THE PROCEEDINGS

of the

18th LINCOLN COLLEGE

FARMERS' CONFERENCE

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FUTURE OF LARGE SCALE FARMING IN NEW ZEALAND

Mr D. N. R. Webb, Director-General, Department of Agriculture, Wellington.

Your decision to invite me to address this discerning audience on such a contentious subject as “The Future of Large Scale Farming in New Zealand” did me an undeserved honour. I accepted the invitation because I have argued in other places with conviction, if not eloquence, on the need for New Zealanders to keep an eye on the agricultural developments which are taking place, not only here but elsewhere in the world and to be ready to break with tradition so that they can maintain their leadership, or at least a leading position.

My interest in farming on large scale was nurtured and developed in the many discussions I had with that provocative character, the late Dr Peter Sears, Director of the Grasslands Division. One thing that could be said of Dr Sears was that he was not afraid to lead. He knew that there was the risk of disapproval and failure but he preferred these to the alternative of “easy as she goes.” He had a clear conception of what was possible and he had the power of his convictions.

Evidence of the developments to which I have referred is everywhere. Prominent in the urgent planning and action of international agencies such as FAO and the World Bank is the rapid growth of world population—another 100 million mouths to feed every year and those mouths will not be denied. Events all too close to us prove that power will no longer beat hunger or suppress the hungry or those who want a change. With no great thought as to the immediate consequences, they will overthrow the established order, particularly if it represents wealth and affluence, which they consider should be theirs, or in which they consider they should share.

We see it in the changing pattern of land ownership—and this has little consistency. In some zones the peasant is replacing the old-time land baron, but elsewhere science, technology and economic reasoning are setting the pace and the peasant or small farmer is giving way to large scale enterprises. We see 150,000 French agriculturists leaving the land every year—this drift has been going ten years or more and in the same period 2,000,000 German farmers have followed the trail leading from the land. Yet production is increasing and threatening some of our established markets.

Dr Mansholt, Vice-President (Agriculture) in the EEC thinks the changes in Europe are not sufficiently swift. His current thoughts are not towards increased subsidies to help the struggling farmer, but the dramatic reconstruction of agriculture—searching for the type of production for 20, 30 or 40 years ahead. Higher subsidies would be palliatives. Even if farm production could be increased four per cent per annum for certain products it would be impossible for many farmers, currently in difficult situations to make up the leeway separating them from other sectors of activity and this, even if prices were established at the highest level. Despite the productivity increases, the cost of investment and the necessary capital are too high in relation to size of holdings, says Dr Mansholt. He puts the question: “Should agriculture be industrialised or should horizontal
concentration be envisaged?” and gives as his judgment that only farms with a capacity of 400 cows will be viable in future.

In Britain, where agricultural production has increased quite dramatically since World War II, the pace of change is fast and is growing faster.

Here in Canterbury in January last Dr H. P. Donald, a former Lincoln student and now Director of the Animal Breeding Organisation of Britain, observed that landlords and big business enterprises are swallowing up British farms at the rate of 2000 a year. Many small farmers, who have clung to traditional methods and know little about economics, are being taken over by organisations bent on making farming a thorough profitable venture. To use his words, “The new owners are professionals, not dirty boot farmers, and have the economics of farming down to a fine art, but probably do not know how to wring a chicken’s neck.”

Some of the smaller operators who want to go big to keep up with the pace are finding an answer in the cotel—an arrangement by which each of a group of farmers commits part of his farm to a co-operative, which is financed by cash contributions by the farmers concerned—in one case the equal of £100 per acre committed to the cotel—and by Government grant.

One 600-cow cotel now being launched will require:

- cash contributions of £50,000 by the five farmers concerned.
- a faith to hand over physical control of their land and cash to a paid staff of specialists.
- a willingness to assume the distant functions of a board of directors.

The British “Farmers’ Weekly” has no doubt about their wisdom. “Everyone concerned with the welfare of farming will agree that bigger units are here to stay. Modern techniques and equipment can ensure that a well planned, well managed, big livestock enterprise can be at least as profitable as the best-run small one. But it also has the advantages of stability and bargaining power and better all round conditions for the operators.”

There are other developments such as the auto battery rearing system for lambs, now moving out of the research field, large scale breeding enterprises of the Colburn-Thornbar type which, because of time, must be passed by with a mere mention.

Here in New Zealand the history of land settlement and farming policies is a reflection of social, economic and political pressures of the times. War, unemployment and scientific advances have all left their mark as has public opinion as represented in the policies of political parties. The cries of land for the landless and for the extension of the freehold were major political issues of their day and not many years have passed since Governments rose and fell by the appeal of their land settlement policy. The stability of the farming economy is still a matter of public interest and concern but Governments no longer fall on arguments centred around closer settlement, breaking up of large estates, the leasehold tenure or the merits of the lease in perpetuity. More economic reason prevails and this is good because in the end what counts for the individual and the nation
is profitability. And any questioning of facts gives us some clear answers:

.. We have only a little more than 40,000,000 acres of farmable land and no amount of wishing or hoping or political activity will extend it.
.. There is a cost-price squeeze operating in New Zealand—as it is elsewhere—and the only answer is greater productivity, better and more rational use of our resources. Efficiency is the word.
.. Some seem to reason that it has some connection with the sweat shop. Efficiency is something that we all have to relentlessly pursue because it gives us maximum value for the expenditure of our time, effort and money. It is like tomorrow. We never quite catch up with it.
.. With the amount of the capital investment needed to buy a farm, stock and equip it and to develop it to its full potential rising rapidly, the opportunities for the young working farmer with a few thousand dollars to launch out on his own are receding.
.. A multitude of small units each with its overhead and its own set of buildings and equipment used for short periods means the uneconomic use of capital. Hence the development of the idea of the cotel.
.. Labour, a most expensive item, will be more effectively used if there is a high degree of planning and specialisation. It will be attracted and retained only if there is room for promotion, security and a good reward. No man with ambition and drive will stay in an organisation which uses his skill below its optimum level.
.. The one man farm is less viable today because of the advancement of science and technology and the growth of economic hazards. It is difficult for Mr Average Man to embrace all the skills required to successfully direct and operate a $50,000, $100,000, $200,000 or greater enterprise.

Let me say with emphasis that the family unit or the economic unit as we define it today will continue to dominate the scene but units will increase in size or intensity of production or both and some will grow very big. Extra acres are not always necessary to the development of scale. Extra acres are what we usually associate with development of scale and the records show that the trust and the company device is being used freely to beat the land aggregation provisions of the Land Settlement Promotion Act.

Companies with agriculture and livestock production as their object are increasing in number and I quote 1967 Year Book figures:

Registered in
1963 . . . . 377
1964 . . . . 545
1965 . . . . 648

Compare these with commercial wholesale and retail: 1609; 1808; and 1787.

I dislike using statistics in a talk such as this but they can give support and some illumination although they do not always show you where to go—they often are about as much use as a lamppost is to a drunken man. Nevertheless let us look at the illumination from more Year Book figures.
Capital value of farms (land and improvements)

<table>
<thead>
<tr>
<th>Year</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>$6,132,000,000</td>
</tr>
<tr>
<td>1966</td>
<td>$9,085,000,000</td>
</tr>
</tbody>
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Values and the cost of ingoing for prospective farmers are certainly rising as is the investment in development. A survey of capital expenditure on 64,000 farms in 1965-66 disclosed the following expenditure:

- On buildings: $42,962,000
- Motor vehicles and trailers: $15,107,000
- Tractors and farm machinery: $23,475,000
- Improvements and development: $55,183,000

Total: $136,727,000

In the same year mortgages to the value of $180,000,000 were registered in respect of 14,169 farms.

A quarter of the total of the mortgage money $45 million, was advanced by Government agencies, $20 million by insurance companies; $80 million by private individuals (a good proportion of this would be vendor money); $5½ million by building societies; $4.8 million by trustee savings banks.

The figures show the dependence of the farming sector on community assets.

The money required is coming in through the mortgage tap. This does not attract money from the small investor nor does it protect the mortgagee, the lender, against inflation. Inflation may increase the value of the farm but the mortgage remains fixed.

Industry and commerce could never have advanced to its present highly developed state on mortgage finance. Money had to be drawn in by more attractive ways—through share capital.

Mr. Hunt, Managing Director of the Rootes Group, says that one of the most crucial questions for the future was how the farm structure was likely to change. The most plausible prediction was a move towards an increasing number of company farms—some large enough in their own right to go on the market for equity capital and some forming part of the assets of diversified industrial holding companies. Only by gaining access to equity capital, says Mr. Hunt, can one see agriculture getting the long term capital it needs on competitive terms with the rest of industry. There was a powerful case for separating ownership from management, he said. While there existed no proper managerial ladder the ambitious and able man sought to farm on his own account and this led to a gross waste of managerial talent.

One American summed it up this way. “While I am sitting on a tractor or digging a post hole I am worth no more than a labourer.”

The power house in the farm ventures of the future will be the desk where plans are laid, facts and figures are analysed until they make economic sense.

Budgeting and planning are not socialistic devices. They are necessary and can be best employed where operations are on a scale that enables specialist services and resources to be employed to the maximum.
A current advertisement in the "Economist" reads this way:

"DO NOT SEND US THIS COUPON
FILL IT IN AND LOOK AT IT YOURSELF.

