheat.

In the 1952 to 1956 series of investigations the application of nitrogenous fertilisers gave the following results:

- (1) The average increase in yield with one hundredweight sulphate of ammonia drilled with the seed was 2.2 bushels per acre. The range in yield was minus 3.2 to plus 6.3 bushels per acre.
- (2) The average increase in yield with one hundredweight of sulphate of ammonia top-dressed in the spring was 1.8 bushels per acre.

The range in yield was minus 5.5 to plus 7.3 bushels per acre.

The trial results show that very small responses were obtained with the application of either superphosphate or sulphate of ammonia to autumn sown wheat.

The trials were carried out on farms throughout Canterbury and North Otago. The small yield increases were obtained regardless of locality, soil type or previous crop. The previous crops included grass, peas, rape, potatoes, lucerne, turnips and wheat. Even with wheat as the previous crop only slight responses to nitrogenous and phosphatic manures were obtained.

Although autumn sown wheat yield differences between no manure and phosphate treated are slight at harvest, very striking

differences are frequently observed from the time of plant emergence until approximately October.

It is usual to observe that the phosphate treated crop emerges first, grows more rapidly, is taller, more flaggy in the leaf and a darker green than crops sown without manure. These differences continue until October after which time differences in growth are hard to detect.

These present day observations are identical with those described in the Journal of Agriculture for April 1929. The only difference between then and now is that in the 1920's although no manure and superphosphate treated crops had evened up by November yield differences did occur at harvest. Today that is usually not the case.

The superior early vigour of autumn sown wheat crops drilled with superphosphate frequently misleads farmers into discrediting sowing without manure. As mentioned previously crops drilled with and without manure have usually evened up by October.

On occasions the increased vigour of wheat drilled with manure can be a disadvantage. For example in a mildew susceptible variety such as Aotea, due to increased flagginess, more mildew and reduced yields can occur. On the other hand, where spring grazing is desired manuring would be an advantage.

As a result of the 1952-56 series of trials and field observations the sowing of superphosphate with autumn sown wheat in Canterbury and North Otago is considered unnecessary.

Many farmers, however, may be of the opinion that superphosphate sown with wheat can at least do little harm and many consider that if the wheat crop does not use the manure subsequent crops will.

My view is that the residual effect of superphosphate drilled with wheat is of minor importance compared with the effect of superphosphate actually drilled with the next crop. For this reason I contend it would be better to save the superphosphate for the next crop.

The post-war trials were conducted when meat growing was of rather limited popularity. In the last three to four years, this popularity has increased and areas once considered marginal for wheat are likely to be brought into production. For example, the foothills and light plains soils. When this occurs it is possible that because of lower fertility and/or difficult climatic conditions such crops will require superphosphate.

In order to determine if this is so, the Department of Agriculture is conducting wheat manuring trials on these marginal wheat soils.

In the 1952-56 series of trials nitrogen application in the form of one hundredweight of sulphate of ammonia per acre gave extremely variable results. For example, minus 5.5 bushels to plus 7.3 bushels per acre for an average increase of 1.8 bushels per acre with one hundredweight of sulphate of ammonia topdressed in the spring.

This variability occurred regardless of the previous crop. Features of nitrogen application are increased leaf flagginess, delayed maturity, sometimes lodging and in mildew susceptible varieties such as Aotea more mildew and reduced yields.

Because of the variable results obtained, the use of nitrogenous fertilisers is not recommended unless the crop is looking yellow and unthrifty in the spring. If this is the case one hundredweight of sulphate of ammonia should be applied in September. Usually later applications will not give as large increases in yield.

Spring Wheat

Although yield increases with superphosphate on autumn sown wheat have been very small an entirely different picture is obtained with spring sown crops.

In spring sown wheat large yield increases (8 to 10 bushels) have been gained with the application of superphosphate. Compared with autumn sown wheat the same differences in vigour between spring crops sown with and without superphosphate are obtained. In the case of spring sown crops, however, the differences remain permanent and yield increases with superphosphate are usually obtained.

It has been found that in spring sown crops wheat drilled with superphosphate tillers better, has more heads, longer and better filled ears and gives higher yields than spring wheat drilled without manure.

In contrast autumn sown wheat drilled with and without superphosphate usually does not differ significantly in tillers per plant, number of heads or yield.

As examples of these manurial effects compare two South Canterbury wheat manuring trials, one autumn and the other spring:

(a) Landsborough Trial (Autumn Sown)

(Germination and head counts are per 10ft. of row.)

	Germination	Tillers per Plant	No. Heads	Yield in bus. per acre
No super ..	157	3.16	288	87.5
One cwt. super	149	3.28	304	88.6

Differences were not significant.

(b) Orari Trial (Spring Sown)

	Germination	Tillers per Plant	No. Heads	Yield in bus. per acre
No super ..	129	3.10	258	69.3
One cwt. super.	128	3.96	291	79.3

The tillers per plant, number and size of heads, and yields were significantly different.

The main reason for the differences between autumn and spring sown wheat crop responses to superphosphate appears to be the time the crop is in the ground. In the case of autumn sown wheat its growth period is usually four to five months longer than that of spring sown wheat. This time lag appears to allow unmanured autumn sown crops to catch up with crops drilled with superphosphate. Because of the increased yields, one hundredweight of superphosphate per acre is recommended for spring sown wheat.

Miscellaneous Wheat Manuring Trials

In autumn sown irrigated wheat trials conducted at Winchmore Irrigation Research Station, Ashburton, slight yield increases were obtained with superphosphate, there were no increases with one ton lime per acre, there were slight depressions in yield with the application of potash and an average of 3.8 bushels per acre with one hundredweight of sulphate of ammonia topdressed in the spring.

Other manuring experiments in which wheat crops were sprayed with copper sulphate, or sodium molybdate have given very variable and inconclusive results. Similarly crops drilled with gypsum (sulphur) have given insignificant yield increases.

The application of 20 pounds of manganese sulphate per acre can, however, give large yield increases in crops suffering from manganese deficiency. This deficiency usually occurs on sandy soils such as the Waimakariri and Paparua sandy loams.

Barley

As almost all malting barley is spring sown, barley manurial trials have also been drilled in the spring. These have shown that, like spring sown wheat, barley responds very well to superphosphate.

In 32 trials conducted in Marlborough, Canterbury and North Otago during 1958 to 1961, 20 gave significant increases with superphosphate. Compared with no manure one hundredweight of superphosphate gave an average increase in yield of seven bushels per acre. Two hundredweight of superphosphate gave an additional increase of only two bushels per acre.

The sowing of superphosphate with barley favours more rapid establishment, increased vigour and leafiness and compared with no manure this difference usually remains permanent until harvest.

Because of Marlborough, Canterbury and North Otago's fairly low summer rainfall, barley usually cannot utilise heavy dressings of phosphatic manure.

Quite frequently where more than two hundredweight per acre has been drilled post harvest cultivation shows a considerable amount of manure remaining unused in the drills.

Significant yield increases with more than one to one and a half hundredweight of superphosphate usually occur in abnormally wet summers only.

The topdressing of nitrogenous manure on barley causes delayed maturity, quite frequently lodging and difficult harvesting, and reduced yields. In addition it can increase the nitrogen content of the seed to a level which affects its malting quality.

As a result of the trials, manurial recommendations for malting barley are drill one to one and a half hundredweight of superphosphate with the seed. For the reasons mentioned nitrogenous fertilisers are not recommended for malting barley.

Oats

Spring sown milling oat manurial trials have given fertiliser responses very similar to those obtained in the barley manurial trials. These are, yield increases of 8 to 10 bushels with one hundredweight of superphosphate, compared with no manure, very slight additional increases with more than one to one and a half hundredweight of superphosphate and delayed maturity, lodging, difficult harvesting and frequently reduced yields with nitrogen application.

As a result the recommended fertiliser for spring sown oats is one to one and a half hundredweight of superphosphate per acre at drilling.

Because of the very limited area of autumn sown milling oats the Department has not carried out manurial trials with autumn sown crops.

Cereal Greenfeeds

Cereal greenfeeds such as oats, barley and ryecorn are frequently sown in the autumn for the provision of supplementary winter feed.

It will be remembered that in autumn sown wheat, superphosphate is superior to no manure in stimulating leaf growth but that

after October the plants in both treatments have usually evened up to give similar yields at harvest.

As leaf growth and not seed yield is required with cereal greenfeeds and the crop would be grazed before this evening up has taken place it is a definite advantage to sow cereal greenfeeds with superphosphate.

Greenfeeds are usually sown after a cereal seed crop and typically such areas are nitrogen deficient after harvest. For this reason the application of nitrogenous fertilisers to greenfeeds can give very large increases in crop growth. The application of nitrogen stimulates leaf production the plant becoming a much darker green, broader in the leaf, taller and more dense.

Nitrogen on greenfeed trials conducted in South Canterbury has shown two important features:

- (1) Nitrogen application can give large increases in greenfeed production.
- (2) Responses to nitrogen topdressed when the crop is two to three inches high are much superior to those gained by drilling nitrogen with the seed. Two trials illustrate this trend:

(a) Pleasant Point (Cape Barley)

Treatment	Yields of Green Herbage in Pounds per Acre
(1) No nitrogen	2,030
(2) 1 cwt sulphate of ammonia	2,860
(3) 2 cwt. sulphate of ammonia	3,480
(4) 1 cwt. nitrolime	3,180
(5) 1 cwt. nitrophos	2,350

(b) Salisbury (Dun Oats)

Treatment	Yields of Green Herbage in Pounds per Acre
(1) No nitrogen	8,010
(2) 1 cwt. sulphate of ammonia	10,160
(3) 2 cwt. sulphate of ammonia	11,280
(4) 1 cwt. nitrolime	9,420
(5) 1 cwt. nitrophos	8,230

In both trials, treatments (1) to (4) inclusive were drilled with one hundredweight superphosphate. The nitrogen in the middle three treatments was applied when the crops were two to three inches high and all three gave good yield increases.

In treatment (5) one hundredweight nitrophos, however, both phosphate and nitrogen were drilled. Nitrophos supplied the same amount of phosphate and nitrogen as did treatment (2), one hundredweight superphosphate plus one hundredweight of sulphate of ammonia. Despite this similarity, nitrophos was much lower yielding than super plus sulphate of ammonia. It was little superior to no nitrogen.

The results from these two trials indicate that nitrogenous fertilisers applied to cereal greenfeeds should be topdressed and not drilled.

Because of the cost of nitrogenous manures, however, their application to cereal greenfeeds is recommended only if the crop is unthrifty and there is the possibility of a shortage of winter feed.

To summarise, recommendations for cereal manuring in Canterbury are as follows:

1. No manure is required for autumn sown wheat.
2. Drill one hundredweight superphosphate with spring sown wheat.
3. Topdress both autumn and spring sown with one hundredweight of nitrogenous manure if the crop is yellow and unthrifty in September.
4. Drill one to one and a half hundredweight of superphosphate with both barley and oats.
5. Drill cereal greenfeeds with one hundredweight of superphosphate.
6. Topdress cereal greenfeeds with one to one and a half hundredweight of sulphate of ammonia if there is the possibility of a winter feed shortage.

Question: What fertiliser treatment would you recommend on cocksfoot for seed production?

Answer. Topdressing in both autumn and spring is the answer. In trials best results were obtained with dressings of one and a half hundredweight in March, September, and again in October. On economic grounds, I would recommend one hundredweight in March and one to one and a half hundredweight in the spring.

Question: What increases in production did the trial indicate?

Answer: An average increase of 80 pounds of seed per acre from the three dressings.

Question: Under higher rainfall, for instance 40 inches or more, would you recommend more than two hundredweight for barley?

Answer: No. Big increases are obtained with one to two hundredweight. But the third hundredweight will give an increase of only half a bushel.

Question: In Southland, would you recommend heavier dressings of super for wheat?

Answer: For spring wheat I would suggest one to two hundredweight of super but this is only a guess. I have no information based on trials in Southland.

Question: Have there been any trials on second or third crops of wheat?

Answer: There have been several trials with second crops showing little or no response to super. Dressings of up to three hundredweight yielded an increase of only three to four bushels per acre. Nitrogen has been used on second crops of wheat but with a negligible response. Super has been used on third crops of wheat with no result.

APHIDS AND VIRUS

A. D. Lowe, Entomology Division, D.S.I.R., Lincoln.

The purpose of this symposium is to discuss new developments, and the subject allotted to me is Aphids and Virus. This is of course far too large a field to cover in 15 minutes.

So I propose to remind you of some recent developments in our general knowledge of viruses and then to look at some experimental work in control of the cereal aphid which spreads Yellow Dwarf virus in wheat.

In Table 1 we have listed a few viruses affecting crops we know well, for the purpose of showing the methods by which they are spread.

It may be news to some of us to know that lettuces suffer from a virus known only to be spread only in soil. If we move to the next virus we find it is spread in the seed. In New Zealand, surveys show that 3 per cent of all seed sold commercially is infected. As if this does not sufficiently emphasise the difference between two viruses affecting one crop, we find as we move across the Table, that the seed-borne disease is further spread in the field by aphids, while the soil-borne one is not.

Moving on down the column we find the spotted wilt virus of tomatoes. When we ask how it is spread, we find the agent is thrips—a small insect quite comparable in size to an aphid, but feeding by quite a different method. We also note that of the various diseases listed, this is the only one that is spread by thrips.

Next we come to diseases more familiar to the farmer—the viruses affecting brassicas and cereals—in particular turnips and wheat.

The two quite different viruses affecting turnips farmers refer to for convenience sake as "turnip mosaic"—their real names are cabbage black ring spot and cauliflower mosaic virus—and the cereal virus we call by a variety of names. Its accepted correct name is now barley yellow dwarf virus.

These viruses have it in common that they are spread by aphids—not by the same aphid it should be noted. This is all very well in the field, but when it comes to experimental work, again they have a marked difference. For the brassica viruses may be quite readily transferred experimentally from plant to plant by sap inoculation. That is, we can do manually exactly what the aphid does. However, when we turn to the cereal virus, no one has yet managed to imitate the aphid by manual methods. We cannot transfer this virus manually from plant to plant by the usual methods.

Some of these facts at least will be new to all farmers, and all of them presented together serve to emphasise the fact that the newest development in virus study is not to apply old information to new fields.

One of the earliest plant viruses to be studied was Tobacco Mosaic virus, and this was followed closely in time by extensive studies of potato viruses. We know now that much of the information we have about these two fields of virus study just cannot be applied to other plant viruses in our present state of developing knowledge. The fact that we recognise plant viruses as a continually developing field of knowledge should warn us not to expect either easy answers or rapid ones. The most likely approach to crop science in the face of new viruses, appears at present to be in resistant

plants, and farmers already know that this takes some years of breeding, and may have to be either preceded or paralleled by fundamental work on the viruses concerned.

In the face of these facts, the obvious line of approach to control of cereal virus was to see whether management practices could be adjusted or the aphid controlled by chemicals in order to alleviate the position.

The value of a long-term study of aphids being carried on by the D.S.I.R. at Lincoln became apparent immediately this problem reared its head. Flight patterns of the cereal aphid were readily available and showed its autumn transfer from grasses to young cereals had concluded by mid-May, and was repeated again in the spring, giving two periods of infection by virus. The temporary recommendation was then made that since autumn infection with virus appeared the more important, this might be escaped by delaying sowing till mid-May. This was associated with the suggestion that the application of a suitable aphicide in spring would reduce aphid infestation then. There was some evidence that, contrary to existing ideas, the reduction of aphid numbers already on the plant reduced the amount of virus infection. At this stage nothing was known definitely about chemical control of this aphid in New Zealand, although some rather slender leads had been established.

Immediate chemical work was undertaken to establish which aphicides would work, how the reduction of aphid numbers would affect the amount of virus present, whether this would increase yield to offset costs of materials. Though discouraged by commercial opinions, it was also decided to test the compatibility of the insecticides with weedicides in common use in order to reduce application costs. All materials were mixed immediately prior to application, and applied by tractor through a boom sprayer on large plots, so that the whole experiment was essentially conducted under farm conditions and with farm equipment. Materials and dosages are shown in Table 2, which also lists per acre costs. Aphicides and weedicides were applied alone and in all possible combinations in 14 gallons water per acre.

There was a fairly low incidence of weeds, and no deleterious effects on the weedicides were noted by the addition of insecticides, when applied immediately after mixing. An aphid population averaging 11 insects per plant was completely controlled by all the insecticides tested, whether alone or in combination with any of the weedicides. There was no significant difference in yield from the various plots (average 73 bushels/acre), probably due to the low numbers of aphids and weeds present in this particular experiment.

In other plots inoculated in autumn with adequate aphids to infect many plants with virus, however, there were large differences in yield between sprayed and unsprayed plots. These differences indicated that the aphids themselves cause some reduction simply by feeding, and the virus infection causes further yield reduction through stunting, and diverting plant food to other purposes. Spraying with an efficient aphicide in this case has two advantages. It stops the aphid feeding, and since an increase in the number of aphids is related to the amount of increase in virus infection in individual plants, to stop the aphid multiplying also reduces the increase of virus infection, both in individual plants and within the crop.

In terms of yield an increase from one spraying of somewhere in excess of two bushels per acre is required to justify the costs associated with insect control. In these preliminary experiments, extra yield far exceeded this stipulation.

As a result of these considerations, and in the light of difficulties experienced in last year's wet season by those who delayed sowing, it has been agreed to recommend that farmers adhere to proven practices in the matter of sowing dates, watch carefully for aphids, and treat as required—if necessary in both autumn and spring. There is now reasonable evidence that such procedure not only controls the insect but gives sufficient yield increase to much more than offset the costs.

TABLE 1
Some Kinds of Virus Transmission

Virus	Soil	Virus Transmitted by			
		Seed	Thrips	Aphids	Inoculation
Lettuce Big Vein . .	Yes				
Lettuce Mosaic . . (LEMV)		Yes		Yes	
Tomato Spotted Wilt (TSWV)			Yes		
"Turnip Mosaic" (CBRSV and CMV)				Yes	Yes
Cereal (BYDV) . .				Yes	

TABLE 2
Control of Cereal Aphid — Experimental Results

Material	Per Acre Dosage Used		Cost Per Acre
	Commercial	Active	
Metasystox (i)	12 oz.—25%	3 oz.	17 10
Rogor . .	*20 oz.—40%	8 oz.	*£1 9 6
Ekatin . .	20 oz.—20%	4 oz.	£1 9 6

(*Maker's recommendation: 12 oz. of 40% at a cost of 17/9.)

Notes

- (1) Applications were made in 14 gals/acre immediately after mixing with weedicides.
- (2) Under these conditions, all insecticides were compatible with 2-4D Amine, MCPA (either mixed or potassic salts) at 1lb/acre acid equivalent.
- (3) All above insecticides applied at maximum dosages allowable under Regulations. Metasystox and Ekatin require an interval of 14 days before being fed to stock, and Rogor 7 days.

Question: Would the speaker be prepared to modify his views on the time of flights for inland or southern areas?

Answer: On Banks Peninsula they fly even later. There does not appear to be any evidence to support this contention. The aphids appear to fly regularly in the autumn to May.

Question (Dr I. D. Blair): Is there any difference in materials other than the cost?

Answer: No. There is no difference in the efficiency of the three materials tested.

Question (Dr Blair): From graphs you have shown me it appears that aphid survival in May is related to rainfall. They show that in May 1960 there was a considerable development of aphids and little rain. In May 1961 there was little or no aphid concentration and heavy rain. After the dry periods this month would you be prepared to forecast aphid infestation this year.

Answer: I would consider there are two factors involved. A year which gives rise to large numbers of aphids in the autumn followed by dry conditions in May and June will allow a build-up in the spring. I am not prepared to make a forecast but there have been few winged aphids this year.

Question (Mr Lister): Has there been an increase in the resistance of turnips to turnip mosaic?

Answer: Although many farmers think this has occurred there is no evidence to support it. Many crops have yellowed this year but the cause has not always been either of the virus diseases. Also a lot of farmers are now sowing York Globe turnips (due to their later sowing date) and these are less likely to be infected.

Question: Could cauliflower mosaic be transmitted by the diamond-backed moth?

Answer: Once again there is no evidence, but it would not be impossible. Recent investigations in the U.K. have revealed that, contrary to existing beliefs, virus diseases can be transmitted by chewing insects.

Question: Can you sow wheat early and then graze to safeguard against aphids.

Answer: No. Although a large number of aphids will be destroyed there will still be a sufficient number left in the sheltered parts of the plant to ensure the spread of the disease.

Question (Mr Smith): When aphids have been noticed on the outer margin of the crop, is this an indication of infestation, and if so what should be done?

Answer: Yes. Spray immediately.

Question (Mr Smith): Would Lindane be a suitable spray?

Answer: Formerly I would have said yes, but now it is out of the question unless there is no possible chance of the crop being grazed. Control by Lindane is less effective than Metasystox, Rogor, and Akatin. It would cost 18/- to £1 per acre.

EXPERIMENTS ON SHEEP FERTILITY AT LINCOLN COLLEGE

Professor I. E. Coop, Professor and Head of the Animal Husbandry Department, Lincoln College.

In striving to increase farm output very substantial gains have been made in pasture production through increasing use of fertiliser, improved pasture species strains and improved management. Increased animal output has been obtained by the simple expedient of increasing stock numbers and up to a point is very successful. But to obtain efficient utilisation of pasture requires a fairly delicate equation of seasonal feed supplies to seasonal stock requirements and this is not always easy. In this connection research workers in New Zealand during the last 15 years have been conscious of the limitations of our existing sheep, in particular in regard to lambing percentage and have devoted much attention to ways and means of improving it. The fundamental reason for wanting to increase lambing percentage is to obtain a closer fit of the flock feed requirements to the month to month seasonal growth of pasture, and thereby to increase the efficiency of sheep production. A second and also important reason is that our greatest competitor in fat lamb production, the British farmer, has a lambing percentage much higher than ours.

Time does not permit me to enumerate all the implications of a high lambing percentage policy but the major ones should be stated. These are:

1. Our Romney, Corriedale and halfbred sheep are dual purpose wool and lamb types and any improvement in lamb production must not be at the expense of wool unless the total income from wool and lamb is substantially increased.
2. Improvement in sheep performance through breeding in dual purpose sheep is bound to be a slow long term business in the course of which the relative economic value of wool and lamb will no doubt fluctuate considerably.
3. Increased lambing percentage must be within the capabilities of both the ewes and the farmer since the extra lambs will be mainly twins. By this I mean that the ewe must be able to rear the extra lambs produced and the farmer must be able to fatten them.

There are some circumstances in which a high lambing percentage is not wanted, but in the main, if we are honest with ourselves, we would gladly accept more lambs from our ewes or the same number of lambs from fewer ewes.

It is my task to summarise the work done here at Lincoln College aimed at increasing the lambing percentage and I want to do this under three headings—environmental effects, selection for twinning within existing breeds, and crossbreeding.

Environmental Effects

The main effect here is that widely known as flushing. Briefly it consists of putting the ewes on an improved level of feeding before mating so that they are on a rising plane of nutrition at the time they are mated. Optimum results are said to be achieved when flushing commences three weeks before the rams are joined with the ewes and for about three to four weeks thereafter. Increases of 15 to 20 per cent in lambing percentage have been claimed. As part of this theory it is believed that the ewes must be in a store condition to respond to flushing and ewes are often deliberately starved before flushing. Associated with this is the belief that fat ewes not only do not respond to flushing but are difficult to get in lamb.

My own observations have led me to doubt some of the claims made of flushing. When ewes are flushed one can consider two separate situations occurring. Firstly the improved level of feeding results in liveweight gain and the ewes become heavier and in better condition when served by the ram than the unflushed ewes. Secondly, during the flushing process the ewes are in a state of improving condition whereas unflushed ewes are not.

The first I would call the static state and the second the dynamic state of the ewe. Comparison of flushed and unflushed ewes does not distinguish between these two. During the last two to three years Dr Wallace at Ruakura has conducted trials which no doubt he will describe showing that ewes in good condition produce more lambs than those in poor condition, namely that there is a static effect of liveweight. Here at Lincoln we have this year initiated fairly large scale trials both at Ashley Dene and on the Research Farm to distinguish between the static and dynamic effect. In the meantime we have completed an analysis of the effect of liveweight of the ewe at mating on its subsequent performance. This analysis covered several thousand sheep mostly at Ashley Dene over the years since 1946.

The figures show that there is virtually no difference between two-tooths and older ewes, and when we separate the older ewes into their actual ages there is again no consistent difference between ages. In other words it is the live-weight of the ewe at mating rather than the age which is important. The figures show two important effects of liveweight. Firstly—barrenness. As the liveweight of the ewes increases the percentage of barren ewes increases slightly until a critical weight around the 90 to 100 pound mark is reached when barrenness increases rapidly.

If liveweight were the only determinant in reproductive performance it should be possible to account for the wide annual variation in lambing percentage. We have tested this for Ashley Dene and find that it certainly accounts for a lot of it but by no means all and that there remains something unaccounted for by liveweight. We have observed that the lambing percentage was abnormally high in the years when the timing of the autumn flush of grass with the ewes on a rapidly increasing level of feed during the main mating period, while the percentage was abnormally low in years when the ewes were still losing weight during mating.

These observations have led me to believe that reproductive performance is determined by both the static liveweight or condition of the ewes and the dynamic situation of increasing or decreasing condition. If this is correct the highest percentages should be obtained in good-conditioned ewes which are also flushed and the lowest in poor conditioned ewes not flushed, and intermediate in good-conditioned ewes not flushed and poor-conditioned ewes flushed. This concept is now being tested and in a couple of years' time we should know whether or not it is correct. In the meantime it is not necessary for me to stress that if condition is taken off sheep either deliberately or through drought the consequences must be appreciated.