I have $........ capital tied up in my fleet.
(And every day it depreciates.)
Last month I had ........ breakdowns.
........ vehicles damaged.
 ........ employees off the road.
Last month I paid $........ for the hire of replacement vehicles.
I estimate ........ working hours p.a. are spent in my company initiating, authorising, recording the sale/purchase of vehicles.
I estimate ........ working hours p.a. are spent licensing, servicing and maintaining my fleet.

FILL IT IN. CUT IT OUT. AND PIN IT WHERE YOU CAN SEE IT OFTEN.

Within days you'll grow to hate it.
Because it tells you the real cost of running your fleet the way it's always been run.
When you're thoroughly depressed, ring Mr D. A. Smith of the Godfrey Davis Contract Hire Division, Newcastle Place, London, W.2."

It has been said that unless a farm is owner-occupied it will not produce to the maximum. I cannot see why this should invariably be so. Let's admit it that some farmers are bad judges of stock, poor stock managers, poor business men. Let's agree also that because University professors do not own the University they are not necessarily slackers—men who do not give of their best.
When you are in a position of responsibility with your operations subject to public scrutiny by a board of directors and the public; when you have to produce a profit or go down the road you give of your best.
Farming anywhere cannot live on tradition. Progress is born in change and if it is made intelligently the individual and the nation benefit.

"... the assumption upon which economic statescraft in the modern world must be based is growth. Those who fear it or entertain doubts about the risks involved will be by-passed while the rest of the world goes forward."

—Sir Douglas Copland.
PREVENTION OF MENTAL HEALTH PROBLEMS

Dr W. D. Wilson, Psychiatrist, Timaru Public Hospital.

New Zealand farmers have won a splendid reputation throughout the world for their readiness to apply scientific methods to agriculture and the wonderful results they have achieved by following this course, the improvement of pastures, the breeding and nurture of animals, and a real concern about the prevention and treatment of disease in their herds and flocks have placed New Zealand in the position where they can be considered one of the leading agricultural countries.

Like the famous N.Z. Plunket Society, originally founded by the way by a former Medical Superintendent of Seacliff Mental Hospital, New Zealand farmers have accepted fully the dictum of the Plunket Society that “It is better to place a fence at the top of the cliff than an ambulance at the bottom.”

The welfare of the stock, and the prevention of illness in stock is rightly regarded by them to be more important than the treatment of illness. Being good businessmen they have seen to it that both the producer organisations and the Agricultural Department, as well as their agricultural colleges connected with the universities, carry out research on a very large scale.

It may truly be said that the New Zealand farmer is very research conscious and he belongs to a section of the New Zealand economy which realizes more than any other perhaps, the value and importance of research.

The subject I have been asked to speak on today is the “Prevention of Mental Illness.” I think you probably had in mind the prevention of mental illness in the farmer, but I would like to emphasise that psychiatrists do not look upon individuals without looking very closely at their backgrounds and in particular the family background, so I would like to enlarge the scope of my talk a little to include the mental health of the whole family.

MENTAL AND EMOTIONAL ILLNESS IS WIDESPREAD

Just how widespread is mental and emotional illness in this country?

There are various ways of gauging the amount of emotional disturbance, for example, in December 1965, there were almost 12,000 people on the registers of the 16 mental hospitals in New Zealand. This figure does not take into account the large number of patients treated by the general hospitals in New Zealand which give psychiatric care. During that year there were 4,083 first admissions to mental hospitals, and there were 3,682 readmissions. During this same period, the number of people in New Zealand who died from suicide was about 200 and this annual toll seems to be fairly steady. The Mental Health Division and the School of Psychological Medicine at Otago accept that one out of every fifteen persons in the community will spend some part of his or her life having inpatient psychiatric treatment and that one out of every three people will suffer from personality disorders or emotional disturbances that in the worst cases can be completely disabling. Coming a little nearer to home, the Public Health Statistician tells us that in 1966 one hundred and
eighteen New Zealand farmers were admitted to mental hospitals and fifteen farmers were admitted to the psychiatric units of general hospitals, making a total of one hundred and thirty-three farmers having inpatient care in the one year, 1966. At the same time a hundred and thirteen farm workers were admitted to mental hospitals and sixteen farm workers were admitted to the psychiatric departments in general hospitals, making a total of one hundred and twenty-nine farm workers having inpatient care. If you bear in mind that the farmers were probably ill for several weeks before going into the mental hospital, that they were probably in hospital for about four to six weeks, and that it took them another two or three weeks before recovering full efficiency, then you will understand how serious a problem this is in terms of personal suffering, extra strain on the family and neighbours, and loss of production.

Also, it should be borne in mind that for every farmer who is admitted to hospital there are usually two farmers' wives admitted to psychiatric care. I think most of you will appreciate that this could be just as big a blow to the farm as having the farmer himself absent from the homestead. In passing, I think it ought to be noted that no section of the community is unaffected by mental illness. Sufferers include farmers, barristers, freezing workers, doctors, clergymen, shop assistants, executives, all types and conditions of people. Although it is difficult to obtain accurate figures and statistics, there is a general feeling that farmers are less susceptible to mental illness than other sections of the community.

The reasons for this could be several:

1. The farmer in his occupation is close to nature and has a greater opportunity to satisfy elemental needs. His occupation provides a good balance between physical and mental activities.

2. The farmer has more chance to be himself; to be his own man. His farm is, in a sense, an extension of himself where he tests himself successfully against nature and does not suffer the same frustrations of personality that the man in the city is compelled to face each day in the more artificial life.

3. The farmer, although he may live more miles apart from his neighbour is less isolated than the man in the city. He belongs to a community, he is a good neighbour, he has good neighbours and he shares and expresses his difficulties with his fellow farmers.

4. Homes in rural areas are probably more stable. More of the old eternal values dominate the home. There is a greater opportunity for happy marriage relationships and the sharing of problems, the sharing of problems and interests in which the whole family can participate. These are only observations, almost guesses and of course I am well aware that there are many disadvantages of farming. I know of the fluctuation of the prices for wool and lamb, making it difficult to budget ahead. I am aware of the lack of refrigerated shipping causing freezing companies to restrict killing and farmers having to hold stock back on the farms. I am aware that there is an uncertain future for butter. I am told that the farmer is unable to pass on increased costs and I am well aware of the fact that the farmer's income is at the mercy of the weather, high winds, heavy rains, late frosts, all combine to present a formidable obstacle. In addition to these natural phenomena, grass grubs, animal diseases and infestations also cause him a great deal of trouble.
PREVENTION OF DIFFERENT TYPES OF MENTAL ILLNESS

So far, I have lumped together mental and emotional illness as if it were one illness. There are in fact, many different types, many of them with differing causes. Before trying to talk about the prevention of these illnesses, I think it only fair to attempt to outline the various types of mental illness. Very broadly speaking, mental illness can be divided into:

1. **Psychosis**—this is a condition popularly known as insanity in which the patient is not aware that he is ill and loses contact with reality.

2. **Psychoneurosis**—a condition in which the patient is aware that he is ill and seeks help.

3. **Character Disorder**—this condition arises when a person comes into maturity, lacking certain character resources such as thoughtfulness and the ability to benefit from past experience.

4. **Mental Subnormality**.

5. **Organic Mental Disease**—there is a group of illnesses associated with physical deterioration in the brain. This occurs frequently in old age and is also seen in certain types of epilepsy, in certain tumours and several other types of physical disease.

PRIMARY PREVENTION AND SECONDARY PREVENTION

**Primary Prevention.**

Certain illnesses, diphtheria and poliomyelitis for example, can be prevented by immunization. This is a very satisfactory procedure and it is not unreasonable for the lay public to ask “How about something similar for mental illness?” A look at the causes of mental illness will show however that this is out of the question.

If we consider Group 1, the Psychotic Illnesses, this is a group of illnesses whose true cause is not yet known. It is suspected that they have a hereditary basis but psychological factors are important in their precipitation and cure. Prophylaxis is difficult because we do not know which people are going to succumb.

Group 2, the Psychoneurosis, offer the largest numerical group and also the largest challenge to those interested in the prophylaxis of neuroticism. We know the cause of neurosis. This always lies in the early development of the child and his relationship with parents, siblings and other members of his family. However, some of the factors which contribute to the maldevelopment of his personality, for example, parental attitudes, prejudices and maturity or immaturity are complex and cannot be easily influenced by the methods which are available, for example, public lectures or the type of group conducted by Marriage Guidance Counsels in their Preparation for Parenthood series.
“CHILDREN LEARN WHAT THEY LIVE”

If a child lives with criticism, He learns to condemn.
If a child lives with hostility, He learns to fight.
If a child lives with ridicule, He learns to be shy.
If a child lives with tolerance, He learns to be patient.
If a child lives with encouragement, He learns confidence.
If a child lives with praise, He learns to appreciate.
If a child lives with fairness, He learns justice.
If a child lives with security, He learns to have faith.
If a child lives with approval, He learns to like himself.
If a child lives with acceptance and friendship, He learns to find love in the world.

Love, wisdom and understanding in discipling children. Love, wisdom and understanding are the three essential factors. Love and discipline should be inseparable, if discipline is to be effective.

A child needs guidance. He needs to understand what is accepted socially. He needs to recognise physical limitations. His definitely call for guidance and discipline. Children respect discipline.

These illustrate some important factors in the development of the mentally healthy and unhealthy child and illustrate also the difficulty in doing anything about these attitudes.

Group 3, Character Disorder, is of particular importance because of the fact that many anti-social persons, children, adolescents and adults figure in this group. The same difficulty is in prophylaxis which I have described with regard to the neurotic illnesses apply here.

Group 4, the Mentally Subnormal, there are over 200 different types of mental subnormality and so far we have effective treatment for only two of these groups.

Group 5, the group of mental illnesses caused by recognisable physical conditions is a group where much effective prophylaxis is possible. In this group we include illnesses caused by the venereal disease, syphilis, and other mental diseases due to endocrine disorder, such as malfunction of the thyroid gland. Many mental disorders of the aged are also included in this group and their full development can be prevented by prompt diagnosis by means of their early physical signs. The control of infectious illness has also led to the prevention of many confusional states which, before the invention of antibiotics, produced states of delirium which had a deleterious and sometimes fatal effect on the patient because of the lack of cooperation which these illnesses induce. So much for Primary Prevention. You will see that it is a difficult field where no straightforward answers are at this time available.

If we turn to Secondary Prevention, then we are in calmer waters; calmer waters where much more can be accomplished. By Secondary
Prevention, I mean the taking of steps to ensure that all forms of mental ill health can be diagnosed early and treated readily. In order to do this it is essential that we in the profession inform the public and, of course, the Government to know a great deal about mental illness. In this process of disseminating information, Mental Health Associations have a particularly vital part to play. They spread information (accurate professional information) and are responsible, or ought to be responsible, for exercising the correct amount of pressure on the responsible authority to see that each area and each segment of the population gets the services which they require. Under this heading of Secondary Prevention, I would include courses of training for certain key groups in a community—doctors, nurses, teachers and clergy for example. I know that the Medical School at Dunedin now offers a well-integrated course in Psychological Medicine, but I think clergymen and the teaching profession do not have sufficient information at their fingertips regarding mental ill health. This is very sad because they above all people have an opportunity of coming in contact with abnormality at the early stage and they do not suffer from the stigma under which psychiatrists have to work.

Reverting once more to the question of Primary Prevention of Mental Ill Health. I think it significant that in its first session the World Health Organization Expert Committee on Mental Health in 1950 remarked that providing a stable and affectionate early home environment is probably the best preventative we have against the development of both criminality and mental disorder. Personalities need such environment for the development of maturity. This same theme was elaborated by the English psychoanalyst, John Bowlby, who, working for the World Health Organization, concluded that the proper care of children deprived of a normal life can now be seen to be not merely an act of common humanity but to be essential for the mental and social welfare of a community for when their care is neglected (as happens in every country in the Western world) they grow up to reproduce themselves. Deprived children whether in their own homes or out of them are a source of social infection as real and serious as are carriers of diphtheria and typhoid.

There are many difficulties in the way of formulating a number of simple, clearcut principles for wholesome child rearing. This has been attempted, however, and Leo Kanner, an eminent American child psychiatrist, has summarized three of these as follows:

Firstly, children are human beings. Secondly, accepted children have a better opportunity for healthy personality formation than unaccepted children. Thirdly, accepted children are more apt to become accepting parents than unaccepted children. He adds that parents practise prevention by living with their children in a wholesome, sensible manner, by steering tranquilly between uninformed carelessness and frantic over-solicitude. In so doing they do not even know how they prevent anything—the less they go out of their way to prevent, the more they really prevent.

Similar principles have been elaborated by United Nations which adopted a draft declaration on the rights of the child. Outstanding amongst the various declarations within this document is declaration
number 6 which says that "The child for the full and harmonious development of his personality needs love and understanding. He shall wherever possible grow up in the care and under the responsibility of his parents and, in any case, in an atmosphere of affection and moral and material security. A child of tender years shall not, save in exceptional circumstances be separated from his mother. Society and public authorities shall have their duty to extend particular care to children without a family and those without adequate means of support. Payment of State and other assistance towards the maintenance of children of large families is desirable."

In conclusion, may I return to the title on which you asked me to speak, namely, the Prevention of Mental Health Problems. I think you had in mind the prevention of mental health problems in the farmer and the farmer’s family. From what I have said I think it will now be clear that your mental health and the mental health of your wife has already been patterned in your own childhood and adolescence. How you will react to adverse circumstances and stresses has already been determined. What you can do however, is to make sure that your children and your children’s children will grow up in a home environment which will equip them to meet difficulties in a wholesome, straightforward way, relying not on any material benefits handed on from parent to child but on much more intangible feelings of security, love and confidence. Sigmund Freud said that "Parents have discharged their duty towards their children if they have taught them to love and work." I hope this afternoon I have been able to give you some idea as to how that state of affairs might be brought about.
THE ESTABLISHMENT OF A 700-COW DAIRY FARM

Mr C. V. Bargh, Farmer, Featherston.

In my opinion there is a simple formula for factory supply dairy farming. Basically it means the all-grass method, a high stocking rate, a certain amount of manure and some form of grass grub control.

These same principles would apply whether a farm was small or large. This was the foundation we worked on. In our planning the number of cows, water supply, milking shed, etc., were adjusted to suit the total acreage, namely 885 acres.

Common sense and logic solved our problems. Once it was decided what was to be done, we set about doing it, whether it seemed impossible or not. A good accountant, a well-worked-out budget, and the Bank understanding what we were about, eased the problem of finance.

The farming of 800 acres in comparison to 80-100 acre farms has obvious economies, especially when there is one herd and one milking shed.

It would be true to say that the establishment of no two 700-cow dairy farms would be the same. The following are briefly the conditions and factors which were to guide the establishment in this case.

A friend and I with 100-odd acre dairy farms in similar circumstances, both considered it was only a matter of time and our farms would become uneconomic. Also it was our opinion that all the necessary ways and means to operate a large dairy farm were in existence, but as yet nobody had attempted to put them into practice.

We consider the main factors being the herringbone type shed, the all-grass method of farming, artificial breeding, and to a lesser extent modern techniques and mechanical aids that are available today. One must not forget of course research in our agricultural colleges and the Dairy Board Advisory Service.

This friend and I formed a partnership and pooled our resources which were our two farms valued at about $30,000 each. Other assets were our stock 300 cows plus 260 calves and a small amount of cash. We leased a property of 747 acres recently developed, running sheep and cattle. This property was mainly in excellent pasture, and fertility was considered high. This land is in two blocks 470 acres and 277 acres a short distance apart. We also lease a further 137 acres seven miles away which was my partner's dairy farm and now used for calf-rearing and dry stock.

The following are the terms of the lease:

The lease is for 10 years at $20 per acre; a purchasing clause allows us to buy the property at a fixed price of $330 per acre, any time within the first five years. Also included is a "no compensation for improvements clause." The length and conditions of the lease made it imperative that we strike out for reasonable production in the first year, and to do this it was essential that all necessary facilities
were ready for use before the main bulk of the cows were due to calve. The milking shed, water supply, races, etc., were designed and built to be capable of coping with 1000 cows.

The capital cost of these items was as follows:

1. Milking shed plus yards and concrete race, a total of 18,000 square feet of concrete—materials only—$5,600.
3. Water supply—materials only—$3,000.
4. Metalling of races $2,000.
5. Fencing, gates, etc., $400.

Total capital expenditure $16,200.

With the lease in view my partner and I raised 150 calves each on our respective farms a year before taking over. During this year we purchased a total of 300 jersey cross cows and heifers, at an average price of $74 and these were grazed out on various properties in the district. This gave us a total of over 600 to calve.

A carefully worked out budget, and our ideas for working the farm were placed before our Bank manager. The Bank was sympathetic towards us, and by using our own farms as security, a small amount of cash, and a guarantee at the Bank for $10,000 by our dairy factory, we were able to raise an overdraft for our requirements.

Our budget was based on the farm producing 150,000 lbs B.F., the first year with 585 cows; we reached a total of 158,000.

MANAGEMENT

We have one objective—to make the largest profit at the lowest cost and with the least effort. To reach this objective it boils down to all-grass farming and a high stocking rate.

The all-grass method simplifies management and make possible the running of a large herd in one mob. To reach a high stocking rate we are rearing as many calves as possible.

Movement of the herd is no great problem, and some of our paddocks are almost two miles away. We prefer wide gateways, but are not altering the existing ones. Our races are 27ft wide which we consider adequate.

Gateways do not cut up unduly if metalled, and likewise the races are not hard to maintain once a good foundation is laid.

One of the most noticeable changes from a smaller farm is the distances and time taken in going round the stock.

All major work such as harvesting, drain cleaning and spreading of lime and fertiliser is done by contractors, and we confine our activities to looking after the herd and maintaining fences, etc. We consider that milking and caring for the stock are the most important jobs on the farm.

We employ three single men and with ourselves makes five milkers. With the exception of the springtime, when the cows are calving, four men do the milking and the fifth has a day off. Next season we are considering engaging an extra man to help rear the calves. Over Christmas we employed a student for nine weeks which enabled each of us to have a summer holiday.

We believe in working to live rather than living to work.
MILKING

Milk ing is proving to be a particularly smooth process. This year we milked 650 cows. Actual milking time during the flush period was two hours. From February onwards this has been reduced to one and a half hours.