My colleague Dr Hart, here at Lincoln, as well as Dr Averill in Dunedin, Mr Haughey in Ashburton and Drs Macdonald and Raeside at Massey some years ago demonstrated that ovulation rate or the number of eggs shed by the ovaries at each heat period was at a low level at first heat at the very beginning of the breeding season in the end of February or early March, increasing rapidly to a maximum during April and May and then declining again to a low level at the very end of the breeding season in August. The implication of this is that if rams were joined with the ewes at the end of March or beginning of April instead of early in March a considerably higher lambing percentage would result. No critical tests in terms of actual lambing percentage have been made but there is every expectation

that an increase of at least 10 per cent would be achieved. This is unfortunately at the expense of a later lambing which may be undesirable for reasons of feed supply and getting lambs away early from their mothers. In circumstances where a later lambing presents no difficulties, advantage may be taken of this phenomenon to obtain an increase in lambing percentage.

Selection for Twinning within Breeds

This offers one of the major hopes of effecting a permanent increase in lambing percentage without recourse to altering the environment, crossbreeding or changing the breed. At this College we have done no experimental work on this and I leave Dr Wallace to discuss its potentialities. What we have done is to use other people's work to expound to students and farmers the virtues of a long term programme of selection of fertility. Within the confines of Canterbury the person who has best demonstrated the possibilities is Mr E. C. Topp of Waipara who for many years used only twin rams from our College Corriedale stud and selected also twin ewe lambs within his flock. His percentage has increased considerably over the years but it is difficult to dissociate how much of this is due to selection, how much is due to management factors, and the fact that his sheep are always well fed and of high liveweight. I would, however, like to make one cautionary remark about selection within a breed. As our New Zealand breeds are not notably good milking breeds an increase in lambing percentage will almost certainly show up to a greater degree the limitations imposed by low milk production. If the increased number of lambs born are to survive and reach a reasonable weaning weight it will be necessary to select concurrently for twinning and milk production which will slow down the rate of progress for twinning alone.

One aspect of selection which we have been vitally concerned with at the College is the influence of face cover. Our own observations made and published several years ago showed that in the Ashley Dene Corriedale flock and the stud Romney, Corriedale and South-down flocks the open faced ewe was much superior in reproductive performance. Taking the Ashley Dene flock as an example, the one-quarter judged as open faced weaned 23 per cent more lamb than the one-third judged woolly faced. This advantage resulted from 10 per cent more lambs born, 5 per cent fewer ewes barren, 5 per cent higher weaning weight. Fleece weight was reduced only very slightly (by 0.2 lb) and the North Island experience with Romneys suggests that fleece weight is not reduced at all.

The face cover effect has already been given wide publicity and is now well recognised, if rather reluctantly by some people. Selection against the woolly face within a flock or a breed can obviously lead to improvement.

Crossbreeding

I now come to crossbreeding—the most controversial means of increasing lamb production—controversial because it involves major changes in breeding policy and because it runs counter to the long established order of things in New Zealand. The first serious attempt, backed by experimental and factual comparative data, was made by Massey College immediately after the war when they crossed the Cheviot over the Romney. These Cheviot x Romneys were shown to be much superior to the Romney on poor hill country in all aspects of reproduction, total lamb production being some 30 per cent better than in the Romney. The major disadvantage, and the one at present limiting expansion of this type of crossbred, is that fleece weight is reduced, thus offsetting to varying degrees the gains in production. The Cheviot x Romney sheep have since been interbred to produce a new breed of sheep known as the Perendale. My own personal belief

is that there is a place for this sheep in New Zealand but that it is not likely to be more than a small place so long as wool is as important as it is. I personally believe that the future is rather brighter for the Border-Leicester cross sheep because it is superior to the purebred (Romney or Corriedale) over a wider range of environments.

Experiments with Border cross sheep began at Ashley Dene in 1950 with the Border Corriedale and Border Merino. These were followed two or three years later at the Ruakura Hill Country Research Station by Mr E. A. Clarke with the Border Romney and two or three years later again here at the College with Border-Romneys. At Ashley Dene we compared first cross Border Corriedales with pure Corriedales both mated to Down rams. The results are shown in Table 1. Briefly, total lamb production per ewe is

TABLE 1
Mean Lamb and Wool Production in Mixed-age Flock at Ashley Dene

	Percent Lambs Weaned	Percent Fat off Mother	Carcase Weight	Relative Lamb Returns	Fleece Weight	Relative Wool Returns
Border- Corriedale	136	80	33.7	129	9.6	98
Border- Merino	127	76	32.7	116	8.9	96
Corriedale	113	69	32.0	100	8.7	100

increased by 25 to 30 per cent, fleece weight by nearly 10 per cent, but fleece value slightly decreased. On the College Research Farm comparison of first cross Border Romney with pure Romney mated to Down rams is as yet incomplete but in general has shown similar results as shown in Table 2. Lamb production is increased by 25 to 30 per cent, fleece weight by 5 to 10 per cent and fleece value by 5 per cent.

TABLE 2
Mean Lamb and Wool Production in Mixed-age Flock at Research Farm

	Percent Lambs Weaned	Percent Fat off Mother	Fleece Weight	Relative Wool Returns
Border-Romney	140	72	9.2	106
Romney	114	65	8.5	100

I would like to anticipate here very briefly that on the Ruakura Hill farm where the average lambing percentage of the Romney is about 85 per cent essentially similar results have also been obtained.

On a strictly comparative basis it is necessary to point out that the more productive crossbred ewe is larger than the purebred ewe by about 15 pounds liveweight and that theoretical calculations suggest that because of this 5 to 10 per cent fewer crossbreds could be carried per acre. On a per acre basis therefore the crossbreds are superior in lamb production by about 15 per cent and equal to or slightly inferior for wool production.

One important feature of crossbreeding, as distinct from other methods of obtaining higher lambing percentage, is that it leads also to increased milk production so that the lambs grow faster. This offsets the lower weaning weight of twins so that the extra lambs are born drafted fat and there is no increase in the store lambs left.

The crossbreds naturally inherit the bad features of the Border Leicester as well as the good ones. There is a higher frequency of teeth and jaw faults, hairy britch and tippiness in the crossbreds. They tend to become daggier, poke through fences more, are heavier to manhandle and may have a very slightly shorter life. But on the other hand they are easier to rear, require no eyewigging, are better mothers, and are much easier to handle during the lambing. On balance these things just about cancel each other out.

The experiments quoted indicate that first cross Border cross sheep have a clear superiority over purebred sheep over quite a wide range of environments from hill country to fat lamb country and have led quite a number of farmers to try them. The difficulties associated with continually breeding first cross sheep from two purebred parents inevitably leads to attempts to produce a purebreeding sheep having the superior characteristics of the crossbred. This is the normal method by which so many of the breeds of sheep now in existence have been bred and the best example locally is that of the Corriedale. The halfbred system using continually first cross rams offers an alternative method. Attempts to fix a breed with the Border-Leicester x Romney have been started here at Lincoln and by a number of individual breeders. Whether such interbreeding through the first, second, third and so on cross will eventually be successful remains to be seen. At the present time evidence is insufficient to promise success or to predict failure, only time will tell. There are grounds for believing that a fixed Border-Romney type would be superior to the Romney but by a smaller margin than the first cross Border-Romney. It is believed that the increased fertility of the Border Romney is due both to the higher inherent fertility of the Border-Leicester and the greater size and hybrid vigour of the crossbred. In developing a fixed Border-Romney type some of the faults, derived in the main from the Border Leicester, which can be tolerated in first ewe sheep mated to Down rams will have to be removed in a purebreeding type. But this is looking into the future.

As to the present there are good grounds for believing that first cross Border cross sheep, i.e. Border Merino, Border Corriedale and Border Romney will out-produce both on a per sheep and per acre basis their purebred counterparts and that farmers can use these crossbreds to advantage. Systems of breeding and using such first cross sheep are already in wide scale use in Britain and Australia and there seems no valid reason why they should not go ahead, as in fact they are, in this country.

In conclusion it is my belief that the current difficulties with lamb, must not deflect us from trying to increase the efficiency of dual purpose sheep even though the improved efficiency is wholly on the side of lamb production. Sheep research in New Zealand did not really get under way until after World War II and in the fifteen or so years since then it can be claimed that major advances in knowledge have been made and are available for farmers to put into operation. In round figures our lambing percentage on fat lamb farms is a little over 100 per cent, Britain's is over 150 per cent. We must set our sights on 150 per cent. Time is not on our side for research workers in Britain have set their sights for the future on 200 per cent, and Britain is our competitor.

Question: Has any research been done to determine the best dates to make various breeds to give the optimum lambing percentage?

Answer (Professor Coop): All breeds appear to have a peak of reproductive activity during April, though the Corriedale reaches this peak rather earlier than the Romney.

RUAKURA EXPERIMENTS ON SHEEP FERTILITY

Dr L. R. Wallace, Superintendent Ruakura Animal Research Station, Department of Agriculture, Hamilton.

The task before me this morning is a formidable one, for I have been asked to summarise in the course of 30 minutes the major findings of the sheep fertility investigations that have been carried out at Ruakura over the last 10 to 15 years.

Naturally in this paper about sheep fertility I shall be talking a good deal about lambing percentages, and at the outset I should perhaps stress that, although the overall lambing percentage calculated by expressing the number of lambs alive at docking time as a percentage of the number of ewes mated, is probably the most useful simple measure of satisfactory ewe performance, it does not tell the whole story, for it is influenced by the proportion of ewes which fail to conceive, by the twinning rate among the ewes that lamb, and by the extent of the ewe and lamb mortality. From the practical viewpoint the time and spread of lambing are also of importance. Ideally the majority of the ewes should lamb at the most convenient time in relation to the feed supply and the stage at which the lamb crop is to be marketed, while a reasonably concentrated lambing is desirable as it is often difficult to fatten lambs satisfactorily when they are born late in the season.

For the purpose of this paper I shall consider the Ruakura investigational work under three main headings—feeding, breeding and management.

1. FEEDING STUDIES

(a) The Rearing of Ewe Hoggets

At the Whatawhata Hill Country Station Mr Clarke has carried out numerous rearing studies. He has found that hoggets which are well reared during the winter not only have a lower death rate than poorly reared ones; they also have a higher lambing percentage as two-tooths. Well reared hoggets (that is, ones which at the end of winter weigh about 15 pounds more than their poorly reared mates) not only produced more wool but had a lambing percentage 12 to 15 per cent higher than poorly reared hoggets. This emphasises that attempts to improve the lambing percentage of a flock must begin with the raising of replacements.

(b) Flushing Investigations

The term flushing means different things to different people; but, as generally understood, consists of putting ewes on an improved diet shortly before and during the tupping period. It is often emphasised that the ewes should be in a rising condition at the time of service, but neither overfat nor severely undernourished at the time that flushing begins.

During the four years 1949-1952 the value of the practice under grassland conditions was investigated at Ruakura. In the first two years the performance of ewes that were "flushed" for a period of six weeks—starting a week before the rams were put out—was compared with that of unflushed control ewes. In the two subsequent years the effect of varying the length of time the ewes were flushed before the start of mating was studied. Each year cast-for-age Romney ewes off hill country were used. They were in fairly thin but vigorous store condition when purchased in early February. During the first two seasons, after arrival at Ruakura, the ewes were run together as a single flock under fairly hard grazing conditions until February 21, when they were divided into two evenly matched groups.

Thereafter one group (the flushed group) were grazed for six weeks on the best pasture available—pasture which had been specially spelled for the purpose. The second group (the control group) were grazed with a view to keeping their average liveweight constant. After six weeks the two groups were boxed and run together as a single flock right through to lambing.

To find out how the ewes came on heat, raddled teaser rams were run with the ewes from soon after their arrival until a week after flushing treatment started, at which stage they were replaced by raddled fertile rams. These fertile rams were changed between the two groups regularly. Both flushed and control ewes therefore had an equal chance of getting in lamb as far as the rams were concerned.

In both years the ewes weighed about 116 lb at the time they were divided. In the first season, during the six-week period from 21 February to 4 April, the flushed ewes gained on average 17 lb and the control ewes gained 5lb. In the second season the respective gains were 15 lb and 6lb. Thus, each year the flushed ewes made substantial gains while the control ewes showed only a small increase in weight.

The main results obtained are shown in Table 1.

TABLE 1
Effect of Flushing for a Period of Six Weeks, starting One Week Before Mating, on Ewe Performance (Average results 1949 and 1950)

	Flushed	Control
No. of ewes put to ram	304	304
Ease of conception:		
Percentage of ewes which held to first service	75	91
Percentage of ewes returning which held to second service	64	73
Dry ewes:		
Percentage of ewes not in lamb at end of		
5 weeks	15.8	9.2
6 weeks	12.8	6.9
7 weeks	9.2	6.2
8 weeks	7.2	5.9
9 weeks	6.9	5.9
No. of ewes conceiving and percentage with twins () during successive weeks of tupping period:		
Week 1	77 (17)	88 (13)
Week 2	98 (25)	137 (16)
Week 3	44 (34)	29 (7)
Week 4	23 (44)	15 (7)
Week 5	12 (25)	7 (0)
Week 6	9 (56)	7 (0)
Week 7	11 (45)	2 (0)
Week 8	6 (0)	1 (0)
Week 9	1 (0)	0 (0)
Total	281	286
N.B.—Bracketed figures denote percentage of ewes that carried twins.		
Lambing Percentages:		
Lambs born per 100 ewes lambing	127	113
Lambs alive at 28 days per 100 ewes mated	103	97

There are several points to be noted:

(1) Although each year the flushed ewes came on heat on average just a little sooner than the control ewes, the difference was so small that it was of no practical importance.

(2) Each year the flushed ewes were rather more difficult to get in lamb. Fewer of them held to first service, and of those that returned to the ram a smaller proportion held to second service. As a result the lambing was rather less concentrated and the mean date of lambing a little later.

(3) Flushing did not reduce the proportion of dry ewes. Indeed, when the results for the two seasons were averaged, there were more dry ewes in the flushed than in the control group.

(4) The flushing definitely increased the percentage of twins. Of the control ewes that lambed, only 11 per cent produced twins in 1949, and only 14 per cent in 1950. For the flushed groups the corresponding figures were 30 per cent and 24 per cent.

(5) Analysis of the lambing results suggested that for best results ewes should be flushed for at least three to four weeks before they are put to the ram. Thus, those ewes which did not conceive until the fifth week after flushing started produced more twins than those that got in lamb earlier.

During the 1951 and 1952 seasons further trials were conducted to establish the length of flushing period required. Each year a group of 300 five-year-old ewes were run together under hard grazing conditions until 14 February, when they were divided into four groups each of 75 ewes. Flushing of the first group was started immediately, and that of the other three groups at weekly intervals thereafter. As a result, by 7 March all the ewes were again running together. At this stage the rams were put out, when the first group had been flushed for three weeks, the second for two weeks, the third for one week, and the last group had not been flushed at all. The results are shown in Table 2.

TABLE 2
Effect of Length of Flushing Period before Topping on Ewe Performance. (Average Results 1951-52 seasons)

Flushing periods before topping (weeks)	3	2	1	0
Lambs born per 100 ewes lambed	143	135	129	118
Percentage ewe deaths before lambing	—	—	1.4	—
Percentage dry ewes	4.7	1.3	2.7	2.0
Percentage lamb deaths (0 to 28 days)	12.4	10.6	7.1	6.9
Lambs alive 28 days as percentage ewes mated	119	118	115	107

These show that as the length of the flushing period was extended from 0 to 1, 2 and 3 weeks there was a marked and progressive increase in the number of lambs produced by the ewes that lambed, i.e., there was a marked increase in the twinning rate. However, the figures show that there was also a progressive increase in the death rate among the lambs born, which has had the effect of reducing the size of the differences between the final lambing percentages based on lambs alive at 28 days and ewes mated. There is nothing mysterious about this increased death rate. The ewes flushed for longer produced more twins and the death rate among twin lambs is almost always higher than that among singles.

One point cannot be too strongly emphasised. It is that as between the groups which gave the final lambing percentage of 119 and that which gave the final lambing percentage of 107, the sole difference in management consisted of the way the ewes were treated over the period of three weeks before the rams were introduced.

They were treated exactly alike until 14 February, and they were treated exactly alike after 7 March.

Let us summarise just what these flushing experiments at Ruakura have shown. They have shown that the lambing percentage of mature Romney ewes held at constant bodyweight in vigorous store condition can be markedly improved if they are provided with good feed immediately before and during tupping. They have shown that with such ewes the flushing period must start at least three weeks before mating if the best results are to be obtained. They have shown that, while this treatment increases twinning, it neither advances the onset of the breeding season appreciably, nor reduces the incidence of dry ewes. On the contrary, flushed ewes have appeared rather more difficult to get in lamb. On average they return to the ram more frequently; as a result lambing is somewhat less concentrated and the mean lambing date a little later. Further if the rams are left out for only a short time there will be more dry ewes among flushed than unflushed ewes.

(c) Effect of Level of Feeding in the whole Period between Weaning and Tupping on Subsequent Fertility

As already mentioned in discussing the practice of flushing it is often stated that the ewes should be in vigorous store condition at the time that flushing is begun. Ewes in this condition are supposed to respond better to the improved level of nutrition than ones that are either very thin or overfat. Indeed it is quite widely held that over-fatness tends to reduce fertility, and ewes may be deliberately grazed very hard for a period after weaning so as to reduce their condition in preparation for tupping. There is, however, no evidence that I know of to support the view that higher lambing percentages will be obtained from ewes deliberately prevented from becoming fat, or reduced in condition before flushing, than from ewes well fed from weaning right through until mating. On the contrary, there is considerable evidence of the importance of having ewes in good condition at the time flushing is begun.

For instance, a Romney flock of approximately 400 mixed-age ewes has been farmed at Ruakura for many years, and each year they have been weighed in the middle of February, about a fortnight before the rams have been put with the flock. What has been most striking is that in those years when the ewes were heavy just before tupping subsequent lambing percentages have been high, while in years when the ewes were light, lambing percentages have been relatively low.

This question as to the best condition for mating is obviously important, and during 1959 and 1960 trials were conducted at Ruakura to secure more information on the point. In late December of each year, a few days after their lambs had been weaned, a group of six-year-old Romney ewes, which had reared fat lambs, were weighed, graded for degree of fatness and divided into three similar groups, each of 120 ewes. For the next two months one group (High Plane) was grazed on the best pasture that could be provided. Over the same period the second group (Medium Plane) was grazed in such a way that their condition was slightly reduced, while the third group (Low Plane) was grazed very hard indeed so that they lost a considerable amount of weight and became quite thin. At the end of eight weeks, in mid-February, the three groups were combined and grazed on good feed. From early February teaser rams were run with each group of ewes in order to see whether the different levels of feeding affected the way the ewes came on heat. These teasers remained with the ewes for three weeks after the flocks were combined, at which stage they were replaced by fertile rams.

The High Plane ewes gained rapidly at first, but their rate of live-weight increase slowed down as they became really fat and by mid-February, when they were combined with the Medium and Low Plane ewes, they had reached their maximum weight (about 140 lb). It is interesting to note that when combined with the Medium and Low Plane ewes these fat High Plane animals lost weight for a time, whereas the thinner Medium and Low Plane ewes gained weight quite rapidly over the same period.

What were the results? These are shown in Table 3, but the first point to be noted is that the feeding treatments had very little, if any, effect on the way the ewes came on heat or the speed with which they took the ram.

TABLE 3
Effect of Level of Feeding (Mid-December to Mid-February) on Performance of Ewes (Average results for two seasons).

	High Plane	Medium Plane	Low Plane
Percentage of ewes lambing which held to first service	89	84	80
Percentage of dry ewes	2.7	4.3	6.7
Percentage of ewe deaths	5.5	6.5	6.1
Average number of lambs per ewe lambing	1.51	1.34	1.35
Percentage of lamb deaths (birth to 28 days)	13.7	11.2	16.6
Lambing percentage (lambs alive at 28 days as percentage of ewes mated)	120	107	98
Average fleece weight (lbs)	9.1	8.7	8.2

The feeding treatments did, however, affect the ease with which the ewes got in lamb. As may be seen from Table nearly 89 per cent of the High Plane ewes lost got in lamb did so at their first service. Comparable figures for the Medium and Low Plane ewes were only 84 per cent and 80 per cent respectively. As might be expected from this, there were fewer dries among the well fed ewes. Within each group those ewes which returned to service were in the main animals in poorer than average condition. Those which failed to conceive at all were mostly very thin animals which at mating weighed 100 lb or less. Mortality was no higher among the fat than among the thin ewes. Perhaps the main point of interest is that the High Plane animals produced the greatest number of lambs per ewe lambing, and gave the highest over-all lambing percentage based on lambs docked and ewes mated. They also produced most wool, clipping nearly 0.4 lb more than the Medium Plane and almost a pound more than the Low Plane ewes (Table 3).

Surveying these results it is clear that they lend absolutely no support for, and indeed contradict the view, that fatness causes increased infertility. It is true, of course, that ewes which are infertile usually become fat; but in this case the fatness is the result not the cause of infertility.

(d) Effect of Level of Feeding During the Last Four to Six Months of Pregnancy

Most farmers are well aware that the number of eggs that a ewe produces at the time she is successfully mated sets the upper limit to the lambing percentage. The number of lambs actually born depends on the proportion of these eggs that are fertilised and develop successfully during pregnancy, while the final lambing per-

centage is also influenced by extent of lamb losses at and soon after birth.

It is now well recognised that lamb deaths before docking frequently account for as high a proportion as 10 to 20 per cent of all lambs born. Some years ago trials were conducted at Ruakura to see how the extent of the lamb mortality was influenced by the way the ewes were fed during the pre-lambing period. For three successive years a group of Romney ewes was mated to Southdown rams and the animals run together as a single flock until five weeks before the first lambs were due to be born. Then the flock was divided into three groups. The first was grazed very well so that the ewes gained about 5 lb a week. The second was grazed rather harder, and gained about 2½ lb a week. The third group was grazed very hard indeed; they just maintained weight but went back in condition. The lambs were weighed at birth and the lamb losses recorded.

The average birth weights are shown below:

Level of Feeding:	High	Medium	Low
Average birth weight of singles	10.3	10.2	9.6
Average birth weight of twins	8.8	8.4	7.3

These figures show that it is more difficult to affect the birth weight of single lambs than twins. On average the single lambs from the Medium Plane ewes were almost as heavy as those from the High Plane ewes. The Low Plane treatment did, however, reduce the birth weight of the single lambs by about 0.7 lb. In the case of twins, the effect on birth weight was graded according to the level of feeding with an average difference of approximately 1½ lb between the extreme high and low plane treatments.

At first sight it might be argued that, at least as far as singles are concerned, the average differences in birth weight are so small as to be of no practical importance for lamb survival, but the small average difference of a tenth of a pound shown between the birth weights of the single lambs from High and Medium Plane ewes was in fact almost entirely due to quite a large effect on the biggest lambs—particularly the biggest of the ram lambs. The 10 per cent heaviest ram lambs from the High Plane ewes were on average a pound heavier than the corresponding ram lambs from the Medium Plane ewes; and with big single lambs weighing about 13 lb, an extra pound can make all the difference between a relatively easy birth and an extremely difficult one. At Ruakura we have in fact found that among single lambs losses tend to be concentrated among the very heavy lambs. For instance, in these particular experiments it was found that for single lambs the death rate at birth and during the first week was only 3.3 per cent for average lambs of 9 to 11 lb, but over 30 per cent for the heaviest lambs weighing 13 lb or more.

Birth weight is also very important with twins—losses in this case being concentrated among the lighter sets. In these trials at Ruakura the death rate among twin lambs at birth and during the first week was only 7.3 per cent for those weighing more than 7 lb, but 28 per cent among those weighing 7 lb or less.

What conclusions should be drawn? It is clear that from the point of view of lamb mortality a very high level of feeding before lambing should be avoided, for it will encourage the production of very big single lambs which ewes have difficulty in delivering and among which a high death rate must in consequence be expected. On the other hand, a very low level of nutrition must be avoided, for this will result in an unduly high proportion of light weight twins, which tend to be born weak and die through failure to drink, from exposure, or from mismothering. During each of these three years at Ruakura losses were lowest among the lambs from the ewes which

had been fed only moderately well during the pre-lambing period. Although this intermediate level of feeding reduced the average birth weight of single lambs by only a tenth of a pound, it was effective in reducing the proportion of single lambs weighing more than 11 lb from 13 per cent to 5 per cent.

Summarising the results of the various feeding trials at Ruakura it may be said that they highlight the importance of good rearing and of having ewes in good condition at the start of tupping, show the value of flushing and emphasise the desirability of feeding ewes moderately well during the pre-lambing period.

2. BREEDING STUDIES

(a) Selection within the Romney Breed

At Ruakura a trial has been in progress since 1948 to see how the fertility of the Romney may be changed by selective breeding. From 1000 flock ewes available at Ruakura three flocks—High, Control and Low Fertility—were established. The ewes selected for the High Fertility flock were either animals which had themselves previously produced twins, or in the case of two-tooths, animals whose dams had a history of twinning. In contrast, the ewes chosen for the Low Fertility Flock were either animals which had at no stage produced twins, or in the case of two-tooths, had been bred by dams which had not produced twins. In choosing animals for the Control flock no attention was paid either to the previous lambing history of the ewes themselves or to that of their ancestors—these ewes were in fact a random sample of the original flock.

In the High Fertility flock all subsequent selection has been for a high incidence of twinning; in the Low Fertility flock it has been directed against twinning. In the Control flock no attention has been paid to breeding records and selection has instead been directed solely toward effecting a general improvement in the quality of the animals as judged by appearances. As its name suggests, the purpose of the Control flock has been to provide a group of control animals. The difference in lambing percentage between this flock and the other two provides a measure of the progress made in breeding for and against fertility.

Right from the start each flock has been strictly self-contained—no rams have been brought in, and each year a fresh group of home-bred two-tooth rams have been used.

Space will not allow a detailed assessment of the results so far achieved, but a few of the more interesting features may be mentioned. The combined data for all years, shows how the percentage of dry ewes varies with age in each of the flocks. In all flocks the incidence of dry ewes tends to decrease with age. The most interesting point, however, is that whereas at the two-tooth stage the percentage of dry ewes has been greater in the High Fertility flock than in either the Control or Low Fertility flocks, the reverse has been the case at the four-tooth, six-tooth and later stages when there have been only about half as many drys in the High Fertility as in either of the other two flocks.

The reason for the comparatively large number of barren two-tooths in the High Fertility flock is not definitely known. However, compared with singles, twin lambs grow relatively slowly up to the weaning stage, and indeed tend to be still underweight when mated as two-tooths. The rate of growth during early life may be an important factor affecting fertility at the two-tooth stage. If this is so it emphasises the importance of breeding ewes capable of a high level of milk production, for the growth rate achieved, particularly by twin lambs, depends to a very great extent upon the milk supply of the ewe, particularly during the first six weeks.

The fact that, since 1948, lambing percentages have varied greatly from season to season makes it difficult to accurately assess the rate at which improvement has been effected, but to give some idea of the progress made the average lambing percentages of the two-tooth, four-tooth and six-tooth ewes over the last five years are shown in Table 4.

TABLE 4
Lambing Percentages of High, Control and Low Fertility Flocks
(Average for 5 years 1957-61)

A.—Lambs born per 100 ewes lambing.			
Flock	High Fertility	Control	Low Fertility
Two-tooths	123	108	109
Four-tooths	137	112	120
Six-tooths	159	132	135
B.—Lambs alive at 28 days as percentage of ewes mated.			
Two-tooths	84	80	91
Four-tooths	115	89	102
Six-tooths	126	102	111

The procedures which have been followed in this investigation are not the best that could be adopted in practice in breeding for increased fertility. The results so far obtained do show, however, that high fertility is a characteristic which can be improved by selective breeding. They also serve to emphasise that those who embark upon an improvement programme must be patient and not expect an immediate dramatic increase in lambing percentages, but rather to make steady but nevertheless thoroughly worthwhile gains over a number of years.

(b) The Performance of the Border Leicester x Romney ewe

At the Whatawhata Hill Country Station, situated near Ruakura, Mr E. A. Clarke has for some years been comparing the performance of Border Leicester x Romney ewes with that of straight Romneys farmed under the same conditions. More recently he has been breeding the halfbred ewes to first-cross rams and comparing the performance of the resulting progeny both with first-cross ewes and with straight Romney ewes.

Average results obtained over five years are summarised in Table 5.

TABLE 5
Lambing Percentages of Border Leicester x Romney Ewes, Romney Ewes and Ewes Bred by Mating Half-bred Ewes with Half-bred Rams.

Age	Border Leicester x Romney (F.1)	Romney	Half-bred x Half-bred (F.2)
Two-tooth	83	54	70
Four-tooth	108	87	90
Six-tooth	116	97	
Four-year	114	95	
Average	105	81	

The markedly superior fertility of the hybrid Border-Leicester x Romney ewes is clearly evident, but results to date from the comparatively small number of ewes available indicates a lowered fertility in the F.2 generation, i.e. in the progeny which result when half-

bred ewes are mated with half-bred rams. On present results it would be unwise to assume that the high fertility of the first cross can be maintained by interbreeding the half-breds, and it will be some years yet before the level of fertility and production of the interbred half-breds can be properly assessed.

In this breeding programme at the Hill Country Station, as the Romney and Border Leicester x Romney ewes reach five years of age they are transferred from the hill environment to fattening country and mated as one flock to Southdown rams under typical fat lamb farming conditions. The markedly superior performance of the half-bred ewe at this stage is clearly shown in Table 6.

TABLE 6

Production from Border Leicester x Romney and Romney Ewes under Fat Lamb Conditions

	B.L. x Romney 5yrs	Ewes 6yrs	Romney Ewes 5yrs	Romney Ewes 6yrs
Lambing percentage (lambs alive at 28 days as percentage of ewes mated)	136	125	102	98
Fleece weight	7.4	7.2	7.5	7.0
Pounds lamb per ewe mated (at time of first draft)	70	67	50	47
Percentage of lambs away at first draft	47	59	41	31
Percentage of seconds at first draft	16	3	29	21

(3) The Importance of Face Cover

The relationship between face cover and fertility has been studied by Mr I. J. Inkster of the Whatawhata Hill Country Station. In all the flocks that he studied, when the ewes were classified according to the amount of wool growing on their faces, he found that the open-faced ewes weaned more lambs than the covered-face ewes. The differences in overall fertility between the two classes was achieved in different ways under different conditions. On hard hill country, where lambing percentages were low, the open-faced two-tooths were more fertile than covered-faced ones. On easier hill country, two-tooths are more fertile and the mature ewes had more twins in the open-faced class than in the covered-faced class.

In the High, Control, and Low Fertility Romney flocks at Ruakura, to which I have already referred, no conscious selection has been practised either for or against face-cover. However, the High Fertility flock now contains a higher proportion of open-faced ewes than either of the other two flocks. It appears that the selection for increased fertility has also brought about a change towards a more open-faced type of animal.

Management Studies

Two management factors which seem to be of particular importance in relation to two-tooth lambing percentages must be mentioned.

(a) Mobbing Up

The first is the matter of mobbing up. Two-tooths do not remain on heat as long as mature ewes, and they do not accept service from the ram as readily. By using rams tethered on a "clothesline," Mr Inkster at the Whatawhata Hill Country Station has obtained evidence which indicates that the majority of mature ewes actually seek out the ram during heat, in contrast to a much smaller proportion of two-tooths. Trials conducted by him have indicated that during tup-

ping two-tooths should, if possible, be run in small paddocks. If this is not possible they should be regularly mustered together during the mating season, these practices have both given improved lambing percentages.

(b) Shearing Two-tooths Before Mating

The second management factor concerns the shearing of two-tooths. Workers from the Whatawhata Hill Country Station have during recent years clearly demonstrated that shearing two-tooth ewes just prior to tupping advances the mean lambing date and increases the percentage of ewes lambing. Much of the work has been carried out with two-tooths at the Waikeria Prison Farm. Three years' results are summarised in Table 7.

TABLE 7

Effect of Shearing Two-tooths Before Mating (based on 3750 Ewes)

Percentage of ewes lambing	1958	1959	1960	3-year Average
Shorn	86	92	91	90
Unshorn	72	76	65	73
Increase due to shearing	14	16	26	17

The average date of lambing was about a week earlier in the shorn groups.

In concluding, I would not like to leave you with the impression that I have dealt with all the work on sheep fertility that has been carried out at Ruakura. In the time available I have been able to cover in a very sketchy way only a few aspects. I have said nothing at all of the study that Dr Edgar is at present making of the way in which the onset of the breeding season and the lambing percentage is influenced by the time the rams are introduced, or of his studies relating to the testing of rams for infertility. For this and other omissions I can only apologise.

Question: Does the use of teaser rams have any effect on the lambing percentage or the spread of lambing?

Answer: This is under investigation at Ruakura. At the beginning of the breeding season the ovary sheds an egg but there is no heat period. This first heat period is 16 or 17 days later. If teaser rams are introduced while the first egg is ripening, most ewes will shed the egg about six days later. This starts the cycle and the first period is 16 or 17 days later on or about 23 days after the introduction of the teaser rams. If the teaser ram is introduced too early, there will be no effect. This practice will not change the lambing percentage—it merely stimulates the earlier onset of oestrus.

Question: Have you found any difference in lambing percentage by varying the feeding before lambing?

Answer: As I said in my paper, the medium plane of nutrition is best and the level we use at Ruakura. High planes give big single lambs which have difficult births. Low planes mean small twin lambs that have a high mortality immediately after birth.

Question: In his paper, Dr Wallace mentioned that feeding does not influence the way in which ewes come on heat. However, it seems to me that the peak period of fertility is an inherent feature bred in over many generations to coincide with the peak flush. Does feeding affect the time of peak fertility?

Answer: Feeding does not affect the time of peak fertility but greatly influences the number of eggs shed.

SHEEP FERTILITY—A BREEDER'S POINT OF VIEW

A. L. Wheeler, Farmer, "Leedstown," Marton.

I suggest that the only measuring stick suited to our discussion this morning is the "Overall Welfare of New Zealand" not merely the welfare of the Romney nor any other particular breed.

In 1882 our first freezing works were built. Up to that time almost the only exportable product from our sheep had been the wool, but in 1890 we exported for the first time one million carcasses of mutton, and a revolution in New Zealand farming had started. The bush in the North Island was coming down fast, development was going on everywhere, and there was started a terrific demand for sheep with which to stock the country, and this demand throughout New Zealand has never since ceased—on the contrary, when fat lambs began to be killed, thus reducing yet further the carry-over of grown wethers, and the topdressing operations of recent decades got into their stride, there has been created an almost insatiable demand for breeding ewes, and during the last 30 years our sheep population has increased by over half a million sheep per annum.

In 1905 the New Zealand Flock Book, the pre-runner of the Breed Stud books of today, showed 16,000 Border Leicester ewes, 16,000 Romneys, 7,000 English Leicesters and 1,400 Cheviots. Prior to this farmers had tried out many crosses, but the Romney proved to be the sheep best adapted to New Zealand conditions, and throughout the next four decades there was such a tremendous swing to the Romney so that at one time over 80 per cent of all sheep in the country were of Romney descent.

In 1912 there were 19,000 Border Leicesters in the stud book and today, 50 years later, there are only 18,589 (1961 stud book) but the Romney breed has increased to 260,000 stud Romney ewes.

All these other breeds have been available and have been tried out all through the years, but it was the Romney that gave the farmer best results and the cry was for Romneys—Romneys at any price. This has put a very great strain on the breed, because it has meant that it left no room for culling—when has anyone here heard of any line of young ewes being killed at the works?

The top stud breeders in what we call the "A" category have, of course, always culled and continued to improve the quality of their studs, selling their rejects to the "B" category stud breeders who in turn have sold their rejects to the "C" category breeders and so on down to the commercial farmer. But so great has been the demand that many of these commercial non-stud farmers have kept their ram lambs sired by very ordinary-grade Romney sires and have found an excellent market for them—thousands upon thousands of them—and the Romney breed has to stand the discredit for all these so-called Romneys. From the overall national standpoint it has been literally impossible to cull even the very tail-enders of the tail end because they have been needed to stock New Zealand.

Let me call your attention also to what has happened and is happening even today in everyday common practice when the farmer brings in his mob of two-tooth ewes probably in January for culling. The first thing he does is to run off all the smaller ones and thus automatically denudes himself of a large proportion of his twins, and he is left with an overdue proportion of singles; he then sells the

smaller ones to the easier-country fat-lamb farmer who throughout the years has been very pleased with his percentages, and who eventually sells his old ewes as fats; but the basic flocks of ordinary Romney ewes mated with Romney rams have suffered accordingly.

I wonder how many people connected with our industry realise what is happening and its full significance. I venture to say that probably in all the history of animal husbandry in all the world, there has never been such a strain placed on any one breed, and I don't believe any other breed could have stood the pace.

Coming back to refer to the stud sheep, it is evident that while the Border Leicesters have perhaps been able to improve by the rigid culling evidenced by the absence of any numerical increase in 50 years, the Romney numbers have increased so greatly that there is now a tremendous difference between the "tops" of the breed and the bottom grades.

Having laid this background I would now like to comment on the experiments that have been made comparing the Romney with the Border-Romney cross.

First of all, very much of the improvement is due to the hybrid vigour of the first cross, in which the offspring is better than the average of the two parent breeds. There is nothing new in this. Many cross-breeding experiments have demonstrated hybrid vigour but it is not a permanent but a transient factor and Mr E. A. Clarke's inbred cross-breeds at Ruakura already appear to be drifting backward in the expected way toward the performance of the Romneys used by him.

Secondly, I believe the same results in favour of the first cross Border Leicester/Romney would not have been nearly so apparent if the experimenters had used high-grade Romneys.

In Mr Clarke's experiment his Romney two-tooth ewes produced 54 per cent only. I call this "tragic" and must, I feel, be due in large degree to the poor quality of the Romney stock used. Authorities in animal breeding agree that when a pure-bred animal is crossed with a low grade one, the offspring tend towards the dominance of the pure parent rather than the average between the two. I have already mentioned the wide range of efficiency that cannot help but exist in the Romney, and I suggest, therefore, that if better-class Romneys had been used the difference in favour of even the first cross would have been smaller, and this difference largely due to the transient effect of hybrid vigour.

I want to digress a moment to say that we should be careful to beware of the fallacy of believing something and accepting it as gospel-truth just because it comes from an institution such as Ruakura, Massey or Lincoln—because something is stated under the auspices of such an institution does not necessarily make it "the truth, the whole truth and nothing but the truth." For instance, about 1934-35 Massey College very strongly advocated the use of the Benzol Test for wool improvement even though it had been first discovered by a similar institution overseas, then examined and promptly discarded by them as of no practical value. The Benzol Test is quite sound, it will do what they claimed for it, but it is of no practical value and today we never hear of it.

More recently Mr Chang of Massey suggested selection for fertility by running teasers with the ewe hoggets and selecting those two-tooth ewes which, as hoggets, had started the reproductive cycle early. Early-cycling-ewe-hoggets produced more lambs as two-tooth ewes. This is right, so they do, but he overlooked one exceedingly vital factor. Twins compared with singles are penalised throughout their early life because they are smaller and lighter in weight as

hoggets and as two-tooths. As weight and development of the young ewe influences the time at which the reproductive cycle commences we would be selecting a large proportion of big early-born singles and perhaps overlooking twins. As two-tooth ewes the big singles will produce as big and probably even bigger percentage than the smaller twin sisters, but after four years of mating the difference at Leeds-town in favour of the twins is over 30 per cent per annum. Mr Chang's findings were correct and the technique is sound provided you can always differentiate between twins and singles, but it is horribly dangerous to New Zealand otherwise.

Yet another example of this sort of fallacy, but not so self-evident, is the suggestion of a genetic connection between open-faced sheep and fertility. When Dr Terrill of Idaho was visiting New Zealand, Sir Geoffrey Peren held a discussion evening in his house which included Professor Rae and Mr Barton together with members of the Romney Association. Now Dr Terrill had just said he was all in favour of open-faced sheep. I asked him, "And, you find, Sir, do you, that your open-faced rams beget more lambs and your open-faced ewes conceive more lambs than your covered faces?" He just about jumped down my throat and replied, "I said nothing of the sort—I will not be misrepresented! I said that open-faced sheep brought in better weight of lamb at weaning time and served the range better. How on earth can there be any genetic connection between reproductive organs and the amount of wool on the face?" You could have heard a pin drop—the silence was startling. I asked Sir Geoffrey if Mr Barton or Professor Rae would care to comment. Mr Barton had nothing to say, but Professor Rae said quietly that their investigations led them to believe that there was a genetic correlation between the two. No more was said, we were left to iron out our differences.

Let me say at once that personally I am entirely in favour of open-faced sheep and wish I had more of them at Leedstown. I blame our show judging in large degree for the development of the woolly-faced Romney and other unproductive features.

Australians have concentrated on open-faced Merinos for many years and they will tolerate nothing else, but this has not materially raised their percentages. The most fertile breed in Britain, the Clun Forest, has lambing percentage of 200 per cent and over; this incidentally is considerably higher than Border Leicesters, or Cheviots, or any cross; but the Clun Forest is not nearly so open-faced as the Border Leicester or Cheviot. Dr John Hammond, when last in New Zealand, also scorned the suggestion that an open-face automatically meant any genetic high fertility.

This brings me back to the improvement of sheep overseas. Mostly it has been done by selection within the breed which has proved itself best adapted to local conditions. For instance, Dr Terrill told us of his work in Idaho. The area was going out of sheep because of their uneconomic returns, and the U.S. Government called in Dr Terrill to solve the problem. When he took charge the lambing percentage was about 50 per cent in a lambing that spread over ten to twelve weeks. This was a severe problem because the sheep had to be confined to and lambed in sheds because of snow and could not be put out to range until after lambing. Now, Dr Terrill did not bother with cross-breeding; he selected and concentrated on the use of the highest producers within the breed that had shown itself best suited to the conditions. He built up a selection index based entirely on production in terms of dollars. His selection was rigorous and, of course, he had the U.S. Treasury behind him. By this method of selecting highest producers within the breed, in 15 to 17 years he raised the lambing percentage to 92 per cent, completed in 21 days—surely a great performance.

There are not as yet many facts available about the variability within the Romney breed so I ask pardon for mentioning any figures from Leedstown. We have one family with a lambing percentage of just on 200 per cent. One ewe had 17 lambs in 7 years and, more important still, she reared twins really well each year. But none of this family would win show prizes nor realise high stud prices. Nevertheless this serves mostly to show that within the Romney breed there is an adequate potential from which to select and rapidly improve along lines similar to those used by Dr Terrill.

The dairy industry is in the fortunate position that they can measure utility in terms of one factor—butterfat—and using this, while still combining selection for other characteristics such as type, etc., they have raised the average output per cow from about 180 lb fat to, I believe, over 280 lb per cow.

The Romney Association has now embarked on a similar course. An investigation is under way to investigate performances in 14 stud flocks within the Manawatu-Wairarapa area, and Mr Quinlivan, a veterinarian, has been appointed for this work. Weaning weights of lambs and growth rate of young sheep is one of the first items to be recorded and this is very important because it is one thing for a ewe to produce twins but quite another thing for her to rear them well. We must select for milk production at the same time as fertility.

In conclusion, I repeat that I believe that the cross-breeding experiments exaggerate the importance of the difference between the performance of the so-called straight Romney and the Border Leicester/Romney first cross, because firstly "hybrid-vigour" is not permanent, and also because inferior Romneys have been used in these trials. In spite of the strain that has been put on the Romney breed throughout New Zealand, there are plenty of high-producing individuals within this breed that has proved itself of such infinite value to New Zealand, and the investigations now begun will start the ball rolling toward the adoption of a measuring stick of production instead of merely for show type, and the adoption of selection accordingly along the lines used so successfully by Dr Terrill.

I fear it will be a sad day indeed for our New Zealand sheep industry if, through short-sighted enthusiasm prompted by the transient early result of hybrid vigour, such institutions as Lincoln allow themselves to foster the indiscriminate use of cross-breeding. No cross-bred could stand the strain and the result could be tragic. I believe Lincoln will rue the day if they advocate such a policy.

LAMBING PERCENTAGES ON LIGHT LAND

H. E. Garrett, Reader in Farm Management, Lincoln College.

The objective of those engaged in farming can be summarised as follows:

1. **Income.**—I do not know of anyone who would not change his situation for one in which his tax-paid income is greater than at present—other things of course being equal.

2. **Capital.**—The same approach applies here. A major objective even surpassing the need for success in income earning is the attainment of a satisfactory capital position.

3. **Way of Life.**—Each to himself according to his tastes, but I feel that in farming above all other activities except perhaps such things as the arts and professions, way of life is a major proportion of an overall objective. As one farmer put it to me something out of him and his family had gone into developing his farm and his stock. This is only one aspect of farming as a way of life—there are many others of great importance in the lifetime of living, farming, and rearing a family.

4. **Transference of the Assets.**—Under modern taxation there is a need for attainment of objectives in this sphere.

In assessing any particular system of management for a given class of land the success attained must be weighed up in terms of the results obtained regarding our four objectives already outlined. Owing to the difficulty in assessing numbers 3 and 4 it is perhaps better to focus attention on the income and capital situations casting a glance or two at the way of life on the way through. The essence of any management discussion is to compare a given situation with an alternative situation in the light of capital, income and way of life advantages.

In recent years many claims have been made that special sheep crosses give pronounced advantages in physical terms. These advantages are presumably ultimately translated into similar results in financial terms. In fact advice along these lines has been given very freely to the effect that the basic management should be changed over from pure-bred animals to production from these recommended crosses. One wonders whether this is just another fashion in agriculture which will come and go like so many which have preceded it. Take for example the yield of butterfat per cow in the dairy industry. Countless millions of words have been written and countless thousands of pounds have been spent towards a goal of a high yield of butterfat per cow. Now we hear from Ruakura and we see from the work of Dairy Board consulting officers in Taranaki and elsewhere that the aim should be towards a high stocking rate per acre with cows of medium body weight producing say 350 lb of factory fat per cow. This thought to me is in complete opposition to the drive for 400 to 500 lb of butterfat per cow which has been going on for generations. It seems possible that heavy-weight high producing ewes may be just as inappropriate. In my opinion as the sheep industry is some thirty years behind the dairy industry in basic scientific investigation, this could be more than a possibility. I certainly think so on light land. The paper to be given by Mr David Watson will confirm the success obtained from light and medium weight animals at high concentrations.

The first point I wish to make regarding light-land is the extremely wide variations which occur in the feed supply. (See Figure 1.) We know that this must be countered by an extremely active and flexible conservation policy preserving enormous quantities

of feed in some seasons and holding the conserved feed for several years before feeding if need be. This conservation policy alone is not enough. A high degree of flexibility must be incorporated into the stock policy. In my opinion these heavy-weight ewes with their high production do not allow sufficient flexibility. Because of the high twinning and the greater requirements the lambs fail to make killing weights in sufficient numbers early enough thus causing the stock demand to exceed the feed supply. With the rapid advance of early summer droughts, which have hit this type of land five times in the last twelve years, the feed supply collapses rapidly leaving the farmer no option but to sell a proportion of his lambs as stores on a deflated market.

This situation has been encountered a number of times in practice and I personally know of some farmers notable for their high lambing percentage who have had to sell store lambs off fattening country in recent years because of the early onset of summer drought. To illustrate this an attempt has been made to compare two alternative situations. A piece of light plains land has been selected of 500 acres productive area, probably equal to some 520 odd acres of surveyed land. The cover summary is:

300 acres of good perennial ryegrass-subterranean clover pastures.
150 acres of lucerne and lucerne mixtures.
50 acres of H1 and subterranean clover sown after a quick fallow.
—
500 acres productive area.
20 acres house yards, plantations and waste.
—
520 acres total area.

In the first situation this has been stocked at the rate of 2½ ewes to the acre with medium-weight ewes giving 110 per cent lambing with 5 per cent lamb losses to sale and 5 per cent deaths in ewes with a further 5 per cent of ewes which are barren or have lost lambs. This gives 700 ewes with single and 200 with twins at docking. The ewes start lambing early in August and some 33 per cent of the single lambs equalling 240 odd are drafted above 1 November and a further 33 per cent of singles drafted on 14 November or thereabouts. About the end of November the final draft of some 25 per cent of the singles and 30 per cent of the twins go to the works and the balance of 314 lambs are weaned. These go fat to the works in the next few weeks off the lucerne.

In the second situation 920 heavy-weight ewes are carried. This is at the recommended 8 per cent reduction in carrying capacity. The ewes suffer the usual 5 per cent losses, 5 per cent dries and lost lambs but have a 135 per cent lambing at docking when 414 ewes have twins and 414 have singles. These are drafted in the same way at the same time—33 1-3 per cent, 33 1-3 per cent and 25 per cent of singles and 30 per cent of twins in the final draft before weaning. This leaves some 600 lambs to fatten as against just over 300 with the medium-weight ewes and this takes well on into February to accomplish.

These two alternatives are represented in Figures 2 and 3. In Figure 2 the situation under conditions where the growth in this 500 acre firm is equal to the arithmetical average of eleven seasons measured by Mr C. E. Iversen, Reader in Agronomy at the College. You will see there is a deficit of feed over the autumn and winter period amounting to 492 lb of dry matter per acre. In the case of 1000 ewes with 110 per cent lambing there is a spring and summer

surplus of 991 lb to cover the winter deficit, thus postulating a 49 per cent conversion of this surplus—a reasonable figure capable of attainment. With the 920 ewes at 135 per cent lambing the extra lambs require more feed and there is a spring surplus of only 717 lb of dry matter requiring a utilisation equal to nearly 70 per cent of this surplus. With losses in conservation and feeding out this will be stretched to the limit. It also illustrates the point that according to these calculations it takes considerably more than 8 per cent more feed to carry these heavy-weight animals.

Turning now to Figure 3 we see the same situation as it would apply to the growth recorded in 1958-59, a dry season as recorded by Mr Ivesen. Under these conditions stocking with the medium-weight ewes releases a spring surplus of 600 odd lb of dry matter to meet a November-December shortage of 212 lb. Although there will have been a substantial loss perhaps in ill-advised hay-making plus shrivelling in the nor-westers, the 600 surplus should get the lambs into the Works. The January-February deficit of 200 odd lb of dry matter can be met by more feed to the breeding ewes as there are practically no lambs left which require quality feed.

In the case of the heavy-weight ewes the spring surplus is only 550 lb of dry matter to the acre to meet deficit of nearly 380 in November-December and a further 260 in January-February containing a sizeable proportion of quality needs for lambs. The prospects of fattening all lambs in these dry seasons in this latter case are therefore remote and a proportion have to be dropped into a weak store market. This situation has been presented in the Table below:

TABLE

	Situation A	1000 Ewes	110 per cent lambing
Income from:			
			£
665 singles at £2	.	.	1330
380 twins at 38/-	.	.	722
Wool	.	.	1500
			3552
Less cost of replacements and fat ewes	.	.	675
			2877
	Situation B.	920 Ewes.	135 per cent lambing.
Income from:			
			£
394 single lambs at £2	.	.	788
500 twins at 38/-	.	.	950
286 stores at 20/-	.	.	286
Wool	.	.	1380
			3404
Less cost of replacements and fat ewes	.	.	675
			2729

Difference in favour of medium-weight ewes + £148

It is therefore concluded that where farmers are running holdings which are subject to summer droughts they are ill-advised to carry heavy-weight breeding ewes. It appears that where farms are fully stocked this class of ewe is inferior in income-earning power, inferior as a means of adding to capital, and because of the greatly

increased worry involved, very much inferior as a way of life. It seems highly probable that it will also be much inferior as a means of satisfying management objective No. 4. Because of the excessive worry involved each second year of drought the farmer will die prematurely leaving an unplanned estate and heavier duties for the surviving family to meet.