Any cow that has mastitis, footrot, or any other ailment, is drafted off as we milk, and these cows do not interfere with our milking routine. With this system of treatment after milking, there is no time limit on attention given.

We are quite sure that a 70- or 80-a-side herringbone would work even more smoothly than a 50-a-side, and so maintain a reasonable milking time when the herd is increased. The alternative to this may come from new improvements in the milking plant, namely the pulsation and inflations, which I understand may reduce milking time to about three minutes per cow.

If this proves correct, we will put extra labour in the existing shed to cope with the faster milking that would result.

WINTERING

We have an area of sandhill of approximately 27 acres, and we are able, during extremely wet conditions, to withdraw to this giant wintering pad. Without this dry area we would not, in our opinion, have been able to manage a large herd on this property.

Our outlook towards wintering is very flexible. We graze out as many as possible; for those at home we prefer block grazing, this is done if it is not too wet. Alternatively we split herd graze on some of the farm, and only retire to the sandhills under dire conditions.

Calving starts on 20th August. This may seem late, but our reasons are to facilitate easier wintering, and to bring calving dates nearer to the maximum growth period. This later calving will become more important as our numbers increase.

CALVING

This season we raised 650 calves using both Nurse cow and Calfeteria methods of feeding. In the Calfeteria method whole milk is used for the first two weeks, and after that until weaning Dankevit and Buttermilk powder.

We began feeding over 700 calves, but by weaning time our numbers had been reduced to 650 due to deaths by scours and salmonella. Later some died of ryegrass poisoning. Every reasonable calf that is born on the property is reared, and the extra calves are purchased from the Bobby Calf Pool. This season we have made an agreement with a sheep farmer to graze a number of our calves from weaning to calving.

We are satisfied with our calf-rearing results and plan to raise 600-800 next season.
BLOAT

Little bloat has been experienced this year. A machine is used to spray oil on to the cow’s side as she leaves the shed—not a 100 per cent foolproof method, but no cows have been lost while using this method.

IDENTIFICATION AND ARTIFICIAL BREEDING

The cows were identified with plastic ear-tags; about 6 per cent of these became lost during the year. Cows in season were marked on the udder with bright green paint, using a brush on the end of about four feet of alkathene. This was done before and after milking, and once during the day. As the cows left the shed during the morning milking, cows so marked were drafted off into a holding yard. After insemination, each cow was marked with red paint. This cancelled out the green paint and so established that the cow had been inseminated.

CONCLUSION

The operation of this farm has been easier than many had predicted. After two years’ experience with this larger herd we are pleased to realise that our original facts and figures have coincided with our results, so we feel confident in saying that large scale farming is, and can be successful.
PROBLEMS IN A GROWING BUSINESS AND THEIR SOLUTION

Mr E. A. Crothall, Joint Managing Director, Crothall and Company, Christchurch.

Farmers used to say, "Farming is a way of life," then heave a deep sigh, implying "None of you businessmen would engage in it." Today, more and more farmers are asking themselves, "Is not farming a business as well as a way of life, and should it not be run on business principles as well as on farming technology?"

Many of those who wonder to what extent business principles can apply to farming have, or plan to have more than one farm. Some have two. Some have three or more. Others have one at the moment but are on the verge of adding another property. I have talked with some of these outreaching men and am impressed with the clarity of their thinking and desire for analysis and for facts. These things—growth, plus an enquiring mind plus systematic records—are of the essence of commercial enterprise. So farming can be a business. Let us then apply some of the guidelines for successful commerce to farming:

The basic guidelines are:
- Objective setting;
- Market appraisal and market orientation;
- Planning;
- Organising;
- Controlling and measuring;
- Leading and innovating.

The effective manager has four basic roles to play:

(a) The Key Role:
- Profit-making, the immediate measures.
- Protecting the invested funds, i.e. survival.

(b) The Enabling Role:
- Objective setting.
- Organising—delegating.

(c) The Measuring and Guiding Role:
- Maintaining a core of simplicity.
- Objectives management.
- Budgeting.

(d) The Deciding and Modulating Role:
- Leadership.
- Decision process.
- Action and follow-up with person(s) involved.

To discharge these four roles, he needs the following skills and attributes:

1. Skills of Identification, Judgment and Creativeness:

He must identify the critical factors and the key areas of the enterprise and recognise that the relative values of the components of each may change from time to time. He must know how to make the necessary adjustments. He must recognise the importance and place of specialists or specialist services, e.g. Farm Advisory Services or contract cultivation, etc. He must be creative, i.e. recognise the need for an entirely new method or product and envisage how to develop these.
2. **Skills of Co-ordinating, Planning and Use of Resources:**
   He must understand how to plan and how to co-ordinate. He must understand and shepherd his staff, knowing their strengths and weaknesses; their training needs. He must smooth the way. He must be flexible in overcoming unexpected difficulties.

3. **Skills of Measurement:**
   He must know how to measure and what to measure. He must understand the validity or otherwise of growth, e.g. volume versus risk and return.

4. **Attributes of Leadership:**
   Let us now examine a few of the main points listed above:

**OBJECTIVES SETTING:**

Abraham Lincoln once said something like this: "If we first know where we are and whither we are tending, we can the better arrange how to proceed."

It is necessary for us to realise that too few enterprises are clear-minded concerning their objectives and the specific way they will achieve those objectives. Merely to say, "We are in business to make money," is the least effective way to realise that hope.

When we start to clarify the objectives we immediately see our need for some clear thinking concerning what it is we really want. We must ask ourselves the question: "What do I expect to achieve from this business when I retire?" This could be your total objective.

For detailed planning, however, a five-year or long-term objective is necessary and, of course, this year's objective (short-term). These two objectives should be stated clearly and in terms which can be measured. One objective frequently used is Return on Investment, or R.O.I. This should be expressed as a percentage of the capital employed. This should certainly be stated for each year. It should also be stated for the long-term five-year period, and should be revised from year to year to take account of any possible increase in the value of fixed assets, particularly land.

If a series of products is envisaged, both short and long term objectives should be expressed in terms which are measureable, i.e. cash value, or weight, or volume, e.g. gallons or bushels.

Obviously if the objective is not stated in specific terms one cannot tell what progress is being made towards its achievement. From this it is obvious that objective-setting enables the manager to discharge his first key role of profit-making and of protecting the investment; but the objective must be stated in writing.

From this we pass to the process of planning: obviously if an objective is to be achieved, cool advance planning for its achievement is essential. Many executives make plans based on opinions. This is wrong. No plan will work if it is not based on facts.

**Planning has four main steps:**

*Step 1:* Collect all the appropriate facts, both positive and negative.
*Step 2:* Assemble them to show possible courses of action.
*Step 3:* Evaluate the possible courses of action.
*Step 4:* Decide on a course, which of course becomes the plan you will follow.

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DELEGATION:

All plans for business action will involve people. This may be the manager himself or it may be the activity of other people to whom the manager delegates duties. There is more misunderstanding about delegation than most other aspects of organising business activity.

There are three degrees, or categories of delegation:

1st Degree: Requiring John Doe to perform a simple operation. John's responsibility ends with the completion of the task. He needs no authority.

2nd Degree: Requiring a third party to have a specific operation done by someone else, e.g. “Mr Share Milker, please get John Doe to build a pig pen.” Mr Share Milker has the responsibility of instructing John and has the authority to command that John does it. Mr Share Milker has a further responsibility to check that John actually builds the pen properly. But he may not initiate the operation unless instructed to do so directly or indirectly.

3rd Degree: Granting the power, the responsibility, and the authority to an executive to initiate action necessary to achieve a wide-ranging series of objectives, e.g., “Mr Share Milker, will you take over the responsibility for running this farm with its herd of 100 cows. My accountant will review the budget limits with you and the Farm Advisory Service will help you whenever you ask them.” In this case the share milker has responsibility to initiate activity:

1. To achieve the budgeted results. He will have been fully consulted during the making of the budget.
2. To use whatever resources are needed within budget limits.
3. To draft his operating plans as necessary to achieve budgeted production and expense limits, and to submit these plans for your approval.
4. To seek further definition or alteration to the budget and plans, if necessary, from you. He has authority to act in whatever way seems appropriate to him within the limits stated. His responsibility is to discharge a broad function. He must satisfy you and the accountant that he has produced the best possible results.

This third degree delegation of authority and accountability is the one which is most often badly handled by the boss, such as a farmer accustomed to making all the decisions for his enterprise and supervising the execution of most of them. Indeed, he frequently performs many of the production routines himself and is accustomed to giving only a short rein to other people. It is difficult in city businesses too, for the boss of the one-man business likes being the centre of attention and the source of power. He finds it difficult to stand aside and permit another man to carry out a function less effectively than he would if he did it himself. So it must be with the farmer too, but if one delegates the right to initiate, one must stand aside and permit the other fellow to learn by his mistakes.

OBJECTIVES MANAGEMENT:

Objectives Management follows naturally from planning and delegating. The term means making sure that each person in the
enterprise understands clearly what he is expected to do, i.e. what are his own objectives. The act of ensuring that every person in authority has a clear written statement of what you expect of him, is called Objectives Management and is the best way to achieve the Overall Objectives for the entire enterprise. There must be constant measurement of his progress towards achieving the targets set and discussion of changes or of the improvements needed.

Such Objectives Management statements must be co-ordinated with the overall operating budget. We do not intend to cover budgeting in any detail at all, since all of you are aware of how a budget must state in monthly periods for a year in advance what are your expected expenses and income, each broken down into controllable

CRITICAL FACTORS AND KEY AREAS:

Now some emphasis must be laid upon Critical Factors and Key Areas. A Critical Factor in any business is one of such continuing significance that its break-down for a sustained period would, at best, seriously affect earnings, and at worst, put the enterprise out of business. Usually there will be not more than four to six Critical Factors. For no two industries will the list of Critical Factors be exactly the same.

E.g., for a household appliance distributor or a car dealer, effective inventory management would be a Critical Factor. For a life insurance company, sales effectiveness, investment control, and home-office costs would be among the keys to success—the Critical Factors.

Key Areas are important elements of performance that must be controlled to ensure satisfactory overall results. Here again, these elements of performance vary from company to company, but in most enterprises the following will be found:

1. Overall performance.
3. Quality of product.
5. Financial position.
6. Innovation (or creativity).
7. Staffing response.
8. Return from investment.

LEADERSHIP:

A leader is a man who grows people and inspires them to attain heights of achievement which they could not otherwise attain. He must be a man of integrity and sound judgment to win their respect. He must have imagination and courage. He must not be pig-headed but be flexible and willing to listen. Much more could be said but this should suffice to indicate that however small or large a group of employees is, there is need for conscious leadership.

From these quite sketchy notes, may I return you to the simplicity of the Lincoln quotation: "If we first know where we are and whither we are tending, we can the better arrange how to proceed."

Do you know—where you are? Where you are going and how you are going to get there?
Have you put it in writing?
These are the seeds of success in any enterprise.
PROGRESS IN FLOCK RECORDING

Mr E. A. Clarke, Director, Sheep and Wool Division, Department of Agriculture, Hamilton.

Breeding programmes based on recording schemes have been inaugurated in many countries and an interim performance recording scheme for sheep has been in operation in New Zealand over the past year. New Zealand is fortunate in being as well, if not better, provided than most primary producing countries with the basic data pertinent to sheep improvement. Thanks to the studies, in particular, of Professor A. L. Rae and his associates over the past 20 years, it became possible to inaugurate a performance recording scheme with every confidence as to its soundness and with a fairly reliable estimate of the sort of progress which might be expected. Time does not permit a discussion of the detailed background data on which the recording scheme is based, but the following genetic principles form the basis of any recording scheme.

Firstly, the objective in improvement must be simple and pertinent. Breeding for characters which have little or no economic importance merely makes the task of improvement more difficult since the greater the number of characters considered in selection the weaker the selection for each of them. There is nothing new in this observation, which was first expounded by Lush over 30 years ago and since that time a considerable amount of research has served to confirm its validity. The inclusion in the selection programme of characters of little or no commercial importance can result in little or no effective selection for those which are important.

The second point is that characters which are to be improved must be capable of being measured and of being recorded.

Thirdly, the characters chosen for improvement must be capable of responding to selection. It is therefore important to know something of the heritability of the characters. Likewise, the repeatability or the correlation between the character on the same sheep in successive years is valuable information which enables the probable gain in lifetime productivity of selected animals to be assessed. It is quite clear from work in New Zealand and overseas that the characters of economic importance in our livestock do respond to selection sufficiently rapidly to justify the inauguration of a recording scheme.

Finally, the most efficient and practical method of selection to be used must be decided upon. Most of the characters of importance are highly heritable so that individual selection alone can result in worthwhile progress. Progeny testing can, for some characters, be a useful supplement to individual selection, so long as the progeny test does not result in extending the generation interval, which is usually the case for most of the characters considered in a sheep improvement programme.

Combining information on several traits in a selection index is used in the recording scheme. This simplifies the problem of selection where several characters must be considered simultaneously.
Correction factors to adjust for known environmental effects contribute to greater precision in the evaluation of the characters of commercial importance and enable the recognition of the most productive animals within the flock or herd to be assessed with greater accuracy. For example, ram lambs must be compared in their ability to grow with ewe lambs, twins must be compared with singles, the progeny of the two-tooth ewe must be compared with the progeny of the older ewe. To enable this to be done, adjustment factors become of great importance.

It is not proposed to give all the details of the recording scheme, but merely an outline in this short paper. A handbook has been produced which sets out in detail all the steps involved and all the procedures devised to overcome variability which is not genetic in origin. This handbook is issued to each breeder participating in the recording scheme and is also available to anyone interested in the details of the scheme.

The recording scheme aims at ranking the animals within the flock in order of merit. The recognition of the best animals between flocks is not attempted. To do this would require knowledge of differences between flocks, districts, management practices, etc., knowledge which at present is not available. This would be efficiently carried out only at central testing stations where the performance of the best animals selected within flocks could be compared under uniform conditions. The purposes of the scheme may therefore be summarised briefly as follows:

1. To supply the breeder with accurate information on the production performance of each animal in the flock.
2. To rank the animals within a flock in order of merit for the few really important commercial characters.
3. To provide the information in a uniform, brief and readily accessible form so that the maximum use may be made of it in animal improvement.

Objectives in Sheep Breeding

It is again stressed that the characters considered must be those of real commercial importance. In defining objectives it is important to consider to what extent a change in each character affects the financial return from individual sheep. This calls for information on market prices for different quantities and qualities of wool and lamb over a number of years. It is clear that increased lamb production ranks first in importance, followed by fleece weight. The quality of each product must receive the consideration due to it.

Characters to be Measured

In addition to the normal pedigree details of sire and dam of each lamb, its date of birth, birth rank, rearing rank, etc., the following information is called for:

1. Total Weight of Lamb Weaned by the Ewe. This has been chosen as a simplified index of the fertility of the ewe, plus its milking and mothering ability. It can be measured only on the ewe. The only indication of the ram's ability to breed daughters with a high lamb production comes from the performance of his female relatives. It differs from most other characteristics of the sheep which can be measured on both the ewe and the ram and can be used
to select for directly in both sexes. Although the estimates of heritability of fertility are low and repeatability medium, there is much evidence which shows that fertility responds to selection and that worthwhile progress can be made.

2. **Fleece Weight.** Greasy fleece weight is required for both ewe and ram hoggets and its measurement presents no major difficulty. There is ample evidence which suggests that with sheep which have been shorn as lambs, there is little to be gained by attempting to adjust hogget fleece weight for environmental effects. Selection experiments have indicated that selection on the basis of hogget fleece weight leads to a rapid improvement in this character.

3. **Fleece Character.** There is no simple and quick way of measuring fleece character objectively, but it can be scored visually with a high degree of repeatability by a skilled observer. It is not yet included as a trait in the selection index because of the objective nature of the assessment. It is recorded on a scale of 1 to 7 or simply assessed as Good, Average, Poor by the breeder himself, and is recorded either on the fleece before shearing or on the shorn fleece. It is left to the breeder to set a minimum standard below which sheep are culled.

4. **Count.** This is assessed visually and by a skilled observer is assessed with high repeatability. Again, the breeder can set limits outside which sheep are culled.

5. **Other Characters.** There are many other characters, particularly of the fleece, which are difficult to record objectively and which generally are of low economic importance. When such things as pigmentation, kemp, medullation, handle and colour are excessive, this can be recorded and again, levels below which culling will operate are set by the breeder himself.

It is becoming increasingly clear that many conformation points are not closely related to productive merit, and consideration of them serves only to weaken the intensity of selection which could be applied to characters of real merit. Deformities, malformations, etc., which are known to reduce the efficiency of the animal, are recorded for culling purposes.

Selection, therefore, under the recording scheme, is concentrated on two main characters—weight of lamb weaned (which embodies fertility, plus milking and mothering ability), and fleece weight. Other traits are controlled by culling those sheep which fail to meet a minimum standard set by the breeder himself. If further characters are added without due regard to their economic importance, the purpose of the recording scheme is likely to be defeated. It is believed that in practice, a sheep of high merit as assessed under the recording scheme, will not be lightly culled because of minor defects in characters of little economic importance. It may be placed lower in ranking for such reasons, depending on the breeder's or the prospective buyer's assessment of the importance of the defect. The recording scheme imposes no restrictions of this sort and remains a flexible tool designed to assist the breeder in assessing the economic worth of the livestock. Over a period of time it is hoped that it will have an educational value in causing a thoughtful reassessment of the relative economic value of many characters of the sheep.
A scheme of this sort becomes possible only because the modern computer enables the mass of data collected to be quickly and accurately processed. The computer, however, does not make any decisions. These are made by the breeder. The computer merely summarises the information into a readily usable form. It must be pointed out, too, that the accuracy of the summaries produced by the computer is dependent upon the accuracy with which the original information is collected. The way the scheme works is best illustrated by a brief consideration of the lists shown in the Appendices. Full details of the way in which these lists are to be filled in are given in the handbook already mentioned, which is supplied to each breeder cooperating in the scheme.

INTERIM RECORDING SCHEME

The scheme in operation at the moment is referred to as an interim recording scheme. Nearly 300 breeders are participating involving over 70,000 sheep of which well over 50 per cent are Romneys. Almost all the other breeds are represented in the scheme except the Merino, for which breed an appropriate scheme is being devised at the moment.