Average Yearly Production 500 ac. Plainsland Farm
(Incl. 350 ac. Per/Rye/Sub.cl. & 150 ac. Lucerne)

Average Yearly Production per acre at Ashley Dene

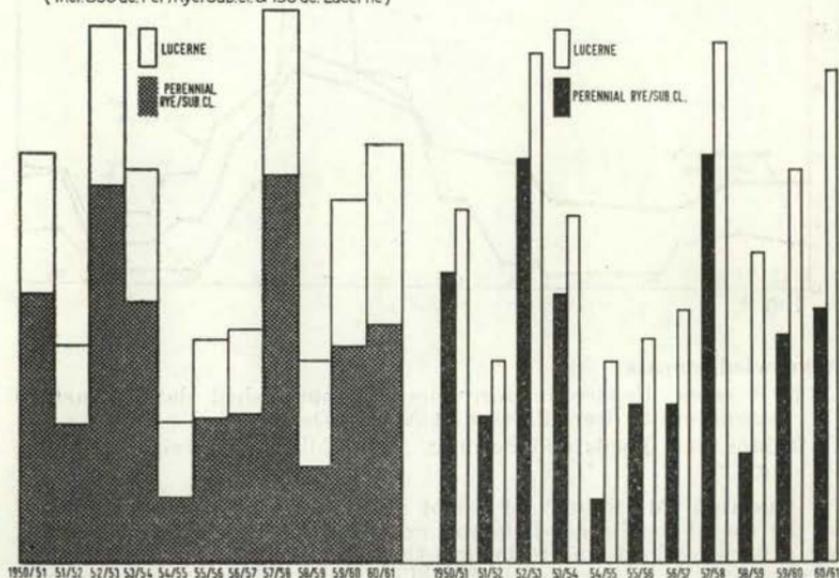


Fig.1

Sheep Requirements of Pasture Production in Average Season

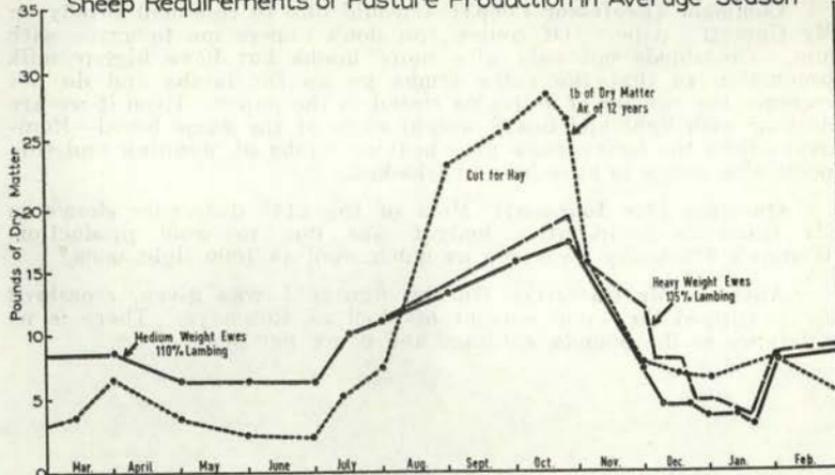


Fig.2

Sheep Requirements of Pasture Production in 1958/59 Dry Season

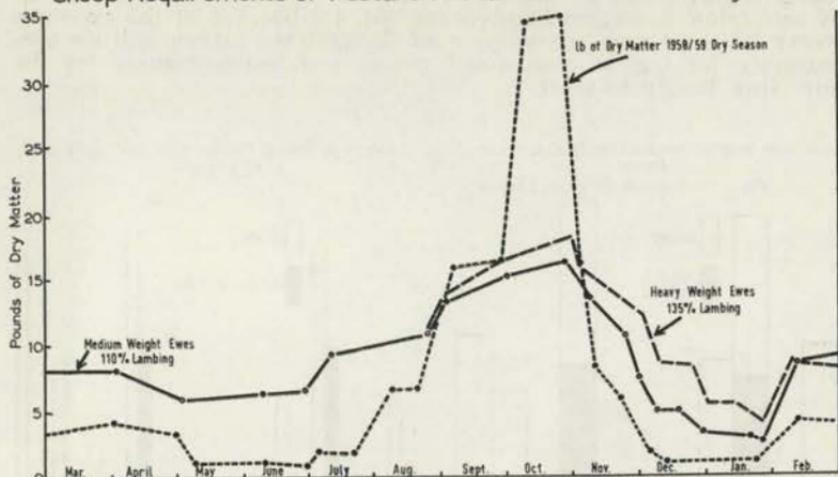


Fig. 3

Acknowledgements

C. E. Iversen, Reader in Agronomy. Unpublished data. Pasture measurements over 12 years at Ashley Dene.

F. B. Morrison, Feeds and Feeding. 20th Edition. Morrison Publishing Co.

Question (Mr Smith): I would like to ask Mr Garrett's opinion on the use of the Border-Leicester cross on the high rainfall country. My experience leads me to believe that the lambs of first cross ewes go away earlier giving greater flexibility for small seeds management.

Answer (Mr Garrett): I do not wish to comment on this as my paper referred to light land.

Comment (Professor Coop): I would like to comment briefly on Mr Garrett's paper. Of course you don't expect me to agree with him. Crossbreds not only give more lambs but have higher milk production so that the extra lambs go as fat lambs and do not increase the number of stores as stated in the paper. Even if we are dealing with light and heavy weight ewes of the same breed—Romneys—then the heavy ewes give heavier lambs at weaning and this point also seems to have been overlooked.

Question (Mr Johnson): Most of the £148 difference shown in Mr Garrett's comparative budget was due to wool production. Wouldn't 920 heavy ewes clip as much wool as 1000 light ones?

Answer (Mr Garrett): On the figures I was given, crossbred sheep clipped the same amount of wool as Romneys. There is no difference in the pounds, shillings and pence per head.

OVERSEAS RESEARCH IN MILK PRODUCTION

I. L. Campbell, Professor of Dairy Husbandry, Massey College, Palmerston North.

During the past year I was able to travel on study leave for eight months and visit a number of universities and research institutions in the U.S.A., Great Britain and Northern Europe. The purpose of this paper is to discuss briefly, some of the research projects and points of special interest in the field of dairy production.

Feed Evaluation and Utilization

I was particularly interested in the progress of ideas and work on the problem of assessing the nutritive value of foodstuffs for farm animals. While much of the work is being done with concentrates and roughage, especially hays, and with foodstuffs in various combinations and physical states (e.g. ground, chopped or long hay), some progress has been made in applying the ideas and techniques learnt to pasture in comparing different species and stages of growth.

Over the last few years more attention is being paid to the qualities of a food which determine how much of it animals will eat—their voluntary intake of it. Perhaps due to the fact that rationing of foods for dairy cattle is common overseas, this has been somewhat neglected in the past. It is now better appreciated from results of experimental work, mainly using such conserved roughages as hays and silages, that the intakes of animals fed to appetite may vary greatly from one sample of foodstuffs to another. This has always been suspected by New Zealand farmers and research workers, but we, too, have not produced much data to illustrate the significance of the point and to help in assessing the value of different foodstuffs including pastures. One limiting factor, of course, has been the lack of an accurate method of determining the intake of the grazing animal. So, we in New Zealand have every reason to be pleased that efforts are being made in a number of laboratories overseas, e.g. Cornell University in U.S.A. and the Hannah Institute in Scotland, to determine measurable characteristics which are associated with voluntary intake of any given feed. Matters which are being studied include the digestibility of the food, its speed of passage through the gut, the total amount of digesta in the whole digestive tract and the type of fermentation which is promoted in the rumen.

There is considerable interest in many research centres in the type of fermentation in the rumen which is characteristically associated with individual foodstuffs or different combinations. This is believed to have an important influence upon voluntary intake of feed, the efficiency with which food is used within the animal, milk composition, and in some instances, on the health of animals.

Where we offer a foodstuff which favours rapid fermentation within the rumen, if other things are equal, we expect a relatively high intake. Rapid fermentation and absorption quickly lower gut fill and encourage further eating.

Some of the principal end products of fermentation in the rumen are the volatile fatty acids—acetic, butyric and propionic. These appear to be equally effective for supplying the energy an animal needs for maintenance, but this is not true for fattening. The type of fermentation which produces relatively high concentration of

propionic acid is more favourable for efficient production of body fat. The relative values of these end products of fermentation for milk production is now under study. This type of work has shown that the value of a foodstuff depends not only on how much of it is eaten and digested, but also on the nature of the end products of fermentation and the purpose for which they are used.

Work is proceeding in a number of institutions in U.S.A. studying the concentration of the various end products of fermentation associated with foodstuffs which have been ground, crushed, heated, pelleted, or waferized as part of a programme of introducing mechanisation and even some degree of automation into the feeding of dairy and beef herds.

For example, the grinding of hay increases the speed with which individual particles of hay pass through the length of the gut. This often leads to an increased intake of hay following grinding. However, there is a catch here in that the micro-organisms have less time to break down the insoluble structural tissues of the hay to make materials which can be absorbed. Hence, ground hay is less well digested than long hay. The net effect in this case is that what we have gained in improving intake, we may partly lose in lowered digestibility.

At other stations, e.g. Rowett Institute near Aberdeen, an attempt is being made to evolve rations which will give especially quick and efficient fattening. By reducing the roughage in the diet to quite small amounts (i.e. below 6 lb hay per day for cattle) and feeding concentrates high in readily available carbohydrates, rumen fermentation favouring high propionic acid production is expected. These diets have given some very rapid weight gains in fattening beef cattle. Needless to say the adoption of this type of ration depends on the economics of the overall husbandry situation.

It has been clearly shown now that the type of fermentation going on in the rumen can affect the percentage of butterfat in milk. The experimental evidence available usually refers to rations which are not normally encountered in New Zealand such as high concentrate-low-hay, or completely ground rations. The depressing effects on fat content of giving cows cod liver oil can also be explained by the effect this has on rumen fermentation. These are rations which promote a low production of acetic acid in the rumen, and this is one of the substances which is used to form milk fat.

Workers in the National Institute for Research in Dairying at Reading, England, are now developing the theory that rations giving low propionic acid production in the rumen are often associated with a lower than normal percentage of solids-not-fat (S.N.F.) in milk. The evidence in support of this theory is not yet conclusive. However, it does fit most of the experimental data concerning S.N.F. in milk which have been obtained at the Dairy Research Institute in Palmerston North. For example: full feeding of cows on hay, silage and a little pasture, typical of many rations for cows in late winter on town milk farms, frequently results in S.N.F. values below normal for the herd. This ration would be expected to promote low propionic acid production.

Work in this field is now in progress in New Zealand at both Massey and Lincoln Colleges. Fundamental studies of rumen metabolism form a main project at the Plant Chemistry Division at D.S.I.R. Palmerston North. It is to be hoped, therefore, that we shall soon be in a better position further to relate the use of New Zealand foodstuffs and our feeding practices to variations in milk composition and to use this knowledge to our advantage.

As a follow up of these ideas on food evaluation, attempts are being made in many institutions to develop test-tube methods of assessment. The thought is that by incubating some of the test food-stuffs under standard conditions with liquor taken from the rumen of sheep or cattle, information obtained about the speed and products of fermentation might be usefully related to the actual feeding value of the foodstuff. So far these test-tube prediction values have lacked precision. The procedure is still being improved, and may yet prove a useful assessing device. For example, it would be very helpful as a preliminary screening procedure for plant breeders, or in plant introduction work where large numbers of different strains or species are being checked for potential usefulness.

While all this work on the functions of the rumen is in progress, workers at some institutions appear to feel that our knowledge of the remainder of the digestive tract in sheep and cattle is far too incomplete. In fact, much of the data available, has been obtained from non-ruminants such as the rat, dog and human. Thus I found groups of workers at the Institute of Animal Physiology at Babraham, Cambridge, and at the Rowett Institute in Scotland, making fundamental studies, using sheep, of the rates of flow and composition of digesta, the secretion of digestive juices, absorption and movements in the digestive tract below the rumen.

Meat Production from Dairy or Crossbred Cattle

In Norway, Sweden, Denmark and Holland, a traveller cannot fail to note the absence of any number of cattle representative of typical beef breeds, and the use made of surplus animals from the dairy herds for beef production. In Britain, there is an increase in production of beef from Friesian cattle. In these countries, a significant research effort is being made to investigate ways and means of improving beef production from basically dairy stock.

In Great Britain in this year, something of the order of 30 Charollais bulls are to be used by A.B. in a large scale trial to inseminate cows belonging to farmers interested in producing beef from the dairy herd. The French Charollais is claimed to be one of Europe's fastest growing beef breeds producing a high proportion of lean meat. In Denmark, the Jersey Breed Society is also promoting investigations of the growth and carcass of the Jersey-Charollais cross.

Another most interesting experiment in progress in Britain involves studies being made at a number of centres, of the growth rate and beef qualities of the off-spring of a number of Friesian bulls each of which has been progeny tested for dairy production. The object of the experiment is to see what kind of qualities for beef production are passed on by bulls which have been assessed for their level of ability to pass on good qualities for milk production.

Also, in Great Britain and Northern Europe, various treatments are being checked on dairy stock for their effect on meat production—hormone treatment, non-castration, low fibre diets, variation of fat in the diet, to mention a few examples only.

A visitor from one of these countries would, I am sure, be tempted to ask whether we have made a thorough examination of the scope for improvement of the meat-producing capacity of our dairy breeds. We have not done much yet.

Milking Management

There appears to be a good measure of agreement from the results of work done in Australia, New Zealand, Sweden and England, that the night and day intervals between milking can be varied up to a 16-8 hour combination without significantly affecting overall milk and butter-milk production. The fat content of the milk at the individual milking of course, varies inversely with interval length although there is less effect on S.N.F. percentage.

Data from Swedish experiments indicated that once-a-day milking gave 50 per cent less milk in first lactation and 40 per cent less in second lactations than in twin mates milked twice daily. In different pairs the differences varied from 15 to 71 per cent, with high yielding cows reducing their yields less than in the case of lower yielders. Even so, the prospects of producing a strain of high producing once-a-day milkers does not look bright. The same workers are now investigating the effects of eliminating one milking a week during the whole of the lactation. Short term studies at Reading have already shown that the effect of single milking interval of the order of 24 hours is to depress the yield over the following normal milkings for something of the order of three to seven days. The workers there suggest that the rate at which milk is formed in the udder might be thought of as having a definite momentum which is not readily depressed by changing of milking intervals. However, if this momentum is depressed by a very long interval between milkings or by incomplete milkings it does not readily recover.

It is generally believed that incomplete milking out of cows favours more rapid decline of milk yields. There is little satisfactory quantitative data on this point. Reading workers have been investigating the effects of leaving various amounts of milk in the udder after milking and have applied their treatments for various periods of time. The results so far suggest a tendency for milk secretion to be reduced to the amount of milk removed and a progressive depressing effect from the extra milk left in the udder. The longer the cows were incompletely milked out, the greater the depression and the less the recovery on return to normal effective milking out. The investigators conclude that the necessity for very thorough milking out may have been over-stressed in the past, but that it does definitely pay a dividend in extra production. They are now directing further attention to factors which determine the efficiency with which milking machines milk out cows. More detailed knowledge of this kind, together with that of factors affecting milking time are of considerable significance to us in New Zealand with our present incentives to increase herd size and reduce labour involved in milking to a minimum. We want to know what practices are necessary to get a thorough milking out in the shortest time and how to get machines to do the greatest proportion of the work.

Milk Composition

Continued interest in matters concerning milk composition is evident in many countries. This is, in part, related to the problem of ensuring a just payment to producers—for those supplying town milk as well as those producing for manufacturing purposes. None the less important is the problem of deciding the composition of milk which it is most advantageous to produce in the light of present and likely future returns from various dairy products.

In the U.S.A. a number of state experimental stations are making studies of variation in the percentage of S.N.F. in the milk

of individual cows and of herd milks in order to gain further understanding of the present situation in their areas and in the hope that further information on the factors which influence S.N.F. may be obtained.

At the end of last year the Milk Marketing Board in England recommended for adoption a system of payment for milk based on its content of total solids and S.N.F. A standard price was to be fixed for milk with a total solids content of 12 per cent or above and less than 12.6 per cent having a S.N.F. percentage of more than 8.4. A premium payment was suggested for milk with a total solids content of 12.6 or above again provided the S.N.F. percentage was above 8.4, a penalty imposed for milk with a S.N.F. percentage below 8.4 or T.S. percentage lower than 12 per cent.

In Holland testing milk for its protein content started in a big way in 1957 and has expanded until in 1960 approximately 3,700,000 samples were tested using the amido black method. The main object of the scheme initially was to arrive at a fairer method of paying suppliers for milk used for cheese manufacture. However, a demand arose for the protein testing of the milk of individual cows. In July, 1960, just over 300,000 cows representing 28 per cent of milk-recorded cows and 19 per cent of all cows in milk were "protein tested." The determination of the protein content of milk is concentrated in a few large laboratories in Holland and the cost per sample averages about sixpence.

It is interesting to note that schemes involving protein testing have been used in New Zealand in attempts to pay suppliers of cheese factories more equitably, but the adjustments were not found to be worth the extra effort and cost involved and the practice was discontinued.

On the breeding side, the Dutch should be able to gain very valuable information concerning the progress which it may be possible to make in breeding cattle producing milk of various fat and protein content. We in New Zealand may be very glad of these Dutch data to help us decide our own breeding objectives as far as milk composition is concerned. In the bulk of our herds the tendency has been to aim for high butterfat production. With this has been associated a steady rise in the fat content of milk produced. Looking to the future it may be very useful for us to know the answer to such questions as "can we get a type of milk which will give us more protein in relation to lactose and fat?"

Since my return a surprising number of farmers have suggested complacently to me that as New Zealand is in the forefront of research in dairy production we probably have little to learn from overseas institutions. I can only surmise that the flattering remarks passed by some of our overseas visitors concerning some of the work done in New Zealand has encouraged such a viewpoint. I hope I have said enough in this talk to disillusion anyone here who might hold such views. It is a major task for all research workers and teachers in this country to keep themselves up to date from Scientific Journals and Reports, and for some of the more fortunate, with the help from visits abroad, with scientific advances in theory, ideas and techniques.

However, it is true that many of the results of overseas work have been obtained in circumstances different from our own. For example: following a period of underfeeding prior to first calving, Swedish cattle in one trial were put on to full feeding—but this with them meant rationing according to size and production. The results

are not easy to apply to our own situation where fully fed cattle would normally be fed to appetite under free grazing conditions. The application of many ideas and techniques gained from studies abroad has to be worked out on our own experimental stations and demonstration farms—but the ideas are none the less very welcome.

Question (Mr Hollard): Did you see any research work concerning the intake of silage by cows under self feeding?

Answer: Work on this is rather limited but under favourable circumstances normal intakes are observed for self feeding. There is general agreement that cows given adequate silage are eating below this capacity. In the U.S.A. various devices are used to get further information. Silage extracts are added to hay to find if anything from the silage decreased appetite. Under favourable conditions there is not much worry about cows eating to their capacity for silage. A major difficulty arises when they won't eat to capacity.

Question: In your paper you referred to grinding hay. Did you mean ground hay or chaffed hay?

Answer: Ground hay is powdered hay. Chopped hay does not give the same effect from a fermentation point of view.

Question: Has any work been done to find if there are any differences in consumption between cold silage and higher temperature silage?

Answer: I cannot recall any experiments on this point. At Massey cows have been fed warm, medium, and cold silage. The cows ate the most of the medium heat. However cold silage was more digestible and the over-heated well down in digestible nutrients. I think from an all round consideration cold silage is the best bet for feeding, but there are no figures to prove this.

Question: Are there any differences between the life spans of dairy cows fed on high concentrate ration and those fed on roughages?

Answer: There are not enough dairy cattle fed on very high concentrate rations to show any differences, but I see no reason why there should be a difference in life span.

Question: Do you consider that zero-grazing could be an economically sound proposition on New Zealand dairy farms?

Answer: There are no figures for this in New Zealand. Any radical change from our New Zealand system of self feeding has to have considerable economic advantages before it is adopted. There are the problems of pugging on wet ground, and the high cost of labour. There is no worthwhile data on the economics of this system in New Zealand.

THE EFFECT OF SOME MILKING MANAGEMENT FACTORS ON TOTAL PRODUCTION

D. S. M. Phillips, Senior Principal Scientific Officer, Ruakura
Animal Research Station, Hamilton.

The study of milking technique in recent years has been concerned largely with its effects on milking behaviour. The effect of various milking practices on total lactational production has not been adequately investigated due to lack of facilities for carrying out such experiments on a suitable scale.

Since 1958 at Ruakura we have had the advantage of a complete herd of twin cows available for just this purpose. This has meant that each year we have been able to carry out a complete experiment for an entire season using up to 20 sets of identical twins. Parallel with these experiments we have facilities for short term investigational work in a small independent dairy unit which permits the study of factors underlying the main experiment. The pattern of experiments so far has centred round those factors in milking which can be expected to have some effect on the let-down response of the cow. The reason for the emphasis on this aspect of milking is that there is increasing evidence that the response of the cow to the "suckling" or "milking" stimulus is important not only for its milk releasing action but also for its control of the lactational performance in terms of days in milk and total production.

With this in mind we have designed experiments which can provide information on milking technique of direct interest to farmers, and which at the same time can provide information about the underlying physiological processes which control production.

The Effect of Pre-Milking Stimulus on Production

For some years now, a vigorous wash prior to milking has been advocated as a means of establishing a satisfactory milk let-down response, although there has been no conclusive evidence that such a practice would increase production. In 1956 Dr W. G. Whittlestone carried out a full lactation experiment, using identical twins to measure the effect of pre-milking stimulus on total production. This experiment, using five sets of identical twins, compared the production of cows which were stimulated for 30 seconds immediately before machine milking, with their twin mates who were not stimulated in any way before the teat-cups were put on. The average within-set difference was 18 per cent in favour of the stimulated cows, but because of the large variability in response between twin sets the results were not conclusive. The responses to the treatment varied from -2 per cent to 36 per cent.

In view of the inconclusive nature of this experiment it was decided to repeat it on a larger scale, and at the same time to attempt to measure any other possibly relevant factors associated with the cow's milking behaviour, which might provide some reason for the very large variation in the response of individual twin sets to the treatment.

The First Experiment on Pre-Milking Stimulus

For the purposes of the experiment, thirteen sets of identical twin cows were used. One set was subsequently not included in the result because of a very short lactation. One member of each set

was used as the control animal and the other as the treated animal. The treatments were as follows:

Control Cows: The cows were washed for 30 seconds immediately before the cups were put on. The wash consisted of hosing with cold running water and rubbing with the hand, followed by massage of the teats and lower udder and squirting of each teat.

Treated Cows: The non-stimulated cows were not given any stimulus to the udder before the cups were put on. The only stimulus to let-down being that produced by the machine. The cows were bailed up in the normal way and when the next cow was finished the cups were put straight on without any wash or other preparation.

All cows were milked normally in a herd of approximately 65 cows and were taken into the bail in any order.

A four-cow single Ruakura machine was used with the vacuum set at 15in. of mercury. The pulsation was set at 40 per minute with a reduced squeeze giving approximately 30 per cent full air pressure.

A small weight of 3½ lb was used on the claw at the end of milking for machine stripping. This was applied when the sight class started to clear and continued until the cow was finished.

Results of Experiment: The milk from each cow was weighed at each milking and samples for fat test were taken weekly.

The average production figures for the twelve sets of twins are given in Table 1. It can be seen that there was a large difference

TABLE 1
Effect of Production of 30 Second pre-Milking Stimulus
(Average 12 Sets of Twins)

Group	Milk (lb)	Fat (lb)	Days	Fat %
30 second stimulus	5850.5	294.9	250	5.04
No stimulus	4405.5	223.3	203	5.07
Difference	1445.0	71.6	47	—
Difference % of N.S	32.8%	32.0%	23.2%	—
Difference % of S.	24.7%	24.2%	18.8%	—

in the amount of milk and butterfat. The butterfat difference averaged 71.6 lb. Again, the days in milk were 47 days less for the non-stimulated group.

The average differences in the fat and milk are given both as a percentage of the control (30 second wash) group, and of the treated (non-stimulated) group averages. This was done because although the 30 second wash and stimulus is standard practice at Ruakura, it may well be that the "non-stimulation" treatment is closer to farmer practice in many cases. In this case the percentage difference is the increase due to the use of the wash stimulus.

It is apparent from the present experiment that the use of a 30 second wash stimulus for milking increased the production by an average of 71 lb of butterfat or 32 per cent.

The average butterfat test was the same for both groups. The average lactation curves for the two groups showed that there is very little difference between the two curves for the first 50 days of lactation. Thereafter the non-stimulated group fell rapidly. An apparent improvement at the end of lactation is due to the fact that only the higher producers were left in each group.

Let-Down Response as a Factor: As anticipated by the earlier experiment of Dr Whittlestone's the between set response to the experiment was extremely variable. The present experiment gave even greater differences in response as seen in Table 2 which gives the butterfat production figures for the individual twin sets.

TABLE 2
Effect on Butterfat Production of Pre-Milking Stimulus

Twin Numbers	Total Fat (lb)		Twin Numbers	Total Fat (lb)	
	Stim.	Non-Stim.		Stim.	Non-Stim.
701-2	335.3	113.1	663-4	373.6	320.9
601-2	216.3	38.1	673-4	328.4	330.9
661-2	246.4	84.6	669-70	257.7	268.0
667-8	199.7	63.0	817-8	145.3	161.4
657-8	388.4	290.5	743-4	460.0	477.2
603-4	273.4	184.1	627-8	314.7	332.5

Having in mind that such variability might occur, every effort was made to measure milking factors which might have some bearing on the result. To this end, the duration of the milk let-down response was measured for each cow by a method which we developed for the purpose. It was found that individual cows differed greatly in this respect, and the let-down activity ranged from as little as two minutes for some cows to as much as 30 minutes for others.

The results in general indicated that those twin sets which showed the greatest loss in production due to lack of stimulus, were those which had let-down duration times of less than five minutes, although there were insufficient cows in this group to prove the point conclusively. Another important result was the discovery of a definite relation between let-down duration time and total production; particularly marked in the case of the non-stimulated cows but also apparent in the normally stimulated cows.

Effect of Cow Temperament: Assessments of "milking temperament" made by milkers were also used as a guide to understanding the results of the experiment. Although the response to the treatment was found to be largely unrelated to the temperament rating, it was found that total production for individual cows was definitely related to the temperament. The placid cows were always among the higher producers and the nervous cows were among the lower.