As already mentioned, procedures differ for the meat breeds and for the dual-purpose breeds such as the Romney and Corriedale.

The first year's operation of the interim scheme has pin-pointed a number of problems which we believe have now been overcome. We are grateful to the breeders taking part in this interim scheme for many useful suggestions and for their ready co-operation in assisting us to streamline the scheme. We believe we have encountered most of the problems in operating such an ambitious scheme and see how to overcome these.

This interim scheme is being offered as a free service to breeders who are prepared to co-operate with us in developing a national recording scheme. It is being undertaken by the N.Z. Department of Agriculture, supplementary funds being made available by the N.Z. Meat Producers' Board and the N.Z. Wool Board to assist in launching this interim recording scheme. The scheme is being operated by the Sheep and Wool Division, whose field officers are functioning as recording officers. The Romney Survey is co-operating with the scheme and field officers of the Survey are undertaking field work in some of the flocks in their Survey. The Biometrics Section of the Dept. of Agriculture is providing the computational service.

A committee, consisting of representatives of the two producer boards, the Romney Breed Society, United Breed Societies, Federated Farmers, N.Z. Sheep and Beef Cattle Survey and the Dept. of Agriculture, have been formed to represent the interested parties in such a scheme and to present opinions and advice on the operation of the scheme. It is anticipated that this interim scheme will operate for some three to four years and provide a free service to those breeders participating. Over this time, problems associated with the operation of the scheme can be met and overcome, by which time it is expected that it should be a service which could then be handed to a national recording council, akin to the National Herd Recording Council, which could operate the scheme as a service to the industry run by the
industry for which an appropriate charge could be made to meet operation costs. Further breeders will be admitted to the interim scheme as the problems associated with its smooth running are overcome.

To be fully effective in raising the level of sheep production in New Zealand, a national recording scheme must achieve a wide coverage of the ram breeding flocks. However, nothing is achieved by recording flocks where the level of accuracy is inadequate or efficiency in the use of the recorded data is low. The scheme will be confined to genuine ram breeding flocks. It is also required that the entire flock be recorded continuously year by year. Accurate and adequate records must be kept. No limitations are placed on the size of the flock, but a small flock is clearly limited in the amount of progress which may be made. Ideally, several small recorded flocks can make much better progress in animal improvement by pooling their genetic resources.

Standardised Procedures

If, for example, recording is carried out in only 300 flocks with an average size of 300 ewes, this means that some 90,000 individual animals must be recorded with some 10 items of information on each, a total of nearly one million pieces of information per year. This means that an electronic computer becomes essential and also that standardised procedures must be adopted in recording information. Information is given to the computer on cards in which holes must be punched, in appropriate places, according to a code. For rapid operation the breeders' records must be clear and unmistakeable and the accuracy of the data put out by the computer depends on the accuracy of the information provided by the breeder.

In the first year's operation of the scheme, we have been made abundantly aware of the necessity for clear-cut standardised procedures and instructions. To this end a handbook, already mentioned, has been published by the Committee in which it is hoped clear-cut instructions are given to cover every conceivable situation and contingency. It has also been necessary to lay down acceptable limits of error. These limits will have to be strictly observed by the breeder who wishes to take advantage of the scheme in order that a reasonably high standard of accuracy is maintained.

Promptness by the breeder in sending in returns is also stressed and deadline dates for the various returns have been set. The computing of the data cannot be held up indefinitely by a few individuals who are tardy in completing the required returns. With the volume of work being handled at present the minimum computer processing time for each of the various lists is about six weeks so that in order that each list may be put out in good time for use by the breeder, the returns from the breeder must be sent in promptly. Apart from requirements of this sort regarding promptness, accuracy and clarity in the returns, the recording scheme imposes comparatively small burden on the breeder since the data required is that which many breeders already collect under their present record-keeping systems and indeed, their record-keeping is facilitated by the provision of lists of animals arranged in numerical order by year. Duplicate copies of all the breeders' returns are provided for and these, preserved in a folder designed for the purpose, provide him with a complete record of his flock year by year.
WHAT CAN PERFORMANCE RECORDING ACHIEVE?

It cannot be expected that performance recording can make an immediate and important impact on the level of production of New Zealand flocks as a whole. There are several reasons for this.

Of great importance today is the large annual increase in our national sheep numbers. This rapid expansion necessarily means that the amount of selection in both rams and ewes is at a minimum, and this situation can be expected to maintain for some years to come. This does not, however, invalidate a performance recording scheme, as any improvement in the general level of ram breeding flocks can be a permanent gain to be passed on to the commercial flocks. It is believed that now is the time to initiate improvement schemes, to learn the problems associated with them, and to overcome these in readiness for the day when stable sheep numbers and improving lambing percentages can allow a performance recording scheme to have a real national impact.

Another reason for the slow impact of a recording scheme is that in breeding, progress is measured from one generation to the next, and in the sheep world a generation is about four years. One would expect to see measurable progress after about three generations or about 12 years.

A third reason for slow progress is the apathy and possibly anti-pathy of breeders and farmers to accept a performance recording scheme. The sooner this can be overcome, the sooner will progress be made.

In the stud industry we see a hierarchical structure where a few leading stud flocks breed the bulk of the stud sires used to supply the ram breeding flocks of the industry. These ram breeding flocks, in the main, supply the rams to the commercial breeders. The progress made in the stud flock governs, largely, the progress which can be made in the commercial flocks.

If all selection were devoted to improving lamb production alone, the expected rate of increase in this character would be something between half and three-quarters of a pound per annum. Where selection is devoted entirely to fleece weight the expected gain might be something like 0.1 lb per annum. Where selection is based on an index which combines weight of lamb weaned and fleece weight the progress for weight of lamb weaned would be reduced to about 90 per cent and the rate of progress for fleece weight reduced to about 50 per cent of the above figures, the reason being that weight of lamb weaned is at least three times as important in terms of economic value as is fleece weight. These estimates are based on what is known of the heritability of these traits and on the amount of selection which can normally be exercised in a flock static in numbers.

Breeding experiments in New Zealand have shown that these estimates are substantially correct. Research at Ruakura has shown that under intense selection, fertility can be increased at the rate of 1 to 2 per cent per annum, and selection experiment at Massey University indicates that a gain of about 1 lb per year in weaning weight or 1½ to 2 per cent in lambing percentage can be achieved. It has also been shown that fleece weight can be improved at the rate of about one-fifth of a pound per year.

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These figures were obtained, however, where all selection potential was devoted to these few characters. Where selection potential is squandered on commercially unimportant characters, the rate of progress can be substantially reduced. All selection potential, however, can never be devoted entirely to these few characters, as a certain amount of culling for serious faults such as wool and conformation defects is essential. Any trend to a finer or coarser wool type likewise must use some of the selection potential. The figures quoted merely illustrate how reasonably highly heritable these commercial characters are and that visible progress can be expected.

The performance recording scheme ranks animals for merit within a flock. No comparison between flocks can be made. Weight of lamb weaned in the performance recording scheme is expressed as a deviation, and though weight of lamb weaned may differ markedly between flocks, the average deviations are likely to be of the same order. Likewise, average fleece weight between flocks could be vastly different, according to shearing dates alone.

A commercial breeder wishing to buy rams is given no guide by performance recording as to which flock to prefer. This he must decide from what he knows of the level of performance of the different flocks. Performance recording does, however, enable him to assess the merit of the different rams within a flock and to select the best from what is offered on the basis of recorded performance.

Selection of rams, however, is but a part of the progress that the commercial farmer can achieve. For maximum progress he himself plays an important part. For example, fleece weights in his ewe hoggets may range from 3lb to 10lb with an average of 6½ lb. If the hoggets for flock replacement were chosen on the basis of fleece weight, the mean of those selected could be improved by as much as 1 lb over a random selection where fleece weight is not considered. It should be pointed out that judging fleece weight by eye is very inefficient. Weight can only be efficiently found by actually weighing the fleeces.

This 1lb gain by selecting the ewe hoggets on this basis means an average gain of 1lb per head in the lifetime of the selected sheep, or on the average 4 lb for each sheep. This is not a genetic improvement. From the heritability of fleece weight, which is about 0.3 we can calculate that 30 per cent of this 1 lb gain per head will be passed on to the next generation (leaving the sire out of consideration at this stage). This amounts to a gain of 0.3 x 1, or 0.3 lb of genetic gain per generation. A sire selected for superior wool production could easily have a selection potential of 3 lb, that is, be 3 lb above average; 0.3 of this could be expected to be passed on to the next generation. Thus, by combining sire selection based on performance recording, plus culling of the flock replacements based on their wool production, the genetic gain could be an average of

\[
\frac{0.3 + 0.9}{2} = 0.6 \text{ lb per generation, as well as the 1lb per annum gain achieved by the initial selection of the ewes (a phenotypic gain).}
\]
On the fertility side the commercial farmer aiming for improved lambing percentage should do the same sort of selection. By the simple expedient of permanently identifying twin ewe lambs, making the first selection of flock replacements from these, and buying sires with a good fertility index the theoretical gain in lambing percentage of 1½ to 2 per cent could be approached.

It is very pertinent to point out that as the lambing percentage improves, so does the selection potential. In a normal commercial flock of mixed age ewes, something like 28 to 30 per cent of the flock consists of two-tooths, and this number is required to go into the flock each year. Where the lambing percentage is 80 per cent the culling rate of the two-tooths can only be about 26 per cent. Where the lambing percentage is 100 per cent the culling rate is about 40 per cent. If the lambing percentage increases to 120 per cent, the culling rate becomes 52 per cent and so on. Thus, as fertility is improved by selection the intensity of selection also greatly improves. Combining fleece selection and fertility selection can result in a worthwhile approach to the theoretical maximum levels of production previously indicated.

Selection is the key to genetic improvement within existing breeds of sheep. The gains to be made, while not spectacular, are permanent and worthwhile. A permanent improvement in lambing percentage, for example, of 1 per cent per annum, may seem a slow rate of progress, but expressed as 10 per cent improvement in 10 years it would, I think, impress most people as a very worthwhile achievement. In terms of our national lamb crop it is a fantastic advance.
WOOL PRICES AS AN INDICATOR FOR FLOCK IMPROVEMENT AIMS

Professor A. E. Henderson, Professor and Head of the Wool Science Department, Lincoln College.

Decision making in a flock improvement exercise is a continuous procedure and we should not underestimate the complexity of it. It is a matter of choosing to consider the factors that really matter, assigning to them their correct measure of importance, and then evolving a programme that is constructive and profitable.

The framework of the sheep industry within which this decision making goes on has its own peculiarities. For example, most of our sheep are dual purpose animals, and this, together with the fact that a very large proportion of the annual lamb crop is slaughtered as lambs, causes us to lay great emphasis on high rates of reproduction and growth. This inevitably must reduce the emphasis we can give to wool production. This restriction acts in more than one way. For example it may influence the breed of sheep and so the wool, or it may influence management procedures which affect wool production.

Another peculiarity is that we are marketing a textile fibre in competition with similar fibre from other countries and with other kinds of fibre and we are doing this in a world-wide market that is sensitive, characterised by greatly magnified reactions to consumer demand or predictions of consumer demand, and which suffers from a scarcity of reliable market intelligence because of the extended chain of distribution and utilization and the great diversity of product. In this kind of situation overall demand for wool may change quickly or slowly, and so may the emphasis on certain kinds of wool.

The wool producer thus finds himself in a situation where he possesses an animal slow to manoeuvre so far as change is concerned and also one on which several not always compatible production demands are in force.

One of the fundamental aims of the sheepfarmer is the production of the kind of wool the customer wants. This is a most elementary and perhaps naive statement. However, it is very pertinent because unless he does this his woolgrowing enterprise must eventually fail. We should continue to be seriously aware of how well this prime requirement is met.

This paper is concerned with one aspect of the problem, in fact the effectiveness of wool prices as a means of conveying information on customer requirements to the farmer.

Due to the complexity of distribution there is no real contact between producer and consumer and in the event the only way information on demand is transmitted is through prices paid for different kinds of wool. There is no doubt that long term price trends can be interpreted by the producer and some action taken. But in the short term there is most often a confusing picture of price fluctuations that are difficult to resolve into a trend sufficiently clear to inspire the producer to engage on a programme of improvement or change.

The last 20 years of wool production and marketing have been fairly eventful and will serve well to examine the effectiveness of wool prices as indicators of flock policy.
An important consideration is the detail of price examination thought necessary. For example one can examine price trends from sale to sale or one may average prices for the month and examine monthly trends, or to go further yearly trends may be considered. Further, the examination may be of the influence of quality within one type of wool or prices for several types of wool may be combined.

The Wool Marketing Study Group report, pages 4 and 5, presents information on fluctuations in price between different qualities of wool of the same grade and type over a series of 27 sales in the 1964-1965 season, and on deviations in prices paid on the same day for the same type and quality of wool. Both of these analyses indicate clearly that sophisticated examination is necessary before any significant trend is identifiable. Interpretation of this sort of price movement is obviously important to anyone trading in wool. These price movements also affect the producer as an individual by influencing the stability of his income. However they should not be used as justification for a change in production policy. Indeed common sense tells us that this would be impossible except on a very small scale.

At present the New Zealand wool producer has available two sources of extensive price information. One is very detailed and is in "Statistical Analysis of New Zealand Wool Production and Disposal" issued by the N.Z. Wool Commission. The other is printed in World Wool Digest issued by the International Wool Secretariat. The source of this data is the London Agency of the New Zealand Wool Commission and the prices quoted represent an unweighted average for super, good and average Noble combing fleece and skirtings. Quotations for 56s and coarser are for New Zealand wools and above this quality wools from other countries are taken into account. Prices given in World Wool Digest are therefore somewhat generalised.

Attempts to reconcile the information conveyed by the two sets of price information have been rather unsuccessful. If the broad view is taken then Wool Digest information is satisfactory but it is not detailed enough to permit the individual to examine a short term situation in his own flock. As an example to arrive at a price for 48s quality wool account is taken of prices for four categories containing 48s quality, one is straight 48s and the others are mixed. Firstly this prevents us from knowing the exact amount of 48s wool sold and so blunts the opportunity of clearly defining a production trend, and secondly we cannot rely on anything but the straight lines of 48s to give us price information.

However, despite these limitations much useful information can be obtained and some of the ways of using it are set out below.

Calculation of Productivity

Productivity is simply the product of the amount of clean wool times the price it fetches. If we need to make comparisons of breeds we need to know the comparative clean wool production and if we want to make comparison of productivity of groups of sheep within a flock then we must know the clean wool production of those groups. This requires us to have information on greasy fleece weights and clean scoured yields. Also, since wool quality or fineness is by far the most important single characteristic affecting price it is convenient and useful to have information on yield and weight of various quality groups within a flock.
Previous work has shown that within a Romney or Crossbred flock there is a drop of approximately one-third of a pound greasy weight per full quality interval as wool becomes finer. But there is a large amount of variation in fleece weight within each quality group and a substantial overlap of fleece weights is present.

So far as interbreed comparisons are concerned this is valid only if the two breeds of sheep are run in the same flock. There is little reliable information on such comparisons. However, search of fleece weights in our own stud flocks where, except for some six weeks during mating, the ewes are run together, has shown the Romney to have an insignificant advantage of 1.7 per cent over the Corriedale. Subsequent discussion assumes that they equal.

It has been stated previously that prices and other relevant data are available from two sources.

1. For the last five years detailed information has been published by the New Zealand Wool Commission and a summary of information on selected types pertinent to our purpose here is given below.

| Table 1. Clean Price C.I.F. London (pence/lb) for B. Grade Carding Fleece |
|---------------------------------|---|---|---|---|---|---|---|
| Type No. | 163 | 149 | 135 | 121 | 100 | 834 | 86 |
| Quality | 40 | 44 | 46 | 48 | 50 | 52 | 56 | 58 |
| 1962-63 | 63.75 | 62.75 | 63.00 | 64.00 | 66.75 | 80.75 | 77.75 | 82.25 |
| 1963-64 | 84.00 | 85.00 | 83.75 | 84.50 | 89.25 | 92.00 | 97.00 | 101.75 |
| 1964-65 | 67.50 | 67.00 | 66.25 | 69.00 | 73.50 | 76.50 | 80.25 | 84.75 |
| 1965-66 | 65.25 | 65.75 | 65.50 | 67.50 | 72.25 | 75.00 | 81.00 | 86.25 |
| 1966-67 | 58.75 | 58.75 | 59.25 | 61.50 | 67.50 | 71.75 | 81.00 | 86.75 |
| Average | 67.85 | 67.45 | 67.55 | 69.30 | 73.70 | 79.15 | 83.40 | 87.95 |

| Table 2. Ratios of Clean Wool Prices (Base = 46s Quality = 100) |
|----------------|---|---|---|---|---|---|---|
| Type No. | 163 | 149 | 135 | 121 | 100 | 834 | 86 |
| Quality | 40 | 44 | 46 | 48 | 50 | 52 | 56 | 58 |
| 1962-63 | 101 | 100 | 100 | 102 | 106 | 128 | 123 | 131 |
| 1963-64 | 100 | 99 | 100 | 101 | 107 | 110 | 116 | 121 |
| 1964-65 | 102 | 101 | 100 | 104 | 111 | 115 | 121 | 128 |
| 1965-66 | 100 | 100 | 100 | 103 | 110 | 115 | 124 | 130 |
| 1966-67 | 99 | 99 | 100 | 104 | 113 | 121 | 137 | 145 |
| Average | 100.40 | 99.80 | 100.00 | 102.80 | 117.80 | 124.20 | 131.00 |

| Table 3. Index of Value of Fleeces of Different Quality.* |
|----------------|---|---|---|---|---|---|---|
| Type No. | 163 | 149 | 135 | 121 | 100 | 834 | 86 |
| Quality | 40 | 44 | 46 | 48 | 50 | 52 | 56 | 58 |
| 1962-63 | 828 | 800 | 780 | 765 | 763 | 800 | 870 | 891 |
| 1963-64 | 820 | 792 | 780 | 758 | 750 | 770 | 835 | 835 |
| 1964-65 | 836 | 808 | 780 | 780 | 799 | 793 | 883 | 870 |
| 1965-66 | 829 | 800 | 780 | 773 | 792 | 793 | 905 | 897 |
| 1966-67 | 812 | 792 | 770 | 780 | 814 | 825 | 1009 | 1001 |
| Average | Plus | Plus | Minus | Plus | Plus | Plus | Plus | Plus |
| Premium | 5.5% | 2.4% | Base | 1.0% | 1.0% | 4.2% | 16.8% | 15.2% |

35
*It is assumed that 46s and 56s fleeces have a greasy weight of 10 lbs and that there is an increase of 0.33 lbs for each whole quality coarser than 46s and a decrease of 0.33 lbs for each whole quality finer up to 52s quality. The decline from 56s to 58s is 0.45 lbs. Clean fleece weights have been calculated using average yields quoted by the New Zealand Wool Commission for each type. The Index is the product of clean weight and price ration.