The Second Experiment: The Effect of Delay Between the Wash-Stimulus and Milking

The effect of delay between stimulus and milking has been the subject of discussion for many years. An experiment was therefore designed to test the importance of this factor in terms of lactational production.

For the purposes of the experiment, 19 sets of identical twins were milked in our No. 1 Dairy under identical conditions except for the following:

Control: Normal 30 second stimulus and cups put on immediately.

Treatment: Normal 30 second stimulus followed by a three-minute wait before cups were put on.

This treatment was continued for the whole season.

Results: On average, the two groups showed identical productions. This indicates that provided a good stimulus is applied before

milking, a consistent delay between stimulus and milking, is not likely to affect production.

The Third Experiment: The Effect of Milking Discomfort on Total Production

It has been recognised for many years that severe discomfort during milking is detrimental to let-down response, and under such conditions it is not uncommon for milking to be completely unsuccessful.

The observed relation between let-down response and total production has further suggested that even mild discomfort might well be an important factor in some cases. To obtain information on the relative importance of this aspect of milking, and also to define more accurately the safe limits for milking machine operation the following trial was carried out.

For the experiment, 17 sets of identical twins were milked with one member of each set as "control" and the other as "treatment" as indicated below.

Control: 15 second wash, followed by normal milking with a pulsation of the type used in the Ruakura milker.

Treatment: 15 second wash followed by milking with the same milking plant but with the squeeze phase reduced to a degree which prevented it reaching full air pressure.

The short wash-stimulus, consisting of washing and squirting of the teats only, was used because it more nearly represents that used by most farmers.

The pulsation applied to the treatment cows was chosen because it is a condition which applies in a number of milking plants in use in the field, and experience in milking machine testing over the past 15 years has indicated that it was likely to produce mild discomfort. The pulsation was adjusted so that the air phase did not reach atmospheric pressure. In actual fact the treatment cows showed no outward sign of discomfort at milking time and no noticeable changes in the condition of the teats took place. This indicates, that under the conditions of the experiment, where the teat cups were removed immediately the cows were finished, the treatment represented only a mild discomfort.

Results: The results of the experiment are given in Table 3. The treatment cows produced on average 15 lb of butterfat less than their twin mates and milked for 14 days less. The difference is not large and it was not possible to prove that it arose from the discomfort treatment.

TABLE 3
Effect of Milking Discomfort on Production

	Milk	Fat	Days
Brief Wash	5184	264	233
Brief wash and discomfort	4911	249	219

It was interesting, however, to note that some twin sets, notably those in the "nervous" temperament group, showed considerable differences in production in favour of the control cows. Butterfat productions for the four sets in this group are given in Table 4. In particular, the set 603-4 are interesting in that when used in the

“pre-milking stimulus experiment” with the treatment and control cows reversed compared with the present experiment, the production differences were similar and again in favour of the control animal.

TABLE 4
Productions Pounds Butterfat

Low Number	Normal	Discomfort
603-4	325	135
785-6	268	150
791-2	377	283
7213-4	179	114

Conclusions

The three experiments just described indicate the following conclusions:

1. Milk and butterfat production can be greatly influenced by the level of the pre-milking stimulus. A routine involving the use of a 30 second wash and rub as against one in which the machine milking is the only stimulus has produced an average increase in production of over 30 per cent.

2. The cows with the least active let-down response appear to be most affected by the lack of stimulus, and will generally be among the lower producers in the herd.

3. A period of waiting of up to three minutes between stimulus and milking will on average not affect production under conditions where the stimulus is of a high level and a regular milking routine is practised.

4. Mild discomfort as results from the use of a pulsation in which the air phase does not reach full atmospheric pressure, will on average cause only a small loss in production if any, under conditions where other milking factors are optimum. Cows in the “nervous” temperament category on the other hand may well be affected adversely to a marked degree by this treatment. These cows again will be amongst the lower producers in the herd.

In conclusion it can be said that adverse milking conditions such as lack of pre-milking stimulus and discomfort can have a marked effect on production. The effects will be concentrated however in those members of the herd with inadequate let-down characteristics and of nervous temperament. The fact that these cows tend to be the lower producers in the herd, indicates that particular care should be taken to ensure optimum milking conditions for those cows if overall high production is to be achieved.

Question: Is the pulsation rate of 40 usual?

Answer: Yes. 40 is the farm average figure. We recommend 40-45. It has never been shown that a faster rate gives any improvement, in fact it does use more air, therefore giving vacuum troubles. Therefore it is better to work at a low figure.

Question: In breaking in bad heifers I use patience for some time but revert to severe disciplinary action after three weeks. Nine cases out of 10 they respond to this but what about production?

Answer: A cow with unfortunate early milking history is likely to be affected in later production. It might well set her against the

whole milking process for a long time. Therefore I strongly recommend running heifers through the shed prior to calving.

Question: Do lighter breeds require more stimulation than heavier breeds?

Answer: Most of our cows are Jerseys with some crossbreds—farmer's cows from all over the country.

Question: Are there any experiments with electric current running through the milk?

Answer: This is a very important point, especially with magnetic pulsation plants. During the last 12 months we have investigated this. We have found in general that some cows can be put right off milking by three volts. This is serious because three volts can hardly be felt. This is not leakage. It arises from loss in voltage to the neutral line. Therefore it can happen in any shed, but every magnetic pulsation plant is wired back to the powerline earth. These plants nearly always get it, whereas others may not. I suggest that, for new sheds, you put steel reinforcements under the concrete floor and weld the uprights to this for good earthing and that existing sheds be inspected by the power board.

Question: Is it standard at Ruakura to put 3½ lb weights on all the time for the last 50 days of lactation?

Answer: In January and February the cups are creeping up on many cows, as milking times drop to 2½ to 3 minutes. I therefore suggest that from February onwards you drop off one set of cups because with this shorter milking time you cannot handle so many.

Question: In stimulation versus no stimulation, were heifers used, with no previous stimulation.

Answer: No—we used a mixed-age herd.

Question: Would cows milked for some time before without stimulation get used to the system.

Answer: Question of getting used to it is a point, but probably not a very important factor.

Question: I suggest keeping heifers on the method you started off on.

Answer: What we are doing is finding out first how important is stimulating, then if it is important, finding information on other factors of training, etc.

Question: Could you tell us something of milking meters?

Answer: Real interest in milking meters has only come since we started working on them, but the process of developing a meter is slow. Our prototype has been sent to the National Dairy Association and has been tested in the field. It has been decided that its accuracy warrants mass production. Therefore the prototype was sent to a plastic factory. They will have to make their prototypes and a delay of at least 18 months is expected. There has been overseas interest in the meter and as none exist now, we are looking forward to exporting them.

Question: Is there any information on different inflations?

Answer: There are basically two types of inflations, soft and heavy moulded. Comfort is most important and the heavy moulded is just not comfortable, therefore should not be used. The Ruakura inflation combined the best of a selection of inflations and has been the most successful in this country. We have investigated the reason for its success and found one of the most important factors is ring cavity vacuum. We have tried to produce an inflation with controlled ring cavity vacuum. We hope to put out a test meter to check ring vacuum in order to tell whether inflations should be thrown away.

ARTIFICIAL BREEDING IN NEW ZEALAND AND OVERSEAS

J. W. Stichbury, New Zealand Dairy Production and Marketing Board.

During the last ten years there has been a rapid growth in the use of artificial breeding as a means of dairy cattle improvement. In several countries the majority of the dairy cows are now mated by this means while in many others, including New Zealand, the figure is over 25 per cent. Artificial breeding is accordingly a very important factor in dairy cattle breeding and the policies adopted by the various organisations concerned with it will to a large extent determine the genetic improvement made in national dairy herds.

It has long been recognised that the key to improvement of dairy cattle is the selection of the bulls used and, for the improvement of characters such as milk and butterfat production, the use as far as possible of proven bulls. The improvement which can be made will, however, depend on the amount of selection which can be practised and here artificial breeding has a marked advantage over natural mating. Because the number of bulls required is reduced the scope for selection is increased. Consequently genetic improvement of the national dairy herd can be speeded up.

It is essential however that the methods used to select bulls are such that genuinely superior bulls are in fact selected. If the methods of selection used are inaccurate then little or no improvement will result from the use of artificial breeding and it becomes merely a method of taking the bull off the farm. This may be desirable, particularly in countries where the average herd size is small. In most countries, however, and particularly in New Zealand the success of artificial breeding will be judged by the performance of the resulting cattle.

The methods being used in New Zealand to ensure that artificial breeding is in fact a means of herd improvement are, I believe, fairly well known. The basic principle is the extensive use of proven bulls, selected under a system of progeny testing which rates the bull by comparing the production of his daughters with that of other cows in the same herd. Originally all bulls were selected for artificial breeding after being proven under natural mating in individual herds. This method has been shown to be very successful and is still being used, but as the demand for artificial breeding has grown, large numbers of young bulls have been purchased for proving within the service.

Until last year proving of these young bulls was carried out by making inseminations from them in the majority of the herds using artificial breeding. To obtain the 50 tested daughters per young bull needed for proving them, it was necessary for 25 per cent of inseminations to be made with young bull semen. Last year the sire proving scheme was introduced under which all inseminations from young bulls are made in special sire proving herds, the owners of which have undertaken to test their herds when the A.B. daughters come into milk. As a result it was possible to provide a complete proven bull service to other users of artificial breeding and 92 per cent of all inseminations were with proven bull semen.

As the country's major dairy breed, the Jersey was the first to be used for artificial breeding, but as the demand has grown the other dairy breeds have been introduced and in recent years beef bulls have

also been used. There has, however, not been any substantial demand for beef bull semen from users and the only change in breed demand of any note is the steadily increasing demand for Friesian semen from owners of factory supply herds.

Last year I spent three months overseas and was able to see at first hand the methods being used by artificial breeding services in the United States of America, Britain and some of the countries of continental Europe. In principle the methods being followed are similar to our own but there are considerable differences in the emphasis placed on various aspects and the type of organisation which has developed.

In this paper I intend to discuss some of these differences. I believe they are not only of interest to New Zealand farmers but also of importance in determining the improvement which will be made.

Organisation

At the present time there is of course only one commercial artificial breeding service in this country although efforts have recently been made to start a second service. This is by no means the case in some overseas countries, particularly in the United States of America.

In this country there are over 50 individual centres which in the main operate independently of each other and sometimes in direct competition. The majority of the centres are co-operatives which generally operate within an individual state or portion of a state. There are, however, a number of privately owned centres, two of which are extremely important. These two centres are both located near Chicago and distribute frozen semen throughout the United States. In terms of the number of cows inseminated they are the two largest centres in the country and are responsible for nearly one-third of the seven million cows inseminated annually. They compete with practically all the co-operatives in their local areas and this competition undoubtedly affects the approach made by many co-operatives to methods of bull selection.

A typical example of this is the question of proving young bulls through the A.B. service. Neither of the two large private centres has a scheme for proving young bulls. In one case a completely proven bull service is offered with naturally proven bulls. The other centre places major emphasis on planned mating and "family" breeding and is opposed to the idea of the wide-spread use of proven bulls unrelated to the cows with which they are to be mated. As a result the smaller co-operatives in particular appear to be reluctant to embark on any large scale scheme for proving young bulls or to cull a bull with a poor progeny test result if he has a fashionable pedigree.

On the other hand several of the larger early established co-operatives have quite extensive schemes for proving young bulls and the largest of all, the New York Artificial Breeders' Co-operative, now relies almost entirely on bulls proven through artificial breeding. This centre is situated alongside Cornell University and co-operates closely with its Dairy Husbandry Department in investigational work. They were able to demonstrate some years ago that under their conditions bulls selected on natural proofs were not as a group proving very successful. Emphasis was accordingly placed on the bull proven through artificial breeding on a large number of daughters. The present procedure at this centre is to use unproven bulls sufficiently to enable them to be proven. They are then withdrawn from service, as is done in this country and to a certain extent in England and at some of the continental centres.

Another factor which appears to be affecting the potential improvement which could be made in countries such as the United States, where there are a large number of independent centres, is the difficulty of co-ordinating the herd testing and artificial breeding services. To maximise progress it is essential that a centre should have information as soon as possible on the performance of the daughters of the bulls it is using. Where the same organisation operates or co-ordinates both services there is little or no problem. Some American centres, however, appear to be faced with considerable problems in this direction. Efforts are being made to improve the situation and the current trend in the United States is amalgamation of many of the smaller co-operatives and increased liaison with the State College of Agriculture which generally processes the herd testing records in the various states.

In England and Wales a number of different organisations operate artificial breeding services but the important service from the point of view of national improvement is that operated by the Milk Marketing Board. The Board operates 23 of the 29 centres in the country and inseminates over 80 per cent of the cows inseminated. Some 64 per cent of the national dairy herd is inseminated but because of the relatively large number of centres and the fact that calving takes place throughout the year the pressure on semen processing and transport facilities is much less than in this country. Inseminators generally collect their semen either directly from the centre or from a conveniently located local distribution centre. The number of cows inseminated by the Milk Marketing Board in the peak months of December and January is around 180,000 per month whereas last October some 350,000 cows were inseminated in this country. On the other hand the majority of our bulls are not used at all outside the spring mating period. However, in spite of this, the number of inseminations we obtain per proven bull appears to be on a par with the British figures. This is probably due to the lower dose rates used in this country and the fact that we operate from only two centres.

As the Milk Marketing Board is also the organisation responsible for milk recording in England and Wales no problems are experienced in obtaining production records of artificially bred cows. Part lactation records (the first 180 days) are now being taken out for A.B. daughters so that early assessments of bulls can be made. Such records are of course, of considerable value in overseas countries in enabling a bull to be proven at a younger age. However, to be of any value here the information needs to be based on the first two months' production records so that it is available in time for the spring mating period. This is impractical at present but it is hoped to use such records when the first daughters born under the sire proving scheme come into production in the 1964-65 season.

The most noticeable features of the organisation of artificial breeding in the countries of continental Europe are the large number of individual centres and the relatively large amount of control at the local level. In Denmark for example, which in area is about the size of the Auckland province, there are 74 individual bull centres each of which is controlled by a local A.I. Society. These societies are all members of the National Association of A.I. Societies which to a considerable degree co-ordinates their activities. However while the large number of centres and considerable amount of local control undoubtedly stimulates interest in artificial breeding it probably also increases the difficulties of introducing new methods and progeny testing large numbers of young bulls. At the present time under 40 per cent of the inseminations carried out in countries such as Denmark, Holland and Germany are with semen from proven

bulls. Only in Germany does there appear to be any attempt to withdraw young bulls from service after their initial progeny testing inseminations have been made.

Herd recording in Europe is generally carried out by separate societies but there is good co-operation in preparing and publishing progeny test information on A.I. bulls. Various methods are used to ensure that young bulls will be used and proven. For example, in Denmark only young bull semen is sent out during the months of July to November while in Holland it is obligatory for A.B. users to test their herds if they have more than four cows.

The Proving and Selection of Bulls

There are considerable differences between various organisations in the methods used to select bulls for artificial breeding and to progeny test them.

In most countries the daughter-dam comparison is the system of progeny testing used. The deficiencies of this method are generally recognised however, and in Britain and some parts of America and the Continent the comparison of daughters with herd mates as used here has replaced it. In Denmark the principal method of progeny testing is the use of progeny testing stations at which 20 daughters of each bull are milked under standard conditions. Some 100 bulls per year can be tested and in addition to measuring milk and butterfat yields information is obtained on such characteristics as milking speed and liveweight gain. The use of such stations certainly simplifies the collection of such data but they are a doubtful proposition from the point of view of proving bulls owing to the poor correlation between the station results and the performance of the bulls' daughters in the field.

Another aspect of some importance is the attention paid to characteristics other than production when selecting bulls. It is generally agreed that attention to such characteristics as udder conformation is essential. Many overseas centres, however, pay what I consider to be undue attention to the conformation of the bull himself. This is very noticeable in some of the American centres while in England and parts of Europe, where bull licensing schemes are in force, bulls to be used for either natural mating or artificial breeding must pass an inspection by Government livestock officers. In Europe the beef performance of the animals also comes in for considerable attention as the breeds used are required for both milk and beef production and specialised beef breeds are not used.

Beef Production

One aspect of artificial breeding which is receiving considerably more attention overseas than in this country is the production of beef from the dairy herd. In Britain 30 per cent of the inseminations are carried out with semen from beef bulls, while as already mentioned the breeds used in European countries are in the main dual purpose. In Germany male progeny of the bulls are checked for growth rate and carcass conformation and the final decision on whether a bull is retained for use as a proven bull depends on his performance for both milk and beef production.

There is considerable interest in the performance testing of beef bulls and selection of beef bulls for artificial breeding is to an increasing extent being based on the results of such testing. Information is being collected in Britain on the growth rates of bulls of the dairy breeds and this is being followed up with similar information for their progeny. An investigation is at present under way which is designed to find out whether there is any correlation between the growth rate of a bull and the milk production of his daughters.

An interesting development is the importation of Charollais bulls into England so that comparisons can be made of the performance of this breed and British beef breeds when crossed with dairy cattle. In Denmark the Jersey Breed Society is studying the value of the Charollais/Jersey cross for beef production. It is hoped that the use of a highly specialised beef breed such as the Charollais for crossings will enable the Jersey to compete on more equal terms with the other basically dual purpose European breeds. I am hopeful that it will be possible to study the value of the Charollais in this country in the not too distant future.

Nominated Service

Because of its particular interest to pedigree breeders some mention of the part played by nominated service overseas is warranted. To provide this service it is generally necessary to use frozen semen and some of the American centres including both the two large private centres now use frozen semen entirely and vary the charge made according to the bull selected by the farmer. As in this country, however, there appears to be a definite lowering of conception rates as compared with chilled semen and it is perhaps significant that the larger co-operative centres are still using chilled semen for their general service although nominated service with frozen semen is available for those farmers who request it. The same position also applies in Europe and in England for example only 2 per cent of the inseminations made are for nominated services. As far as the A.I. movement overseas is concerned its greatest value appears to be in breeding sons of top bulls to come into the service. Under our conditions the use of frozen semen could also play a part in enabling greater use of bulls throughout the year and work is concurrently going on both here and overseas in an endeavour to improve conception rates.

My general conclusions are that as a means of dairy cattle improvement our artificial breeding service is giving as good if not better results as in any other country. The rapid growth of artificial breeding in practically all countries and the possibilities it offers for diversification of breeding aims will result in changes in the selection methods used and the emphasis placed on different aspects. It will pay us not only to constantly examine where we are going but also to keep a close watch on the changes taking place in other countries.

Question: Are we dragging the chain in New Zealand or leading the way?

Answer: I did not visit an A.B. centre which measured up to New Zealand from herd improvement point of view. However, some organisations in the U.K. and the U.S.A. are adopting measures which should bring them to our level. So far as beef production is concerned, we have a lot to learn, especially if it becomes economic for us to go in for beef.

Question: How does co-operation with breed societies in New Zealand compare with that overseas?

Answer: In Holland, A.B. is an offshoot of the breed societies and 95 per cent of all dairy cattle are now artificially bred. The breed societies in continental countries have a wider function than those in New Zealand. The U.S.A. and U.K. breed societies are the closest to ours. In some U.S. centres, A.B. is a means of extending breed society work and they use breed society methods and recommendations. Other centres in the U.S.A. have differences of opinion.

Question: If the N.Z. Dairy Board wanted to use more deep freeze semen surely lowering the price would increase the sale of this?

Answer: We would like to see as good a conception rate with deep freeze semen or with chilled semen before we made efforts to expand the use of deep freeze semen. The same fee is now charged for normal inseminations whether chilled or deep frozen depending upon which is available. A surcharge is only added when deep frozen semen is used for nominated service.

Question: Could our dairy breeds be improved for quantity and quality of milk by the importation of semen?

Answer: Generally our cattle are just as good as overseas. Therefore there would be no great improvement from large scale semen importation. But imports of semen from outstanding overseas bulls would be a good thing.

Question: Has anything been done overseas to study beef production from dairy breeds?

Answer: Yes—quite a lot. There are big differences between the progeny of bulls in the growth rate of their offspring. So far as breeds are concerned, the Friesians have shown up particularly well. There is also work in progress comparing the carcass composition of beef breeds. No country has got far in the selection of sires for beef production from dairy cattle—but there is quite a lot of basic information.

Question: What has happened to herd testing in Denmark with so much A.B. development?

Answer: In Denmark, 65 per cent of the dairy cattle are tested. Of course the records are used not only for selection but also for rationing feed for milk production.

Question: Is the testing service cheap?

Answer: Probably as cheap as in New Zealand but the service is more complex. In Holland, if you have more than four cows and want A.B. then testing is compulsory.

Question: Why is a 10/- surcharge put on pedigree A.B. stock in New Zealand?

Answer: Originally the surcharge was put on by your Herd Improvement Association for two reasons. Firstly it was considered that the pedigree breeder should pay a premium because he got merit bull semen and did not have to take his share of son of merit semen. Secondly there was a charge of 5/- to cover the high clerical cost associated with pedigree animals. But now all users get merit bull semen and clerical costs have been reduced. I am pleased to say that this association together with four North Island associations have decided to discontinue the surcharge for pedigree cows.

MILK WORK IN PROGRESS AT LINCOLN COLLEGE

Dr C. S. M. Hopkirk, Veterinary Science Department,
Lincoln.

There are three subjects I should like to discuss of interest to this group—Brucellosis, Mastitis and the use of Antibiotics.

BRUCELLOSIS

As you ought to know brucellosis is an incurable disease caused by *Brucella abortus*. It produces contagious abortion in cows and also undulant fever in man through the drinking of infected milk or cream. Control of the disease in dairy herds in the past has been by vaccination of calves between the ages of four to eight months. This has reduced, very considerably, the abortion rate in cows but it has not yet prevented infection of the udder. Therefore brucellosis continues to be a danger to human health when unpasteurised milk is drunk. Various outbreaks of undulant fever in neighbouring towns in recent months have shown this to be true. Also cows with infected mammary glands can transmit the disease from cow to cow during the milking process. This is suggested by the fact that cows can have one or all quarters affected. Antibodies are apparently produced from infected mammary tissue and these antibodies are picked up in laboratory tests, thus condemning the cow as a producer of infected milk. The exact truth of antibody production must be determined by further research.

The milk producers of Christchurch have decided that, as their herds are practically free from tuberculosis, they were then in a position to clean up brucellosis. To that end laboratory facilities were made available at Lincoln College.

The original infection rate in the Christchurch area was 4.7 per cent—a figure stated by Dr Cameron, who commenced the testing from Wallaceville. This figure was obtained by blood and milk testing of herds.

At the moment figures for Christchurch show that out of 281 herds supplying milk for the city, 76 herds have always been free from disease, 155 herds have been cleared and have remained clear, 25 herds have broken down and been recleared, 28 herds are still affected, most of them with very few cows remaining which have not been slaughtered, and four herds have infected supplies not issued to the consumers. This means out of 281 herds, 249 herds are quite free from brucellosis and a very small effort can clear all but four. The cost of slaughter has been 798 cows at £10 per head. Probably about 70 cows still have to be slaughtered, but the exact figure has not been computed.

This position has been brought about by submitting composite samples of milk regularly for the Ring test. This test is very sensitive and has served as a basis of payout of a premium for supplies from clean herds. Where the Ring test is positive, an agglutination test of individual cow's milk has picked up infected cows and these have been eliminated by slaughter at freezing works. Affected cows do not therefore find their way back into the milk industry. Compensation at the rate of £10 per head has been paid to farmers whose cows have been slaughtered, plus the proceeds from the works. Affected cows should be got off the farm as soon as possible for they are dangerous to clean cows. Retention of such cows has quite certainly been the reason why some farmers find it difficult to get rid of the disease. Spread may be slow or fast depending on the number of organisms in infected udders.

The Animal Research Station at Wallaceville very kindly checked on twenty herds which we claimed were clean by blood and milk examination of all cows. They have corroborated our findings. It has encouraged us to continue with milk testing rather than revert to blood tests for it is understandable that farmers do not like blood sampling but do not object to collection of milk samples. Should a complete eradication scheme come into being later, then a blood test will be the final referee.

Purchase of replacements free from disease is very important, and tests should always be carried out ten days or so after calving or preferably a blood test before calving should be carried out. One of the pleasing results of testing has shown that breakdowns are rare and they result from purchase of affected replacements.

The weakest point in the whole scheme is the difficulty which producers have in obtaining clean replacements, for purchase of an infected animal can cause a serious breakdown and considerable monetary loss to the farmer.

Vaccination of calves is still a useful procedure and should not be left out of farming practice until the disease has been eradicated from an area. Adult vaccination of dairy herds inhibits the use of the test for as much as a year and should not be practised in town milk supply herds. It is also advisable to get rid of infected cows as soon as possible to prevent spread in the herd.

Greater safety for human beings is obtained in town milk supplies by pasteurisation, for undulant fever is a real danger in towns where this is not practised and on farms where individual cows are relied upon for milk for the family. It can be prevented by heating milk and greatly minimised by bulking milk. However, raw cream remains a danger.

The scheme put into practice by Christchurch producers will be widened to other town supplies under the auspices of the Milk Board with the work still being based at Lincoln College. As far as we can discover, this is the only instance in the world of brucellosis control by a private dairy concern. It should be a matter of pride to Christchurch suppliers that they should have taken the initiative to provide brucellosis-free milk. Summarising the important points:

- A. Vaccinate calves only.
- B. Positive ring test herds should have agglutination tests of individual cows carried out.
- C. Agglutination positive cows should be eliminated or isolated as soon as possible.
- D. Ring tests should be carried out regularly in case of a breakdown in order to find the affected animal.
- E. Replacements should be either blood tested before calving or milk tested ten to fourteen days after calving and should be purchased subject to test.
- F. Raw milk from infected cows should be pasteurised.

MASTITIS

Mastitis is a disease of the udder causing greater loss to the industry than any other single disease. The era of antibiotics which started over fifteen years ago stopped almost all research work on the prevention and cure of mastitis in dairy cows. Penicillin did reduce the problem of Streptococcal mastitis so that there is much less of that type in Christchurch herds, but it has not reduced Staphylococcal mastitis which now has a solid hold in all herds of dairy cows. Therefore there is a great need for research work to prevent and to cure Staphylococcal mastitis.

Within this staph group there are many strains of the organism most of which are resistant to penicillin and some apparently resistant to all commonly used antibiotics. There appear to be a number of human strains existing in herds and some of these can produce

violent gastroenteritis or food poisoning from the toxins they produce besides causing serious illness or death in the cow.

In this discussion I propose to leave out *Strep. mastitis* and simply say that control lies in the persistent use of penicillin together with hygienic milking practice.

All herds have mastitis present in an acute or in chronic form, not only in New Zealand but in all countries. Few farmers can recognise the chronic form which causes a fibrous condition of the udder and sharply reduces the quantity of milk. Cows frequently have two, three, or four quarters affected. There is only one way to recognise the state of the herd and that is by a laboratory examination—in the first place by a composite sample from a cow, followed, where signs of mastitis are demonstrated under the microscope, by examination of each quarter. The laboratory can tell which quarters are affected and by cultural tests what organism is present. Also it can tell which antibiotics should be used. No one can say exactly what the result of the use of antibiotics will be for with many cows the milk remains infected because of the deep situation of the Staphs in the quarter and the formation of small abscesses in the milk ducts. Such milk can pass on infection to other cows through milking cups.

It is difficult to give advice to farmers until antibiotics or udder antiseptics are found which will reliably cure the affected quarter. For too long we have infused two or three tubes of Aureomycin or Terramycin or other antibiotics into quarters with only temporary curative results—often a costly business. Under these conditions the farmer cannot keep his herd entirely free from infection. Thus prevention is important and there is an urgent need for research upon this problem. Staphs grow on the skin of the teats and udder and the higher the population of the organisms there the greater the risk of the gland becoming affected. The practice of washing the udder and teat cups with antiseptics and detergents is good when fresh wash material is used, but usually the whole milking is carried out with the original solution. The cost of using fresh solution is of course high.

Work in the direction of using good soap and clean running water to wash the skin thoroughly, and the rinsing of cups after use between cows with running water is under way, and I believe with present knowledge this is the best way in which to control infection. Spread from man to cow from infected hands, and from cow back to man is not uncommon. The cow is therefore not always to blame for human ills.

Pasteurisation of milk kills mastitis organisms, but with toxic Staphs, this does not inhibit the action of the toxin. The risk to man lies in keeping unpasteurised milk at room temperature so that Staphs can continue to grow and produce more toxin thus giving severe food poisoning. Although this risk occurs, it is rare to find toxic Staphs. To those who object to pasteurisation of milk, I would say that milk must be cooled as soon as it leaves the cow and must be kept in the refrigerator until used. Even then, in untested herds, there exists the risk of undulant fever and perhaps Leptospirosis by contamination, a risk which can be accepted by adults but should not be allowed for children who drink so much more milk and have no knowledge of the risks. Fortunately the risk from Christchurch herds is now much less than in other city supplies.

A vaccine to control *Staph. mastitis* is under experiment at the College and in other herds. It will be some time before its efficiency can be evaluated both in prevention of the disease in milking cows and in protecting heifers coming into the shed, but it is a line of approach which failed completely with the *Strep.* form of the disease.

It is proposed to go fully into the study of the strains of *Staph.* being encountered in milk work at Lincoln and to see, if we can,

what makes it so difficult to eliminate them from the udder when they are so easily killed outside of the body.

Meantime thorough hygienic precautions in the shed—milking affected cows last, using antibiotics other than penicillin as a routine in acute cases of mastitis, and attention to the cleanliness and proper function of the milking machine is all the advice that can be offered at the present time.

Summarising the important points:

- A. As affected cows with chronic mastitis are not easily recognised by farmers a laboratory test should be conducted.
- B. The broad spectrum antibiotics must be used for Staph. mastitis.
- C. Hygienic methods are important in prevention.
- D. Attention to correct running of milking machines requires tests by the makers or officials of the Department. This should be regularly carried out.
- E. Sudden changes of feed should be avoided.
- F. The dangers of drinking unpasteurised milk from untested cows should be recognised.

ANTIBIOTICS IN MILK

Antibiotics are used in animals not only for control of mastitis but by veterinary surgeons for cure of footrot and other troubles. Whereas various antibiotics are infused into the udder for mastitis, in other conditions they are injected into the muscles of the animal. Various bases are used to contain the antibiotic. Antibiotics in watery bases are soon excreted but when oily bases are used, excretion from the body whether by milk or by other routes is delayed, sometimes for many days. Sulphonamides also given to cows may be excreted in the milk.

Regulations say that where animals have been treated with antibiotics, milk must be withheld from supplies to factories and for human consumption for 72 hours. This is sufficient time for elimination in most cases where udders are treated with penicillin. Penicillin placed in one quarter may appear temporarily in other quarters in small amounts. Where Aureomycin is used in quarters, especially if made up in an oily base, a number of cows continue to excrete the antibiotic for varying times above the 72 hour limit. Again oily base antibiotics given by injection can be excreted in milk for considerable periods over the 72 hours. This idiosyncrasy of the cow is not allowed for in the regulations and farmers may be penalised even though they may have acted honestly and in good faith.

In the laboratory, tests show as little as 0.05 units of penicillin per ml. in a sample from a herd. That means that penicillin at that low figure is present at 30 units to the pint, and that if 100,000 units are excreted at one time, .05 units can be found in 400 gallons of milk by ordinary sampling methods. With greater dilution penicillin cannot be shown to be present. Other antibiotics give similar results. We have never found antibiotics present in samples taken from vats in pasteurising plants because of this dilution factor. Pasteurisation methods do not break down more than 10 per cent penicillin in the milk.

The reasons why antibiotics in milk might be dangerous are twofold. They stop cheese starter cultures from growing and also there is the possibility that penicillin may cause allergy in human beings with sensitivity to that antibiotic, though this is a rare occurrence.

Testing for antibiotics is carried out at Lincoln College on all herds supplying milk to the city. The position has improved. Very few farmers contravene the law, and then only by accident or because of a cow idiosyncrasy. To those few complacent farmers who think that their gallonage due to dilution is protecting them, I would say that the test can be improved tenfold. Testing has stopped illicit use

of penicillin such as adding to promote greater keeping quality of milk and a better reductase test, a method which is not unknown to some shrewd farmers.

Supplementary testing can differentiate between penicillin and other antibiotics and this is often carried out as a check.

The position of antibiotics in milk and other foodstuffs is also checked by the Dominion Laboratory on behalf of the Health Department.

As the question of mastitis and antibiotics in milk is intimately connected, new work on less harmful methods of control of mastitis is urgently required and the suggestion has been put forward that a National Committee be set up to study mastitis.

Summarising important points:

- A. Where antibiotics are used, milk must be rejected for 72 hours, because of the danger to cheese starters and in a lesser degree danger to human beings sensitive to penicillin.
- B. Tests can find very small amounts of antibiotics in milk. These can be differentiated when necessary.
- C. Sulphamamide also may be excreted and give a positive test.
- D. Around Christchurch where Strep. mastitis is now not very common, broad spectrum antibiotics should be used.

Question: What is the price per cow of testing a factory herd for brucellosis?

Answer: The work has been carried out free of charge by the kindness of the Christchurch Milk Suppliers. Wallaceville would give you a free test.

Question: What method of testing do you suggest for the eradication of brucellosis?

Answer: The ring test on a full herd supply. If this is positive then the agglutination test on each animal. In most herds there are only three or four affected cows and it is most important to get rid of these as quickly as possible before they pass infection on to other cows. Also calves should be vaccinated annually.

Question: What inroads does mastitis make into the dairy industry? Is any other country carrying out research and are we pursuing the study of Staph. mastitis enough?

Answer: No—we are not. The U.K. and the U.S.A. have started. The U.S. has a special committee correlating all information which started two years ago. The U.K. is giving us a lot of information. In New Zealand some work has been done at Massey, and Lincoln has just started investigations. I imagine this is all in New Zealand but we must do more than this. New Zealand should have a national mastitis committee to correlate work. Every farmer is losing quite a lot of milk from mastitis.

Question: How effective is testing and slaughtering for brucellosis, and how many tests are required to clear up a herd?

Answer: We have eliminated the disease in the majority of herds. The breakdown is where animals are bought in, or where an animal has had the infection, but it has not gravitated down to the udder. However we are constantly ring-testing, and these animals are soon picked up. By quickly eliminating such cows a herd is kept clean. On Christchurch figures it is quite simple to keep herds clean.

Question: The incidence of brucellosis is now very low because of calfood inoculation. What would the gains be in relation to the cost of cleaning it up?

Answer: We have not given real consideration to this because we don't know the position. I would like the ring test applied to all herds in New Zealand. We could then evaluate the cost. While we still have brucellosis we may be penalised in overseas markets when competing with brucellosis-free countries.

PANEL DISCUSSION ON SOURCES OF CREDIT

CHAIRMAN:

Associate Professor A. H. Flay, Head of the Farm Management Department, Lincoln College.

MEMBERS:

Mr D. S. B. Heather, Supervising Valuer, State Advances Corporation, Head Office, Wellington.

Mr V. P. McGlone, Assistant Fields Director, Lands and Survey Department, Head Office, Wellington.

Mr J. Andrews, Chairman, New Zealand Bankers Association and General Manager of National Bank of New Zealand, Wellington.

Mr H. M. Caselberg, Assistant to the General Manager, N.Z. Loan and Mercantile Agency, Head Office, Wellington.

Chairman: Production from the farmlands of New Zealand must be progressively increased in the interests of all concerned. Finance is an essential factor. There are a number of sources of finance, a substantial one being first mortgage money from private individuals, insurance companies etc. This class of finance has little influence on farming activities and standards of production. However, second mortgage money, stock and plant finance, and working capital have a substantial influence. This second type of farm finance which can influence and control production frequently extends to the edge of the security margin.

Everyone accepts, firstly, that lending institutions must be assured of the re-possession, in due course, of their capital, and, secondly, that loans must bear the appropriate interest. We all agree that the prerequisites of these principles are a reasonable margin of security, a paying farm enterprise, and a good farmer of high integrity together with experience and "know how."

The Crown is one source of farm finance—the Lands and Survey Department and the State Advances Corporation. Also, there are the commercial banks and stock and station firms. It is to these institutions that the community looks for its farm development funds. Because of the unpromising economic outlook in farming, finance for current working expenses and for development could well be operating at the edge of the security margin.

Farm finance is required both for new entrants to farms and for existing occupiers. Among new entrants are young farmers acquiring their first property. There are also experienced farmers moving to larger units who can usually supply their deposit money, but the young farmers will normally require maximum assistance. We are all interested and indeed concerned about getting young men onto the land; but we are equally concerned that present production shall continue to increase on all farms.

Now we have a number of questions we wish to put to the panel. These questions are associated with four types of farms (shown in the appendix).

Let us first take the financing of the entrant to a new farm. A 28-year-old man has saved and acquired an appreciable sum. He is competent in his chosen line of farming, having worked all his life on farms and has managed a farm for a time. His integrity is beyond question, he is married with two pre-school children. We want to know if he can acquire a property of his own. (see appendix).

Here we turn to Example 1 and I would ask Mr Heather what he could do about this young man.

Heather: First of all I want to disagree most emphatically with the Chairman about the importance of first mortgage money. We are compelled by Act of Parliament to lend on first mortgage. I put it to you that by advancing £6 to 7 million each year we have done quite a lot of good for the farming community as this is used for both purchasing farms and developing land. So the first mortgage is very important indeed.

Now to start with the State Advances Corporation has a maximum loan for dairy farmers of £10,000 and a maximum of £14,000 for sheep farms. At the present we do not exceed these amounts. Further any loan we make must be no more than two-thirds of the valuation made by the corporation. At times, we do increase the security value by taking in stock and chattels, but if we do this we still don't exceed the figures I've mentioned—£10,000 for a dairy farm and £14,000 for a sheep farm.

The case in question (Example 1) looks a pretty good one on paper but it does not look like an economic unit. In other words it would probably not be able to pay full charges on money outstanding. We took out a rough budget to back up our ideas—our staff are skilled in making up budgets. They must keep abreast of the times, of costs, and of probable receipts and for this we make intelligent guesses for the future.

The farmer would need £16,500 for his land — assuming he bought it at the government valuation—plus £3,500 for his stock—making a total of £20,000. We're prepared to take his potential production, shown here as a 20 per cent. rise in 5 years, and to take a reasonable risk—that is if we are satisfied with the man, with the property and that he can pay his way. So we'd lend up to £11,000 on the land. We could go further than £11,000 if we took in his stock and plant.

Andrews: My team have also had a look at the budget on this farm and they feel it's rather a tight proposition. They've first of all assumed you couldn't buy the farm for £16,500 and that it's going to cost £18,500. They've also assumed that if you buy it in the dead season, it's going to cost an extra £1,000—£2,000 in living expenses before next year's returns come in. So they put it down as:— land £18,500, stock and plant £3,500, dead season's expenses another £2,000 making a total "going in" cost of £24,000. Now that's perhaps taking a gloomy view but it sometimes pays to do that.

The question is how much money would this man need for the farm. We've assumed he'd get a first mortgage of £11,000. We've then valued what's left for the second mortgage on the farm—the stock mortgage, the life policy and something for the motor car which we've written down because values change. This security for borrowing on adds up to £5,800. He could expect to borrow somewhere between £4,000 to £5,000 between the stock agents, the banks and other ways of borrowing. That means he'd need to have at least £8,000 himself.

Chairman: Could I ask, Mr Andrews, would the banks lend at the present time on the conditions you have just stated?

Andrews: Yes—it depends—it isn't as easy as it was and the credit squeeze creates all kinds of limitations for us. We are still lending to farmers but it would be difficult to find money for these propositions if there were a large number of them. Also, it would depend on the man, his family relationships with his bankers and all sorts of odd personal factors.

Chairman: This is a very good chap Mr Andrews.

Andrews: Well between the stock and station agents and the banks I'd assume he could get £4,000 anyway—perhaps between 4 and

5 thousand. Our people feel that anything less than £8,000 in cash is too low.

Caselberg: I'd agree in the main with the other two speakers. One has to do a considerable amount of guessing about the farm described on the paper in front of us—in fact one of the things that always worried me is the amount of guessing which seems to go into financing farmers. Now to start with we're told there's a 20 per cent. rise in production as a potential but we're not told just what that's going to cost. However, it's reasonable to assume it's not going to take a great deal of capital in this case. I think we can take a risk there, whereas in the other examples presented to this panel—you couldn't take the same risk. I'd agree that somewhere between £8,000 to £8,500 cash would enable this man to go in because of the favourable circumstances. However, I agree that, at the present moment, the farm is uneconomic or borderline.

There's another factor which Mr Andrews touched on—the working expenses. Now you might be able to get a loan of £1,500 from a stock and station agent. I would imagine the budget costs here would be £5,000 so the peak of his account would be about £3,500. If a stock and station agent gave this chap a loan, they'd have loaned £1,500 plus £3,500 giving £5,000 at the peak of his account against a security value of £3,500. This illustrates the chairman's point that you are getting near the bone with this type of finance. Obviously the wool has grown, the stock appreciated over the period from a take over in February - March until revenue starts coming in over the September - November period; but you are near the bone.

But the reason why this appears an easy case which can be financed even under the credit squeeze is that he's an exceptionally good chap. He's got a good wife. There's a desirable property with good saleability. There's no development needed from capital—I've got to assume that it can be done out of revenue. The average institution would lean over backwards to try and help a man like this on this type of farm.

Chairman: Then we can take it that a man with these credentials is in a very good position to get started in farming. Can we now move to Example 2. The same man on a more difficult farm. What could you do for him Mr Heather?

Heather: Example 2 is not so attractive and, as Mr Caselberg has pointed out, the information given is rather sketchy. We'd want a whole lot more from our staff reports. There's no mention of the buildings so we've assumed they're satisfactory. Now if this place is to function there's obviously got to be more development. The paper says there's 100 per cent. potential with large scale discing, ploughing and fertilizer. We wouldn't be happy to lend on the land alone. We'd want land, stock, plant, and development. We estimate there'd be a minimum of £3,000 for development and we'd lend him the money for this purpose.

Once again we've taken out a shadow budget—and this budget does not pay charges. We'd lend here a maximum of £14,500 on land, stock and plant, and development. We'd pay up the money for development as the work was done and then we'd add a certain amount to the value of the farm for that work. This chap would be on budgetary control. We'd provide seasonal expenses—possibly three, four and even five thousand pounds as mentioned in the previous example. Then we'd have him, his farm, his stock and his plant and would be providing everything.

We realise from the farm description that costs would be greater than usual. This would be reflected in his budget—a budget we would agree with the borrower to implement. In other words he agrees

with us that the way we propose the farm, the farm should be run is sound and proper, and agrees to work faithfully under that programme. So there we are with all the security, lending £14,500 plus seasonal capital. I think that's quite good.

Chairman: That is good—Mr Andrews will you comment.

Andrews: Mr Heather has now explained how this can be financed with budgetary control through the State Advances Corporation. Without it, it was our feeling that this man did not have enough cash for the project. The property has obviously got to have a lot of time and money spent on it. Now, for a start he hasn't got the cash—its got to be built into the asset. Apart from his first mortgage, his borrowing capacity is not particularly high. £10,000 would not be enough unless Mr Heather helps him. If he was relying on the banking institutions beyond the first mortgage, he'd need £12,000 to £13,000. We assumed he'd be paying a little more than the government valuation for the property.

Casenberg: I'd agree with the previous speakers and particularly with Mr Heather that this type of proposition demands complete control if it's going to be successful. It's vital to work out the costs of development for a start. If these costs are too high, the thing won't work. Therefore the homework of the farm and the lending people concerned has got to be done first.

Now this project is outside normal stock and station finance because the unit is uneconomic now. There's also the difficulty of separating capital money which must be put into the farm from working expenses—this is always difficult. We therefore come back to Mr Heather's point that complete control would be necessary. You see as you go up in farm development, so you need extra stock. Now it is quite impossible for a stock and station firm to find the extra stock and put it on the farm with the security held by someone else. It's quite obvious that the best interests of the farmers are served by a lending organization, which has security over the land, stock and plant.

You have a farm which is not easy to sell; it's not highly desirable and once again life being what it is, this type of chap in this type of farm hasn't got the amount of cash to enable him to develop it. If he had the amount of cash, he wouldn't buy this type of property.

Chairman: You said the farm was not economic—could you tell us what sheep numbers it would need to make it economic from your point of view?

Casenberg: You can't put a wet towel around your head and work that out by sitting in your office. You'd have to see the place. It might be 1200 to 1800 sheep depending on the working costs necessary—fertilizer and labour particularly.

Chairman: If it was 1200 to 1500 even then it could need 1½ or 2 men to run it.

Casenberg: And then you'd get into the situation where you haven't got enough to support the labour.

Chairman: That's an important point. Now I think we could move along to the next question. Suppose this young man that we've been talking about so far has only got £3,000 in liquid cash, a small motor car, and household furniture. What prospects has he got of getting a start in farming.

McGlone: Provided he had adequate practical farming experience, did not own adequate farm land, and had not recently disposed of an economic farm, he would have quite a good chance of being settled under the Government Civilian Settlement Scheme. Under this scheme,

the Government is trying to make available approximately 100 farms a year. Some of these will go to servicemen under the preference scheme but the majority will be available for civilian settlers. The details of the scheme are set out in the pamphlet which is available at any Lands and Survey Office.

The main points in this scheme are that the applicant must satisfy the Land Settlement Council that he has got adequate farming experience and finance to handle the property. Finance means he has got to be able to meet the minimum deposit which is fixed by the Land Settlement Board. Assuming for a moment that examples 1 and 2 were economic units, the deposits on a leasehold basis would be £3,000 for the first example and £2,800 for the second. On a freehold basis the figures would be £6,000 and £4,500.

In addition all applicants have to satisfy the committee that they can make arrangements for seasonal finance from an approved source—a stock and station agent, a bank, or a relative who is prepared to put the money up.

Chairman: Would anyone else like to make a comment on this man with £3,000? Mr Andrews.

Andrews: Our advice would be to go share milking with his own herd—preferably in town supply.

Casenberg: It's a controlled job—just like the last case.

Heather: This chap would have a bit of a struggle to get on a farm with State Advances Corporation finance—but it is possible if his father or a relation or maybe the vendor is prepared to help him by a mortgage at a low rate of interest or possibly at no interest at all. We've had numerous cases of this over the past year. If his people are prepared to help then a man with £3,000 could get onto a farm. We would be prepared to come in but of course any loan we gave would be no more than two-thirds of our value of the security offered—either the land, or possibly the land, stock and plant. But it's a pre-requisite where we lend that the farm must be economic—that is it must be able to pay charges not only on our loan but also on any other money's that are outstanding against the property.

Chairman: Anyone else help this man—well there you are—this chap with £3,000 has got two chances. One with the Land Settlement Board and one through the kindness of the vendor.

We now move onto the next question:

While starting young men on farms is of tremendous importance, the main increase in farm production must come from better and fuller land use by existing occupiers. This may involve new buildings, hay barns for instance, better water supply, greater subdivision, pasture renewal and heavier topdressing, bringing native lands into grass production by ploughing, discing or by aerial topdressing, and so on. Such development needs extra stock as well as extra money. All improvements demand considerable capital outlay and further, very often there is a significant time lag before full returns are realised. To assist here we have given two examples (example 3 and 4 are shown in the appendix.)

Now what we want to know is this:

Firstly—Would members of the panel state if they can finance these two farmers.

Secondly—What tags and conditions would there be to loans for each example.

Casenberg: This is the man with 300 acres (Example 3). He's got a 50 per cent. rise in 5 years, I see, and again we don't know what it's going to cost. But as I see it, the snag here is that this chap already owes £1,500 to his stock firm. Now the first charge here,

if anyone is going to finance him, is to repay the £1,500, to find the working expenses and possibly to find new plant. I must assume that something like £7000 or £8000 will be required. Now if that's so, we are going to have a land mortgage of £12,000, a stock and plant debit of £7,500 making £19,500 against the security value of £16,500 for the land plus £3,500 for the stock and plant giving only £20,000—plus of course, the added value of stock and plant which is normal and seasonal. No—I would say this is outside normal finance.

Chairman: Developing via more sheep is only one alternative. He has another. He's in a cropping district where his land has been built up in fertility by numbers of years of sheep farming. Now he thinks he can make more money by turning to cropping. The suggestion is that he grows 80 acres of cash crop—say 50 acres of wheat and 30 acres of small seeds or peas. All he requires is a header and a tractor to get on with the job of growing crops. He'll maintain his present ewe numbers—these crops taking up his potential increase in production. What's your comment now? He merely wants £3,000 for a header and a tractor.

Caselberg: And who finances him for his working expenses?

Chairman: I was wondering if you could answer that question?

Caselberg: If he were a skilled operator, well known for his ability to grow crops—

Chairman: He is skilled.

Caselberg: But he's going into a new venture you tell me!

Chairman: He's had experience.

Caselberg: I'd like to spend a moment on this experience factor. Now in all the examples we've been told—he's a good chap. That's sketchy enough because one wants to know if he's a skilled operator in the project he's now undertaking. Now that's vital.

Chairman: He's recognised as a capable man.

Caselberg: Aw—fine! What at? Well, we've got to assume for the panel that what the chairman says is right. If that were so, there is a chance. But there's not enough security here and you'd have to take a very careful look at it—in his own interests as well as your own.

Chairman: Mr Andrews—can you help. He only wants £3,000 for a tractor and a header.

Andrews: If we count the £1,500 in from the stock firm, he needs £4,500 plus something for working expenses. Altogether that's £6,000. It's not easy to see where he's going to get it. His property is mortgaged to the full. He might get a few hundred against the surrender value of his insurance policy and a mortgage on his car but I can't see him getting something like £6,000 for this particular project from the normal lending institutions. This looks like Marginal Lands or a budget job.

Chairman: I would have thought this was a gilt edged security. Cash crops are quite reliable in an area like Canterbury—it never lets you down—bringing in £30 to £40 per acre over 80 acres—something additional to his present income which at present pays all his costs.

Andrews: But he wouldn't carry the same stock.

Chairman: Oh yes he could. He'd take up the slack with crops—he's understocked at the present—otherwise he couldn't put in 80 acres of crops without reducing stock numbers.

Andrews: Like Mr Caselberg, I'd have to have more facts.

Chairman: Mr Heather thinks this is a job for the banks and the stock and station agents.

Heather: Yes—it's a fair bet for them—we wouldn't come in at all.

McGlone: I'm sure he'd get the money from the banks or the stock and station agents particularly if the chairman represented his case for him! If he couldn't get money anywhere else, then the Marginal Lands Board might give him assistance.

Heather: The reason we won't come in is because there's already a considerable mortgage on the land. Now by statute we are compelled to stick to first mortgage lending. If his mortgage were only in the order of £3000-£5000 and there was an equivalent amount of development to be done on the farm—then we would probably pay off the existing mortgage and advance the money for development so long as we were satisfied with everything else.

This is an important factor on farms which are fairly lightly mortgaged. We are prepared to take a reasonable risk for the development of land in the national interest. We will lend an equivalent to the existing mortgage for essential development. But we will not advance money for frills—things which might be desirable but are not essential. However we will advance to that extent where there is an equal amount of development to be done on the property.

Chairman: I'm disappointed with the panel that this fellow has such a job getting a little money. I would imagine that some of the machinery firms would help him provided they got paid back at £300 to £500 a year and got interest on this money.

We now move to the last example—Example 4. This fellow—just as good a man—has got 2,500 acres of land, he's carrying 1200 ewes and replacements. Some of it's topdressable by air—nice tussock country. Some of it's ploughable and there's a great potential.

Caselberg: Obviously it will be 10 to 15 years before projected improvements will show a return. Now we've got to get our thinking straight on the function of stock and station agents and the function of other lending institutions. They are interwoven a great deal which does not make it easy but certainly stock and station agents do not lend long-term on land, they simply aim to assist farmers and by a greater knowledge of farms and farmers than possibly some other institutions have—they are sometimes willing to grant short term credit even to people who are under security both for land, stock and plant to others. A great deal of stock and station business is done that way. But when it comes to tying up capital for long term, it's outside the normal sphere of operations. Therefore in this example, unless there was complete control, and we were assured of the success of the chap, then we would not lend.

This man has got a lot of problems for the future. He's got an educational problem among others. You've got to take these into account at the beginning and not find them foisted onto you two or three years afterwards. After investigation, we might be able to help but I suggest that this is outside the scope of normal stock and station business.

Andrews: I support Mr Caselberg. I think a man who tackles a proposition like this—a plan bearing fruit in 10 to 15 years—needs more than just useful experience. He'd need a heart of oak. As a banker I'd say to him, "We've got some excellent people called Marginal Lands—they are just the chaps for you."

Heather: I second the motion. This is undoubtedly a case for Marginal Lands—not the S.A.C.—because of the fairly substantial first mortgage. If it were smaller we might come in and refinance

for essential development. It seems a case for Mr McGlone and his merry men.

McGlone: I don't know if we would go in very merrily—but if everything else failed we would go in with a three-way partnership—the farmer, the Marginal Lands Board, and the stock firm. There would be some reservations. The case would have to be investigated. I don't like the look of the crawler tractor and all that heavy cultivation plant. The Board would, I think, look sideways at that. He might be better to get the initial work done on contract rather than put out some thousands of pounds in depreciating plant. If the mortgage was a short-term one, the vendor would have to agree to a reasonable extension—say five years or more. We wouldn't want to get caught in the middle of the job with the problem of re-financing.

It wouldn't be easy for this farmer to develop this property even with the assistance of Marginal Lands and the stock firms. He'd have to accept budgetary control and keep his living expenses down to a minimum. He hasn't got the cash to do the job—he's got to do the job by savings and hard work.

If a loan was forthcoming for plant, it would be lent on a fairly short term—say 10 to 15 years—because the only security the Board would have would be the depreciating plant. A first mortgage would be taken over the plant with collateral security over the land and improvements and the other stock and plant.

With the co-operation of the three concerned—the farmer, the stock firm, and the Marginal Lands Board, I am quite sure that this chap could be put on his feet and have a successful future ahead of him.

Chairman: That's very encouraging Mr McGlone. Here is a source of credit for many farmers, and I suspect that more and more will think about using Marginal Lands. To my mind this farm is a gilt-edged security yet at today's prices there is only one source of finance for it. This is a stark and naked fact. We are indeed grateful to the Government for the Marginal Lands Act which makes this kind of development possible.

Now we come to one of the most important questions of the lot. It is this. We've limited capital resources in this country. We've the problem of making the best use of them. Farm development has a high priority from a national point of view—but is farming getting its proper share particularly with a credit squeeze in operation? Lending institutions have to be very careful. Now Mr Andrews can you reconcile the situation of limited resources and credit squeeze with national farm development?

Andrews: Yes, I think I can. It has been a fact that over the years when we have had credit squeezes there's still been a tremendous amount of development in this country in all directions—including farming. The credit squeeze is applied to prevent too much development in all directions—as well as to reduce the pressure on the labour supply, to reduce the pressure on imports, and to control the value of money. In principle the credit squeeze is right—though of course I don't always agree with what's being done on the day—but it can be reconciled with national development so long as it is not too severe.

Chairman: In other words you would be doubtful about the wisdom of developing the last farm we discussed (Example 4.) It has tremendous scope for development but it will take a long time. I suppose you would be a bit hesitant about it Mr Andrews.

Andrews: I think it would be quite wrong for that particular farm to be financed through the banking system at the present time.

Casenberg: I agree with Mr Andrews but I'd like to comment on a remark the chairman made. He said the people providing credit are being very careful. Now they have to be. Now I'm looking at Mr Andrews—he knows what most of the audience know—that the stock and station agents provided the income tax last year for a large proportion of their clients—and again this year. The upshot of this is that the stock and station agents are in considerable overdraft with the banks. I'm right there Mr Andrews?

Mr Andrews: Well — yes — (laughter) — I can explain that (laughter). I have some figures with me that I brought down for a managers' conference. These show that the overdrafts of farmers have risen from 16.7 per cent. of the total in January 1958 to 17.1 per cent. of the total in January 1962—four years later. If you include the stock firms, dairy companies and freezing works along with farmers—after all that is the farming sector of the country—you find that in January 1958 this made up 35 per cent. of the total overdrafts whereas four years later it had risen to 39 per cent. Manufacturers have stayed the same. Wholesalers and retailers have dropped from 20.7 per cent. to 17.9 per cent. These were the people who were supposed to have got away with the swag on bank overdraft—but it simply isn't true. So from the banking point of view the farmers got very much more out of the pool than any others. I think that's a point well worth making. It's not the farmers—it's the other sections of the community which have had the credit squeeze applied to them.

Chairman: Mr Heather—is there a limit to the number of farms you could finance up to the limits you mentioned earlier—£10,000 for dairy farms and £14,000 for sheep farms?

Heather: Well our funds are limited like everyone else's today and we have to use them as wisely as possible but I haven't yet heard of a loan being turned down for lack of funds when circumstances were such that we should obviously lend. In actual fact last year we authorised £7,302,661 for the purchase of lands and for further development covering 1451 farms. So we are really taking a fair slice of the lending in New Zealand.

Chairman: Is there any limit under Marginal Lands?

McGlone: Yes there's a definite limit. The Marginal Lands Board's funds are allocated like all Government funds. But since the Act has been operating it has not been found necessary to turn down any worthwhile case where the conditions of the Board were met. I expect that will continue in the future.

Now I would like to comment on Mr Casenberg's statement when he said the stock and station agents had to be careful. My experience with Marginal Land's work has led me to wish on occasions that they were more careful (laughter).

Chairman: Looking further—how do lending institutions decide which is a good proposition and which is not? How do they apply discretion?

Casenberg: Obviously anybody in business would exercise discretion. Obviously if the business was good or likely to lead to a greater volume of business, it would be given the most favourable consideration in regard to the conditions.

Chairman: Would that apply to the State Advances Corporation too? Would you work out budgets and calculate future production costs to make sure that your money is being put to the best use? There might be a farmer down the road who could do with the money more urgently.

Heather: We will not lend for certain purposes. For instance as a general rule we will not repay mortgages, stock firms debts, pay death duties or help a man leave an economic unit—though we are generous in our assessment of this. In other words we say that he is satisfactorily settled and there are plenty of other people who have no land at all who are just as fully qualified as a man now on an economic farm. So, in the main—we reserve our money for landless men and for helping people on farms for further essential development.

Chairman: Now I think we can draw the discussion of our panel to a conclusion with these words. It looks at the present time that establishing oneself on the farm is quite possible one way or another so long as you can meet the requirements. To my mind that's not as important as the development of existing farms by existing occupiers. It seems that those existing occupiers with no liquid cash who want to borrow are likely to have a more sticky time than those who want to buy a farm itself. This is the impression that the panel have given me but I would invite members to correct that impression if necessary. It also seems that they are worried about future farming prospects and are not too keen to lend to the margin of security or beyond. One hardly blames them of course. Against this we are asking the farmers to expand output. We are asking him to do this at the risk of his own capital rather than at the risk of anyone else.

Caselberg: Isn't it a fact that a lot of farmers go into projects out doing their homework and consequently get themselves into bother? Lending institutions get into bother too if they skip their homework. There must be an element of risk but it should be a calculated risk. In his own interests the farmer must know the risks he's running and how he's going to meet them. If you know where you are going and how you are going to get there, then you have a reasonable chance of success.

Heather: We are prepared to take an element of risk. I'd like to add that we not only lend on land but also on stock and plant directly. We'll lend up to 60 per cent. on the market value of stock and 30 per cent. on the current market value of plant—and that's quite high lending. It's repayable over 5 years at 5 per cent. Now in this line we lend up to £3,500 to Y.F.C. members going dairy farming and up to 75 per cent of the value of stock and plant to encourage them to go in for farming. We've put a whole lot of young farmers on the land—particularly in the dairy line.

Chairman: Mr Andrews would you like to say something about the question of risk.

Andrews: To me it's a quite remarkable thing that a good man gets the money he needs to do the job—it gives you great faith in the lending institutions that you rarely see a good man having to jettison a project because of lack of cash.

McGlone: It seems to me that there are only two organisations prepared to take a real risk—the Lands Settlement Board and the Marginal Lands Board. The experience of both boards has fully justified the risks they have taken and the faith they have had in the young people of this country. They will go on taking these risks.

Chairman: I am sure that my whole panel has a great deal of faith in the young people of this country.

I am now going to open the panel to questions from the audience. The first question is this. "Would members of the panel define what they mean by an economic unit?"

My definition is this. It is that sized farm which when farmed with average efficiency will meet average costs at average prices—including wages of management, and all costs including depreciation and interest at the accepted current rate.

Caselberg: Your definition is interesting. If it is accepted—very few farmers would have an economic unit. Interest on capital seldom comes up to an accepted business rate because that intangible “way of life” comes into farming. Farmers are also prepared to accept a lower rate in the hope that their reward will come finally in a higher capital value. Consequently I think an economic unit is difficult to define because it’s a personal matter. A man on a small farm with his family gone and only his wife to look after is quite happy to accept a different standard to somebody else. A man on a small farm with no commitment may have as much take-home pay as the man with a large unit with heavy commitments. However when it comes to lending money—then you have to take into consideration all the things we have discussed this morning. I would not care to put a figure on it by saying 50 cows or 900 ewes because so many factors have to be accounted for.

Heather: I agree with Mr Caselberg but we have to give an opinion on this in our work. Our estimates vary widely. A 13,000 lb. fat dairy farm would be economic with average commitments. Where costs are higher we would say 14,000 lb. fat and in fact we’ve gone up to 16,000 lb. fat in some places. Now we arrive at these figures by budgets giving a figure where we can say this farmer can pay all charges.

In sheep farming, the units vary much more. We run from 900 ewes on a fat lamb farm to 1500 to 1600 ewes on a store sheep property with even more in some districts. I don’t want to be tied down to these figures because they vary so much as you go from place to place.

Chairman: In fact the ability to pay determines the economic unit rather than the actual stock carried or the production output.

McGlone: Mr Heather, who is also a member of the Lands Settlement Board has expressed the Board’s view. When we are subdividing land we can’t allow for individuals and we have to make a decision regarding the area of any particular soil type to make into an economic unit. Broadly speaking it’s around 1000 ewes and replacements plus cattle for a store sheep property, and for dairy farms we like to see a potential of at least 15,000 lb. fat. In fact there are many returned servicemen on crown land who are now producing between 20,000 and 30,000 lb. fat. Besides taking the production of the farm into account when the farmer goes in, we also consider the potential and the cost of getting that potential.

Andrews: Our approach is quite different. We have a large number of bank managers all over the country and if they are not gossips they are not much good! When a manager is moved to a district, he finds out about the farms and the farmers. He builds up information about what can be done in the area. It is the only approach that a manager is much good at. He can get others to add but he’s not much good at it himself. He first looks at the proposition to see if it’s possible and then he looks at the farmer and decides “if I lend him the money will I get it back again in due course?” It’s as simple as that so that’s the economic unit to us.

Chairman: The next question from the floor — “Do the panel think that the value of land is too high in relation to its productive value making it difficult for young farmers to get on the land? What is the solution to this problem?”

Andrews: Mr Caselberg has expressed the view that return on capital in farming is too low. Now the reason for this is that land values are too high and they won't come down until farmers stop paying the price.

Caselberg: I want to join issue with Mr Andrews. If you work it out you find that the interest you pay on land is only a small proportion of your total costs. Now whether land is £100 or £120 per acre for good stuff or £45 or £55 per acre is a factor—but it is not the crucial factor. Land values influence the amount of money you have to borrow and they affect yield—but the extra interest you pay is not great compared with other farming expenses. Therefore I doubt whether, within reason, the price stultifies the purchasing of farms as the questioner suggests.

Heather: I haven't a solution but I'd like to make a point on this in relation to the State Advances Corporation. We are not prepared to enter into a loan commitment where the price of land is a silly one—well out of line with the price for the district. In other words where someone is being taken for a ride. It's been said we ought to lend wherever the security is there. We don't have to lend Gentlemen! We exercise discretion when considering what we think are over-priced farms. Now we've been accused of depressing land values. This is not a fact at all and we have had a lot of support from the farming community in the attitude we have taken.

McGlone: I think this all supports Mr Caselberg's point that farm buyers should do their homework first. We operate the Marginal Lands scheme which is essentially the casualty department, and can see what happens to eager would-be farmers who hold the wrong conception that if you have a little capital the type of land you should buy is unimproved land and build yourself an equity. They seldom make themselves an equity, inevitably they make themselves a terrific mess. With limited capital it is best to buy the best land available.

Chairman: The next question — — — “is it a fact that insurance companies, banks etc., are forced by the Government to put a proportion of their money into Government loans rather than make it available for use by farmers or other private business?”

Andrews: Insurance companies may feel some obligation to put some of their revenue into Government securities—but banks don't lend to the gilt-edged security market. However we have been asked by the Government on one or two occasions to help a loan along by telling our customers about it.

Chairman: In other words, government loans do not directly restrict loans to farmers.

Caselberg: Insurance and trustee companies have to balance their inventory in the interest of their shareholders or policy holders. All their money can't be invested in either business or in houses, or in farming—they must spread it around to minimise risk. So a prudent business house balances its inventory by taking some gilt-edged securities, some equity shares, by some lending on houses and by some lending on farms.

Chairman: The next question is “has the size of the economic farm changed since prices fell?”

Heather: In working out budgets we use current prices so this influences our ideas on the size of an economic unit.

Chairman: Another question—"Does the 75 per cent. stock and plant available to young farmers from the S.A.C. apply to dairy farmers only? Is it available to other farmers as well?"

Heather: So far we have only lent to dairy farmers. The Act does allow us to lend up to 50 per cent. on sheep but so far we have not lent under these conditions.

The upper limit for the Y.F.C. loan is £2,500 for a one-man herd and £3,500 for a two-man herd.

Chairman: A comment from the floor "it is well known that cropping in Canterbury is one of the most profitable forms of farming. Why weren't the panel prepared to help the man in Example 3?"

Heather: We don't distinguish between different types of farming. We demand an economic unit, a man who knows his job and a margin of security. If we've got those—we lend.

Chairman: A plain concrete answer. The question from the back is "when lending money—which does the panel consider the most important—the personal factor or the security?"

McGlone: For Marginal Lands, the personal factor is paramount security takes second place. Frequently it does not exist!

Caselberg: You must take all factors into account but its obvious that no one wants to lend money to a poor personal element.

Chairman: A speaker from the audience says "sons have to take over their father's farms at too high a figure because of valuations which are out of line with productive worth."

Caselberg: The questioner also says that the Valuation Department are forcing the price of land up—but it is the farmers themselves which guide the department into making assessments.

Heather: Mr Caselberg is quite right. I wonder, as I look around, how many farmers here would sell their farms at the government's valuation. Not many would—so the valuations can't be too high. The State Advances Corporation makes valuations too—but we level them out by ignoring the over-average figures. There is another difference with the S.A.C. Valuations. Under the act, we have to take the production of the farm into account as well—so we combine the two figures.

Chairman: Most buyers of farms would like to buy their farms at the Government Valuation. Now the next question, "Do lending organisations use their own valuation or do they use the Government valuation?"

Heather: We make our own valuation partly because the government valuation may be as much as 5 years out of date. We employ our own competent staff—originally trained here at Lincoln and then we improve them from then on! You can rest assured that the valuation we put on your land is quite fair and equitable.

Chairman: The last question—"when lending money to buy a farm what significance do the panel put on the accounts of the previous owner?"

Heather: We use accounts—particularly when we are lending money to an existing occupier. We ask for 3 years of accounts. Now we dissect these in our own way to find out what they mean. That could be quite different from what the taxation people think because we are experienced in farm finance. Costs are quite often grouped under quite different headings from how they appear on the printed form.

APPENDIX

EXAMPLE 1

Size of Unit

300 acres.

Carrying Capacity

900 ewes, 100 per cent. fat lambs sold at 33 lb. wool per head.

Potential

20 per cent. rise in 5 years.

General

Clean attractive property. Good buildings. Handy to main centre.

Govt. Cap. Value Mar. 31, 1960.

£16,500.

Clearing Sale Value of Stock and Plant, Feb. 20, 1962.

£3,500.

Personal Factor

Age 28. 2 pre-school children. Character refs. excellent. Excellent refs. from employers re farm work. Has saved lot of money since leaving school at 16 years of age. Wife capable and a worker.

Securities Held

Life insurance for £3,000. Surrender value at £700 at 31.3.62. Car worth £800. Furniture usual.

EXAMPLE 2

Size of Unit

800 acres.

Carrying Capacity

1000 ewes. 350 ewe hgts. 50 w.hgts. 50 br.cows. 50 other cows. 85 per cent lambing. 8 lb. wool. 80 per cent. calving. A store stock property at present.

Potential

100 per cent. increase with large scale ploughing, discing, and fertilizing policy.

General

Unattractive property not very handy to amenities. 300 acres—fair pasture. 300 acres—partly in scrub. All capable of ploughing and discing by crawler. 200 acres—unploughable rough gullies with a fair amount of scrub.

Govt. Cap. Val. March 1, 1960

£12,500.

Clearing Sale Value of Stock and Plant, Feb. 20, 1962

£6,000 including 7-year old crawler tractor and discs, harrows, roller and drill.

Personal Factor

Age 28, 2 pre-school children. Character refs. excellent. Excellent employer refs. re-farm work. Has saved lot of money since leaving school at 16 years of age. Wife capable and a worker.

Securities Held

Life Insurances for £3,000. Surrender value £700 at 31.3.62. Car worth £800. Furniture usual.

EXAMPLE 3

Size of Unit

300 acres of medium soil in a cropping district.

Present Carrying Capacity

900 ewes—100 per cent. fat lambs sold @ 33 lb. plus 10 lb. wool per ewe.

Potential Carrying Capacity

50 per cent. rise in five years or equivalent in cash crops—present stock plus 80 acres in cash crops.

Personal Factor

Age 35 years. In occupation 3 years—moved in from smaller unit. 4 children, 2 boys and 2 girls, 1 boy at secondary school, 4 miles distant. Both boys keen on farming. Occupier recognised as capable farmer. Integrity excellent.

Govt. Capital Value, March 31, 1960

£16,500.

Clearing Sale Value of Stock and Plant

£3,500.

Debt. on Land

Vendor Mortgage, £12,000.

Debt. on Stock and Plant

£1,500 to Stock Firm. This was £2,500 3 years ago.

New Plant Required

Additional new tractor and a header etc., at cost of £3,000.

Securities Held

Life Insurance for £3,000. Surrender value is £700 at 31.3.62. Car is worth £800. Furniture as usual.

Earning Position today

Only a reasonable reward to management after meeting all costs including interest on mortgage and over-draft.

Pay-off period at present day Prices

It will be 3 to 5 years before projected improvements will show a return on invested capital.

EXAMPLE 4

Size of Unit

2,500 acres, extensive grazing unit, 1000 acres in easy downs ploughable with a crawler tractor, in brown-top, a little scrub and odd gorse. 1,500 acres in steeper tussock.

Present Carrying Capacity

1,200 ewes plus replacements. 30 beef cows and replacements. Average lambing and calving percentage. 8 lb. of wool per ewe.

Potential Carrying Capacity

1,500 acres tussock aerially treated with 10 cwt. sulphur-super over 8 years. Carrying capacity raised to 1½ ewe equivalents per acre. 100 acres of the 1000 acres of ploughable land would be re-sown to grass each year after a crop of turnips. Cost is £20 per acre for cultivation manure, fencing and water supply. Subsequently it would carry 3 ewe equivalents per acre producing fat lambs. This performance has been proved by neighbours.

Personal Factor

Aged 35. Occupied farm 5 years. Moved from smaller unit. 4 children, 2 boys and 2 girls, with 1 boy at secondary school 15 miles away. Both boys keen on farming. Occupier recognised as capable farmer. Has had useful experience with tractors, cultivation, pasture establishment on previous farm. Integrity excellent.

Govt. Capital Value, March, 1960

£14,000.

Clearing Sale Value of Stock and Plant

He has not got a crawler tractor or implements suitable for developing this class of country.

Debt. on Land

60 per cent. Govt. value being a Vendor Mortgage.

Debt. on Stock and Plant

£2,000.

New Plant Required

Crawler tractor and plough, disc, harrows, roller and drill.

Securities Held

Life Insurance for £3,000. Surrender value £700 at 31.3.62. Car worth £800. Usual furniture.

Earning position today

Only a reasonable reward to management, after meeting all costs including interest on mortgage and overdraft.

Pay-off period at present day prices

It will be 10 to 15 years before projected improvements will show a return on invested capital.

LIGHT LAND DEVELOPMENT

Mr David Watson, Farmer, Sandy Knolls.

On sitting down to write this paper I began to think of all the people who in some way or other have been of help to me. I would like to mention my father. Firstly because he taught me the fundamentals of light land farming. Secondly because he leased and later sold me a portion of his farm to experiment with and thirdly, because he had the grace to stand aside and let me do things my own way.

I would also like to mention a Mr George Mason, who was a research officer in the farm management department of this College. Mr Mason, as many of you will know, conducted a survey of 39 farms in the Burnham-Aylesbury area. This is known as the Malvern light lands survey. Whilst not wishing to depreciate the hard work and genuine effort he put into the survey, I would disagree with many of the assertions he made. The point I wish to tackle in this paper is one Mr Mason arrived at by looking at averages and as you all know there is no such thing as an average sheep or an average farm. To quote Mr Mason, "It appears that big increases in net profits may be obtained by raising carrying capacity on these soils to about two ewe equivalents per acre. Beyond this level the rate of increase starts to drop off until at about three ewe equivalents further increases are unlikely to be obtained", end of quote. He says it appears, and I say it appears, to be a lot of nonsense and many farmers may have been deterred from increasing their carrying capacity because of it. I would be happy if this paper encouraged light land farmers to increase production beyond three ewes. Many already have. With millions of people starving in the world today it is a great pity that our advisors and our farmers are so concerned about profit. Seeing we are so concerned about profit I wish to show that it is possible even at today's prices and costs to increase production beyond three ewes and make a satisfactory profit as well.

Let us first get a picture of my farm and its initial development. The farm is at Sandy Knolls and was one of the 39 farms in the Malvern survey. It is one block of 444 acres, at present subdivided into 22 paddocks. Government valuation is £30/10/0 per acre, as at 1958. Water supply is from County races. The land is flat and stony in places. The soil is two-thirds Chertsey and one-third Lismore and is 8 to 9 inches deep on shingle. Rainfall averages 27 inches and the farm is subject to droughts.

I started farming this block of land in April, 1954, leasing it from my father. I bought the land in 1959. My father had farmed this block as part of an 1180 acre farm for the previous 27 years and had been responsible for breaking it in from browntop and sweet vernal etc., to the stage where it was possible for me to lease the 444 acres and develop it further from the revenue derived solely from it. When I took the block over it was subdivided into 10 paddocks and most of it had been limed with from half to one ton per acre. The farm was well endowed with buildings. The pastures ranged from good grass and clover to run-out permanent pasture of sweet vernal and browntop. Stock carried during the first year equalled 428 ewes and 22 dry sheep and rams, a total of 450. The rams were 2 South-downs and 5 Border Leicesters. Lambing percentage was 96. Wool clip averaged 7½ lb. per head.

Stock numbers were doubled in the first three years. This initial lift in production was achieved by a policy of ploughing the poorest paddocks and sowing them down in pasture with an application of one ton of lime. This was merely an intensification of the policy carried out by my father — the difference being that paddocks were being

ploughed every four years on average instead of seven years. The disadvantage of this policy was the large area of fallowed ground. And as you all know, you need more than dirt to feed sheep.

During the summer of 1956 I commenced surface cultivation of subterranean clover paddocks. This I feel was the turning point in the development of this farm. One of my neighbours saw me doing the job and told me I would ruin my farm. In my opinion, the opposite has been the case. In fact I would go so far as to say, this farm could not have been developed to the present stage without the swing to surface cultivation.

The big advantage of surface cultivation is the relatively short period required for cultivation which means that sheep can be grazed on a greater area of the farm for a longer period. A period of five to six weeks of surface cultivation out of grass will give equal or better results in terms of subsequent growth than will five to six months of fallow following deep ploughing, as well as providing an extra four months of grazing before cultivation. Successful crops of green-feed and turnips have been obtained from paddocks surface cultivated for as little as one week before sowing but the longer period of five to six weeks seems to be the ideal. This has proved over the years to be 100 per cent successful.

Lucerne was first introduced to the farm in February, 1955. A paddock of 46 acres was sown and after a good strike failed the following spring and completely disappeared. The second paddock of lucerne, 15 acres, was sown in November, 1955, and has been a valuable source of hay ever since. I commenced making hay in the 1956-57 hay season and obtained 1640 bales of subterranean clover hay off a surface cultivated paddock which grew so vigorously I couldn't cope with it with the stock I had. I also made 640 bales of hay off the 15 acres of lucerne.

The Department of Agriculture took soil tests of five paddocks in 1956. The pH level ranged from 5.3 in a paddock which had never had lime to 6.2 in a paddock which had over two tons per acre Phosphate was considered low in all paddocks. They recommended that three ton of lime per acre be applied to the paddock showing 5.3 pH and at least 1½ cwt of phosphate per annum be applied to all paddocks.

To summarise so far. The carrying capacity was doubled in the first three years. In the first place by intensification of the previous system of farming and secondly by the introduction of certain policies that were intended to raise the carrying capacity beyond two ewes per acre, e.g. during the first three years 530 tons of lime was applied. A quantity which was in excess of that required to farm at two ewes per acre. We had started saving hay.

It can also be said that the point had been reached where the stage was set to raise stock numbers to three ewes per acre and more. The limiting factors had been determined and action had been taken to overcome these limiting factors where possible. It can also be said that the cast was assembled, the main feature of which was the acquisition of a leading lady in 1955 without whose help and encouragement little would have been achieved.

Let us now look at the most interesting part of the development of this farm bearing in mind the statement quoted from Mason's report. To quote again, "It appears that big increases in net profit may be obtained by raising carrying capacities on these soils to about two ewe equivalents an acre. Beyond this level the rate of increase starts to drop off until at about three ewes further increases are unlikely to be attained." He goes on to qualify this statement by adding "the diminishing earnings of net profit are, of course, associated with the diminishing gains in farm income made with each additional level of expenditure."

I wish to show that this assertion is misleading and therefore dangerous. Misleading because it focuses the attention on the average and ignores the efficient. Dangerous because farmers, bankers, stock firms, and other with money may be led to believe that it pays to develop this class of land to a certain stage (two ewes) and that it doesn't pay to develop it further.

Let us now look at the development of my farm beyond the two ewe stage.

- We will consider:—
1. The factors involved in development.
 2. The cost of development.
 3. The results achieved.

1. The Factors Involved

Well before the two ewe stage was reached I had worked out the limiting factors. They were in the following order:—

- (a) Water; this is beyond my control.
- (b) Manure in the form of lime super and DDT.
- (c) Cultivation.
- (d) Extra feed for winter and summer droughts.
- (e) Extra stock to complete the cycle.

Manure plus Cultivation equals More Feed equals More Stock equals More Manure equals More Feed, etc.

A. Manure:

The amount of manure had been determined by the soil test and confirmed by another test three years later. The use of DDT super on all grass paddocks is now a regular feature. The pH of all paddocks has now been raised to approximately 6.2 to 6.4. Between 900 and 1000 tons of lime has been applied to achieve this result which is reflected in vigorous clover growth and this in turn provides for nitrogen to stimulate grass growth. What is more this growth has been maintained by the use of 2 cwt per acre of super and the regular use of DDT. The lime and super are applied in bulk by the local transport company whose service has been excellent.

B. Cultivation:

This has been simplified by the swing to surface cultivation and the lime and increased fertility have helped to make this soil more friable. Paddocks to be surface cultivated are first completely bared of all vegetation by heavy concentrations of dry ewes in December and January. This also helps to reduce and simplify cultivation. The actual time involved in this system of grubbing, harrowing, rolling and drilling equals approximately one hour per acre. If turnips are wanted, 8 oz of York or Green Glob plus one bushel of rye-grass is sown. If straight pasture is wanted 2 lb of certified white clover plus one bushel of ryegrass is sown.

C. Feed:

This year 60 acres of pasture and 60 acres of turnips were sown by this method. Also 20 acres of rape and grass were sown in a paddock ploughed during the winter and 20 acres of turnips and grass were sown in a paddock ploughed in the early spring for lucerne. The lucerne wasn't sown because of the drought. So it can be seen that contrary to the opinions of some I still have a plough and still use it and it's not for sale.

The area in lucerne is now 157 acres or a little over one-third the farm area. The lucerne is used for grazing and hay, the hay is used to supplement the turnips and grass during the winter and as reserve for summer and autumn droughts. This year I have about 2200 bales. Present indications are about 40 to 50 acres of the turnips will be all I need. Those turnips not required will be sold to farmers from Banks Peninsula who find that it pays them to graze their ewes out for about two months during the winter.

Approximately 4½ miles of fencing has been erected. On a farm the size of mine, paddocks of approximately 20 acres are ideal if maximum utilization of feed is to be achieved.

As approximately 80 per cent of lambs are sold off the mothers; about 20 acres of rape is sufficient to fatten any weaned lambs and thin ewes.

It will be appreciated that there is no point in growing feed unless it is used and it has always been my policy to convert the food grown back to manure through animals. No straw crops have been grown.

D. Stock:

The emphasis has always been on ewes. Ewes are bought in as four or five-year old halfbred or Corriedale at the February-March fairs and kept for one, two or three years depending on teeth, constitution, fitness, etc. I aim to winter the maximum number of ewes mated to Down and Down-cross rams. Lambing starts the first week in August and I sell as many lambs as possible off the mothers before shearing in December when the balance are weaned. The ewes which fail to lamb or for some reason or other have no lamb with them are shorn in October and sold as soon as possible. The cast ewes are sold in fat condition in the New Year. This means minimum stock numbers during the summer period.

Up to 1100 store lambs have been bought and fattened on lucerne and rape. Lambs have also been bought, wintered, shorn in August and sold as hoggets to the works. I have also bought Aberdeen Angus-Hereford cross heifer calves and wintered them on two occasions. Also there have been over 3000 sheep belonging to other people on the farm at the one time.

Last year I wintered 1520 ewes, 467 hoggets and 18 rams, a total of 2005 sheep. It must be noted here that I had approximately 8000 bales of hay, 5000 of which were stacked by a belt of trees with no covering and had to be used during the winter. This year I have 1513 ewes and 28 rams, a total of 1541 or approximately 3.5 sheep per acre. It should be remembered that some winter grazing will be sold.

2. The Cost of Development

What has been the cost of development above the two ewe stage? So called capital costs would be:

The extra two ton of lime per acre required at 50/- per acre on the ground.	£2220
Approximately two miles of extra fencing at £3/15/- a chain for materials	£600
Extra machinery for hay making, baler £885, side rake £220	£1105
620 extra ewes at 33/- and 10 rams at £8	£1105
Total capital investment	£5020

Then of course there are extra running costs. All the farm is topdressed annually with super whereas at the two ewe stage only one quarter of the farm would be and one quarter of the farm area would be drilled. So instead of 1 cwt on half the farm, 2 cwt is applied to all the farm. This means 44 tons of super instead of 11 tons, an increase of 33 tons, 8 tons of which would contain DDT to give protection against grass grub and porina to 300 acres of the farm, excluding lucerne.

8 ton DDT super standard at £18/4/- per ton spread ...	£118
25 ton of super at 2 cwt per acre at £10/19/- per ton spread ...	£274
Maintenance of ewe flock (the extra 620 ewes) 275 at 25/- ...	£344
Maintenance of extra rams ...	£24
Dipping, vet., etc. for extra 620 ewes:	
crutching ...	£12
shearing ...	£37
vet. ...	£30
farm stores ...	£60
Depreciation of farm machinery ...	£110
Extra casual labour for hay, shearing and general ...	£100
Total ...	£1109
Extra income gained:	
9 lb wool off 590 ewes at 3/- lb. ...	£796
590 lambs at 37/6 a head ...	£1106
245 cast ewes at 18/- a head ...	£220
Total ...	£2122
Less expenses ...	£1109
Net profit gain from extra 620 sheep ...	£1013

Summary:

Capital cost ...	£5020
Net gain ...	£1013

This means a net return of 20 per cent. for the year under review. Now I would consider a return of 20 per cent. to be a satisfactory return on an investment, the majority of which can be provided tax free, over a period of years.

At the present moment, the College estimate that 5 per cent return on capital is a good effort for a reasonably efficient sheep farmer. Mason—an economist—predicted that extra capital would produce a declining rate of return and to make further intensification unprofitable. This prediction does not apply to my farm where we appear to be getting a 20 per cent return on the cash we have pumped into the enterprise.

3. Results Achieved

I feel that even in such illustrious company as this a result of 20 per cent. is nothing to be ashamed of.

Briefly the following has been achieved:—

Production has been increased by 300 per cent. in the eight years. The ability to obtain catch crops of grass and clover has been enhanced. The value of the farm has increased an estimated 150 per cent. on the fair sale value in eight years also. The appearance of the farm is more pleasing and the owner is more satisfied. What's more this development has been carried out from income.

On the other hand:

Stock health could have deteriorated, but it hasn't.

You would think more work was involved, but in actual fact less tractor hours are done than previously.

There is a risk attached to the money referred to as capital, i.e. the £5020.

In conclusion I would say this, "There are more ways of killing a hen than wringing its neck" and there are more ways of developing light land than this. In endeavouring to show you what has been done on this farm, how it has been done, and with what costs and results, I am only too well aware of the fact that there are many light land farmers who could have shown you a more rosy picture.

Question (Mr McGregor): Has not Mr Watson overlooked the cost of extra labour because he is young and fit?

Answer: Hardly any extra labour has been employed. I can handle the 1500 ewes quite easily. There are other farmers in our district who are looking after 2000 ewes and doing them well.

Question: Is water a problem with increased stocking rate?

Answer: It has been a problem due to the lack of water in the county races—but this is being overcome. Our main problem is lack of water from above!

Question: What is your lambing percentage and what type of rams do you use?

Answer: We usually get 100 per cent. lambs tailed on the basis of ewes put to the ram and 95 per cent. of these are sold.

We use the Southdown or the Southdown Dorsetdown ram.

Question: What percentage of your farm are you covering each year with D.D.T. super?

Answer: We use 8 tons a year putting on 1½ cwt. per acre over 100 acres—or a quarter of the farm.

DEVELOPMENT OF A SOUTHLAND FARM

Mr G. S. Fougere, Farmer, Southland.

I have been asked to describe the development of my farm at Springhills near the Gore-Winton highway, ten miles east of Winton. This area was first closely settled about 1890 being covered at that time I believe in manuka, red tussock and flax, with cutty grass and rushes on the flats. Until about 1918 this place was well farmed. Adequate cheap labour was used to dig outfall drains and a very extensive system of slab, facine and tile drains was installed. All went well for a few years but at some stage the outfall drains were allowed to block up and as a result the whole drainage system collapsed. As most of these drains have a soft pug bottom I realized that keeping them clean must have been a formidable task. This land in its natural state lies waterlogged for six months of the year owing to the tight clay nature of the soil, even on the hills which rise to about 100 feet above the flats. As the drains became blocked the cover once again went back to rushes, etc., with the addition of gorse and brown-top. This was general over most of the district and as a result credit was seldom available to settlers. Rabbit infestation increased alarmingly at this stage and some of the settlers lived off the rabbits. In other cases rabbiters often earned more than the farmers on whose farms they trapped. During this period rabbits would often eat half the crops so that farmers had to sow twice the area required.

One farmer of my acquaintance used to go all round his turnip paddock and tie a strand of freshly tarred binder-twine to sticks about three inches above the ground as a deterrent to keep the pests out of his crops. In 1949 a Rabbit Board was formed and with the adoption of a killer policy in 1951 numbers were reduced overnight.

Such was the situation when in 1951 my father and I bought our 279 acres for £2700. We reckoned that the new house on it was worth £6 an acre leaving approximately £3/13/- as the price we paid for land and other improvements.

With the exception of 30 acres grass, 10 acres of manuka and 14 acres of second crop turnips the whole farm was in brown-top rushes and gorse. As the farm could not provide a living or a surplus for development my father and I continued with our agricultural contracting business sinking the profits into development. This meant that it would have been difficult to look after sheep of our own as the fences were deplorable and we wanted to concentrate on sowing the maximum area of new grass. On seeing what a neighbour had done in a next-door paddock we knew it was possible to get high producing pastures established. The 14 acres of turnips were sold at 2/- a sheep week. This returned £400—enough to get the main outfall drains cleared by drag-line. This looked an easy way to finance development so the next year we swamp ploughed 70 acres and sowed turnips for sale; however, with a wet season our turnips sown on undrained land were mostly drowned out while other people's thrive—making a poor market for our poor crop.

A small area of linseed was tried and yielded about £25 an acre. Now realizing that turnip growing for profit on this land was a somewhat hazardous venture we determined to get grass established and followed a system that worked reasonably well for neighbours. After tiling and mole draining the paddock we sowed oats and grass—although we only got 50 bushels of oats per acre the grass establishment was excellent and that paddock is carrying six ewes and their lambs to the acre.

At this time finances were at a very low ebb and we could not raise money to buy stock or repair fences. After trying all other

financial institutions for assistance without success, an approach was made to the Marginal Lands Board. At the time of the application in the spring of 1952 they estimated the carrying capacity could reasonably be placed at 180 ewes. After this loan was granted we were able to continue with the development, especially drainage and fence repairs. With the backing of this loan a stock firm was encouraged to provide money for ewes which were purchased in 1953. The general pattern of development from this stage was to swamp plough as much as possible each year after draining and after a winter fallow, disc it in the spring and apply two tons of lime to the acre. Seed was sown in November with four hundredweight of super followed by a further two hundredweight in the autumn.

In general, the grass established well and the main problem was controlling it with the stock numbers available. Alternatives were either to top large areas or cut hay for sale as there was more than we could use for ourselves. We chose the latter course and used the money to provide more fertiliser, planning to add stock numbers the next year. Some paddocks were so thick with rushes that it was necessary to sow them out first and then drain them. Molybdenum was used to aid clover establishment in these cases, until the land was drained and then we were able to get the lime on. Drainage is the key factor on this land. Without it the upper limit is about three ewes to the acre—with it six ewes to the acre can be adequately fed.

Since 1951 we have laid over 40,000 tiles, mostly four-inch. Moles are pulled across these. The assistance of the Department of Agriculture's drainage advisors has been a great help—indeed, I don't think we could have coped without them. Moling is difficult, especially on sidlings and it is a slow job as an acre an hour is all that is possible at six foot centres on our country. In 1953 we bought 550 cast ewes and the next year carried 850. Lamb weights were excellent off these new pastures. The next year numbers were stepped up to 1200 ewes and we began to keep our own hoggets. We then went through a difficult period with falling lamb prices and weights; however, we still managed to fatten all the lambs except in one drought year when we sold 100 stores.

Cattle were bought in at this stage in an effort to improve land health, but although quite profitable as a means of topping paddocks they did not seem to affect stock health, and as they were a nuisance with poor fences they were dropped from our programme.

During a trial we dosed half our ewes before tupping in July and again in August and lambs at marking with selenium. There was such a noticeable improvement in their condition that we now dose all ewes three times and all lambs at docking and weaning. Whether this is the cause or not it is a fact that our lambing percentage and numbers fattened off the mothers has jumped considerably. We are still carrying 1200 ewes and some replacements and I see no reason why stock numbers cannot be maintained.

Since taking over the farm on my own account I have stepped up cash cropping to approximately 70 acres a year and look forward to increasing yields from crops as the years go by.

Question: Do you lay field tiles by machine or by hand?

Answer: We have a large number of contractors using machines in our district.

Question (Professor Flay): Are you still using Marginal Lands finance and if so how much longer will you continue to use it?

Answer: Marginal Lands finance was used to bridge a gap of two years when no other finance was available. The farm was then taken over by an insurance company and the Marginal Lands loan repaid. From then on we carried on with normal finance.

LABOUR-SAVING GARDENS

S. Challenger, Lecturer in Charge of Horticulture,
Lincoln College.

There is no such thing as a labour-saving garden. All gardens cost labour. But different gardens cost differing amounts of labour, and different gardeners have different ideas on the amount of labour it is reasonable to spend. A "labour-saving garden" strictly means a garden which costs as little as possible in labour for upkeep, consistent with fulfilling its owner's desires. The most labour-saving garden of all is a section covered with concrete, but it wouldn't fulfil the desires of many gardeners!

But you never get something for nothing. Saving of labour in one direction means the expenditure of money or effort somewhere else. Even the section covered with concrete, which never costs labour through the years, costs effort and cash in the beginning, when the concrete is laid. This relatively obvious fact cannot be belaboured too strongly.

Labour-saving in the garden is no different from labour-saving on the farm. The farmer who runs his many acres single-handed has the assistance of machinery and other forms of capital equipment to speed his work; his buildings are laid out to apply the lessons of time and motion study, so that wastage of effort is avoided. The gardener has to approach his problems in the same way. Labour goes further by employing machinery and other aids to speed work; labour wastage is reduced by effective layouts, combined with the removal of forms of gardening costly in effort.

Planned Labour-saving

Labour-saving gardening begins before the garden is ever in existence, for it begins with thought about what you are to grow and how you are to organise it into a garden. It begins with a plan. This is the initial expenditure of effort, which many are unwilling to give. But a plan which costs about two or three evenings of thought can easily save that effort in avoiding time-wasting snags. Time can be saved either by the application of common sense to the layout of the garden, getting rid of repeated waste of labour by the assembly of those areas between which one has to go back and forth; or by spending money in introducing low upkeep items. A fence is more costly in cash than a hedge, or a paved area more costly than a lawn, but their maintenance is negligible when once installed.

A concept of landscape gardening which has gained considerable favour overseas is the treatment of the garden as a mere outdoor extension to the house. The house is ideally organised as three units, and the garden can be organised to correlate with them. The service rooms of kitchen and laundry may, with advantage, have the service areas of the garden — garage, vegetable garden, fruit garden, and the various utility outbuildings—assembled within reasonable proximity. The various rooms of the house which one regards as being relatively private—dining-room, sitting room and bed-rooms—may be associated in the plan with the private part of the garden, which is screened from both the street and the utility area of the garden. The third unit of the house, the public approach, should be associated with the part of the garden which is seen from the street. A common-sense assembly all round, which enables the saving of half-minutes all day long.

Unfortunately this is seldom possible. The house layout is frequently not conducive to this unified approach. Rooms are not

assembled into their blocks according to utilisation; the front door is either an ornament or around the side or rear of the house. But if your house and garden are laid out in a unified fashion it provides a basic advantage in the problem of labour-saving.

Mechanical equipment can save time, but even this needs to be allowed for in the planning stage; access to the hedge for the power trimmer; the avoidance of odd bits of lawn which cannot easily be mown with a motor mower; or the avoidance of awkward angles and corners which cost time and temper to negotiate. Your layout must always allow the most efficient use to be made of machinery. Obstacles of any type should be avoided. This does not mean, however, that your garden has to consist of straight edges and straight rows. Machinery can be handled effectively without this negation of design. The choice of planting material profoundly affects the expenditure of labour. The use of bedding plants as the backbone of a garden planting is most costly in effort, for plants have to be changed twice and possibly three times a year, regular dead-heading is required to maintain a colourful display, and the general care and attention is relatively costly in time. On the other hand, the use of flowering trees and shrubs is a method of economising in upkeep without losing too much colour. In actual fact it is difficult to provide a graded list of the relative amounts of time required by different plantings. It depends on the wisdom of plant selection and general suitability to the environment and upon the degree of spic and span neatness which the gardener demands.

Choice of Plants

Banks of annual plants used in lieu of bedding-out can be much cheaper in effort, being sown on the spot, although they may not be so long lasting in effect. Herbaceous borders on their own are fairly costly in labour, requiring staking, tying, top-dressing, forking over and so on in due season. But the choice of self-supporting plants—iris, for example—in preference to the weak-kneed can reduce effort—and the labour of mowing a lawn, edging on to a border, is less where plants do not flop unduly. Vigorous growing herbaceous plants like michaelmas daisy demand division at frequent intervals and are much less desirable than those slow-increasing types such as peony which look after themselves, despite the immediate effect they give. The adage of "More haste less speed" is very true when it comes to labour saving.

Hedges are another example of this truism. The average gardener buys the most rapid-growing type available—macrocarpa or escallonia are examples—partly to obtain a quick result, and partly because it is cheap. It grows quickly and needs frequent trimming. Its vigour causes depletion of the food reserves in adjacent soil. But if patience can be kept the best hedging is often one of the more expensive lines—they cost more because they grow slowly. Trimming is required much less frequently—only once a year with many plants—and root competition with adjacent plants is much less severe.

Trees and shrubs have been instanced as plants which cost little in labour, but they do cost effort if badly chosen. Plants which grow strongly and need constant trimming to keep within bounds, or are susceptible to pest or disease and need spraying at too-frequent intervals should be avoided. Flowering plums, due to the attack of slug-worm, and manukas, due to manuka blight are unfortunately tending to come within this latter category.

Rock gardens are very costly in hand labour, despite the undoubted charm which they possess, but it is as well to point out here that there is a psychological factor which enters into garden upkeep. A job you can finish in half-an-hour is much less effort—so it seems

—than half-an-hour's work on a job that will take another couple of hours to finish. And this tends to apply to work on the rock garden, for all the jobs there are small ones.

Ground cover plants are seldom seen in New Zealand, although they attract considerable favour overseas. Ground cover plants are perennials, usually woody, which carpet the ground to a greater or lesser depth, smothering weed growth and cutting maintenance to a minimum. In the first years of their life they probably need more labour than most things, for they have to be kept free from weed whilst unable to smother it. But as soon as they cover the soil surface the growth of any seedlings which attempt to gatecrash is inhibited. For open position there is probably nothing better than the various forms of heather. Depending on species they flower in summer or winter, and they make an excellent feature on their own account. Shady spots are not so easy to furnish, and those plants which tolerate such a spot—ivy and periwinkle, for example—are too frequently regarded as weeds. But there are suitable plants and this method of labour saving is one which should be investigated more carefully.

When one gets down to the detail of garden design, as opposed to the broad issues or choice of plant material, there are many little dodges for economising in labour, although certainly some of them may cost money. A rule of thumb which can be applied in some countries regarding garden costs is to estimate garden expenditure at about 10 per cent of the cost of house and section. This figure is very rarely attained in New Zealand. If it were, the use of structural materials, which in themselves are labour-saving, would be much more widespread. When the potential expenditure is low there is still no reason why this rule of thumb figure should not be attained. Good planning in the first instance enables you to see all the jobs which integrate to make a satisfactory garden which avoids waste of effort. And good planning enables these various jobs to be carried out in their proper sequence as time and finances allow. Impatience is the worst enemy to a labour-saving garden.

Lawns

Lawn-moving is a constant and repetitive job, but we cannot do without a lawn. It provides the base line, as it were, for the contrasts of form and colour which make a garden. But work can be minimised by avoiding splitting the lawn into sections, which multiply edging and hand clipping. If your machine cuts 14 inches, then a 40 inch width of strip means three passes with the mower, but a 45 inch strip means four. There is no quick short cut to labour-saving—it is achieved by attention to numerous finicky little details like this. Mowing strips of concrete along the edges of beds avoid frequent edging, and such edging as is required may be quickly carried out with a wheel cutter. The avoidance of small beds cut in the lawn not only adds to the effectiveness of your design but obviates edging, too. If at all possible the lawn should finish either on a mowing strip—six inches wide—or against a paved path which is flush with its surface. The use of small kerbs on paved paths add to your labour, for dirt spilled over the bed edge on to the path cannot be swept straight back. It has to be picked up on a shovel. Gravel paths should have a small kerb, however, to retain the loose surface from spreading on to adjacent areas, particularly if they be grass, though it is still possible to combine a kerb edge with a mowing strip if desired. The top of the kerb is level with the lawn surface, the path being sunk. There is no need, in this case to have a wide mowing strip. If the kerb be, say, four inches thick, it can be chamfered to two inches wide at the top by inserting a triangular piece of timber in the top of the boxing

when concrete is poured. Grass will grow over this small strip and disguise it.

The labour involved by a lawn depends, too, upon the standards of horticultural perfection we desire. The use of rotary mowers enables mowing to be less frequent, and yet long growth can still be controlled. With reel mowers, whilst it is admitted that the standard of finish is much better, mowing has to be more frequent. Control of long grass with this type of mower is far less easy, and, indeed, is somewhat exasperating.

Raised Beds

The use of raised beds, built in brick or stone, save your back, for weeding, cultivating and watering are easier to carry out, and they give a permanent clean line between the grass panel at its base and the plants in the bed. If these latter do sprawl—well, it adds nothing to your labour bill. And if a raised bed is planted with low and free-growing shrubs the maintenance is negligible. The use of raised beds gives an air of definition which it is difficult to obtain from other plantings. They provide a positive structural element which is especially useful in the smaller type of garden. They can be adapted to use as merely surrounding and enclosing features, or as an item of focal importance. A paved approach to the house, highlighted by a raised bed planted with a permanent combination of attractive small shrubs can be both economical in labour and distinguished in appearance. Casual damage of all types is obviated by the bed's height, whereas a bed at paving level could be walked over and easily damaged, as well as becoming a receptacle for odd debris which blows around.

Labour Saving Gear

Gardeners are not too well provided for in labour-saving equipment. There is certainly a multiplicity of equipment on the market, but the ideal of a compact power unit to which numerous accessories can be quickly coupled has yet to be introduced. Most dual purpose machines take so long to adapt to their new job that it would frequently have been quicker to do the job by hand. The garden which is most economical in labour is one which makes use of permanent plantings, and cultivators are infrequently needed with them. Motor mowers and hedge trimmers are too well known to require discussion; it is in the field of efficient sprayers, small tools and water-sprinkling devices that labour-saving most likely will be achieved. Few gardeners possess a really effective knapsack sprayer—and yet spraying is one of the jobs we are frequently bound to do, whether it is liked or not. The average gardener spends far longer either on the end of a hose or in shifting hoses than he should do. There are highly effective permanent sprinkler systems available which when once installed merely need a turn of the top to operate them. When sprinkling is over the nozzles drop back to their position below ground and out of reach of the mower.

Weed Control

Weed control chemicals cannot be classed as equipment, but their efficient use can save labour in many ways. The use of hormones for lawn weed control is well established, but the use of chemicals such as Phytazol A for clean-up of existing vegetation, or pre-emergence weed-killers amongst newly planted shrubs has been far from widely exploited. Weed control by cultivation will always remain of major importance in the home garden, however, and the application of basic rules of husbandry will materially aid control here. Hoeing or scuffling the surface before it is apparently required is frequently regarded as a waste of time, but five minutes then save half an hour

later on. Small weeds can be chopped off, but large weeds have to be hand-pulled one at a time. Perennial weeds are the worst curse in a garden, but if the ground is cleared completely before planting, either by chemicals or cultivation, the problem is slight. Again, it should be pointed out that hasty preparation and planting leads to permanent expenditure of labour later on. Once perennial weed roots are firmly interwoven with those of the rightful inhabitants of a bed eradication is almost impossible.

In Summary

Garden maintenance can be either costly or cheap in labour depending on what we expect from our garden. But it is possible to obtain equal aesthetic pleasure from each type of layout, depending on our individual reactions. There is only one golden rule in producing a labour-saving garden—the labour you save through the years depends very largely upon the thought, energy, and expenditure you put into the job at its commencement.

Mr Challenger

Question (Dr Burns): Would you not agree that one of the big essentials in labour saving gardening at the outset is weed control especially when twitch is present?

Answer: I couldn't agree more—it is the first chance you have of early expenditure, saving you maintenance later on.

Question: What is the best way of keeping edges mown? Is the serrated edge cutter better than the smooth blade?

Answer: I used to think so but the people at the College which use them complain that they are more difficult to sharpen.