2. The second source of price information, the World Wool Digest, provides less detailed but more long term information. It serves well to examine long term trends but it is unfortunate for our purposes that no information is given on wools coarser than 46s. Relative index values for a period of 21 years, in effect since the return to free trading after the war-time commandeer, is given in Table 4.

Table 4. Index of Value of Fleeces of Different Quality.*

<table>
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<tr>
<th>Quality</th>
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</tr>
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<td>947</td>
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<tr>
<td>1966-67</td>
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<td>780</td>
<td>814</td>
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</tr>
</tbody>
</table>

Average Premium

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<tr>
<th>Base = 46s</th>
</tr>
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<tbody>
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</tbody>
</table>

*Derivation as for Table 3.

Discussion

Figure 1 has been plotted from data selected from Table 3. It uses the most detailed information that is freely available and is of the sort that can be considered if one is contemplating whether to run very coarse, or medium or very fine Romneys or crossbreds or if indeed one should move towards a much finer breed. It is clear from this detailed but short-term information that very coarse wool (40s quality) has shown a consistent premium of about 5 per cent over medium crossbred. The fine crossbred has broken about even. On the other hand, and basing our calculations on the fairly reliable assumption that Romney and Corriedale sheep will produce equivalent amounts of greasy wool per head when run under similar conditions,
Figure I. Comparative Return from Coarse, Medium and Fine Romney and Medium Corriedale (N.Z. Wool Commission Quotes. Base = 46s)

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<td>+20%</td>
<td>+20%</td>
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</table>

Figure II. Comparative Return from Quality Groups Within a Romney or Crossbred Flock (Wool Commission Data for Straight Types) (Base = 46s Quality)

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</thead>
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<tr>
<td>760</td>
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<td>-5%</td>
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</tbody>
</table>

Figure 2. Comparative Return from Quality Groups Within a Romney or Crossbred Flock (Wool Commission Data for Straight Types) (Base = 46s quality).
it is clear that 56s wool has shown a considerable premium. This premium averages 16.8 per cent over 46s and it has not been below 10 per cent in any of the five years under study.

A more detailed approach using all the wool qualities that can be produced in Romney and Crossbred flocks is shown in Figure 2. Both 40s and 44s have shown a considerable premium averaging plus 5.5 per cent and plus 2.4 per cent respectively and a similar premium averaging plus 4.2 per cent has existed for 52s. However, the premium for 52s has not been consistent. Medium-fine Romney and Crossbred wools (i.e. 46s, 48s and 50s) have been on a par with each other. It is perhaps of interest that the very coarse wools show a consistent premium. It might suggest that these wools are more unlikely to suffer from substitution than wools in the fine crossbred range which exhibit a less stable relationship to other wools. It could be that while the very coarse wools are undeniably used for carpet and furnishing fabrics the fine crossbreds have alternative uses in that they may be used in carpets if demand is heavy or they may be used as apparel wools if demand for these is heavy. In other words they fall between the wools really preferred for furnishing fabric and apparel. If demand from either or both of these two groups is good then these wools fare well. But it seems that these fine crossbreds might be unduly sensitive to even a slight withdrawal of demand in either group.

Figure 3 gives the long term picture of events. The period 1949-50 to 1959-60 stands out as one in which a consistent advantage existed for coarse crossbred wool; 46s had an average advantage of 4 per cent over 50s. This period is also notable for the steadily decreasing advantage of 56s in relation to crossbreds.

If there is any likelihood of the producer being able to use wool prices to guide his sheep breeding and wool production activities then surely the period 1949-50 to 1959-60 would be the one most likely to inspire confidence. It seems that it did. In a paper at the Massey Sheepfarmers' Conference last year Mr McFaull pointed out that since 1950-51 the proportion of wool in the clip finer than 50s has fallen from 36 per cent of the total to less than 20 per cent and wools 46s and coarser have risen from 2 per cent to over 10 per cent of the total. The particular advantage held by coarse wools became less from 1960-61 onwards but producers were apparently slow to realise this. The impression is gathered that almost five years passed before action was taken. But we can perhaps question closely whether even now any radical change is justified. Our detailed analysis over a short period, in Figures 1 and 2, has shown that when price and expected fleece weight are taken into account very coarse crossbred wool has a 4 to 5 per cent advantage over medium-fine crossbreds which have only varied 1 to 2 per cent either way of each other.
Figure III. Comparative Return from Quality Groups over a 21 year period
(World Wool Digest Quotes. Base = 46\(^\circ\))
There seems no justification for changing a very coarse crossbred clip. Further, the price information we have, both long and short term, suggests that it is immaterial to returns whether we aim for average 46s, 48s or 50s.

The advantage of wools finer than this appears to be variable. There seems no question that 56s wool, implying the use of Corriedale or Halfbred sheep, has given the producer a substantial advantage. Under similar farm conditions and fleece weights it averages 20.8 per cent over the 21 years. The position of 52s and 50/56s Crossbred is more obscure, the advantage of this wool is variable and has never been consistently high. Certainly not high enough to warrant radical breeding changes. But when considering this we may perhaps pay attention to some other information likely to be pertinent. Wools of this fineness are out of the range of carpet wools; therefore, they must be considered as apparel wools and the users of apparel wools persistently point out that the trend is for lighter clothing and this requires finer wools. There is fair certainty that this trend will not be reversed and if we must run Romney and Crossbred sheep for other quite powerful reasons then it appears logical to suggest that we reduce the large quantity of medium-fine wools—this production being shifted to the very coarse or very fine. However, in either case the margin of advantage gained would be small and cannot justify precipitate action.

One other aspect of productivity, that of price premiums associated with grade, has not been discussed. There is no ready source of information from which conclusions can be drawn. But if an opinion can be given it seems that in a seller’s market there is often small reward for excellence. In a buyer’s market the position is reversed.

If we look back on what has happened in wool production trends the overall picture suggests that farmers have correctly interpreted the situation. Inevitably of course some individuals have made the wrong moves and there has been a certain amount of now do this and now do that. If it is change in fineness that a farmer wants then this can be done deliberately and with success but only within the framework of time necessary to produce new generations, first of all in the ram-breeding flocks and then in ordinary flocks.

Despite the apparent success of following a trend in demand for wools of certain fineness it seems that the overall excellence of the clip has declined. Collectively and nationally this is a bad thing. The major reason for this can be placed to the responsibility of management and this is something that can be manipulated quickly and although there are times when no reward is apparent reason tells us that consistent offering of high-grade wool must ultimately give strength to the seller’s position.
TRENDS IN THE USE OF WOOL IN MANUFACTURING

Dr D. A. Ross, Head of the Fibre Products Group, Wool Research Organisation, Lincoln.

The one factor which is of major importance in dictating trends in the use of wool in manufacturing is the development of directly competitive products made from synthetic fibres. As the synthetic fibre industry is anything but static so the place of wool in the textile industry in general, and in the various sections of it, is continually changing. The aim of the synthetic fibre producer is clear. It is to capture as large and as profitable a share as possible of the world fibre market. His object therefore is the same as that of the wool fibre producer.

Only a few years ago it was not possible to buy quality products of items such as carpets, blankets, or suitings, or a wide variety of types of knitwear which were not made of wool. The situation today is very different, particularly so overseas where a wide range of these products made from synthetic fibres to acceptable quality standards, are on sale. Moreover, the range and quality of these synthetic fibre products, which are in direct competition with wool products, is continually expanding. Competition between fibre producers, whether they are producers of nylon, acrylics, wool, rayon, etc., is increasing and will continue to increase. Wool will not retain a profitable share of the fibre market without a concerted effort by all sections of the wool industry.

The following table illustrates the inroads which synthetic fibres have made in the last few years into the carpet field in the United States.

### Pile Fibre Consumption in Broadloom Carpets in the U.S.A.

<table>
<thead>
<tr>
<th>Fibre</th>
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<th>1963</th>
<th>1966</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Million</td>
<td>%</td>
<td>Million</td>
</tr>
<tr>
<td>Wool</td>
<td>163</td>
<td>64</td>
<td>160</td>
</tr>
<tr>
<td>Nylon</td>
<td>43</td>
<td>17</td>
<td>120</td>
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<tr>
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</tr>
<tr>
<td>Others</td>
<td>35</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>256</td>
<td>100</td>
<td>341</td>
</tr>
</tbody>
</table>

In only six years the total fibre used in the pile of American broadloom carpets doubled from 256 to 519 million pounds. However, during this period of rapid expansion the consumption of wool decreased from 163 to 104 million pounds, a fall of from 64 per cent of the market in 1960 to only 23 per cent in 1966. While the new carpets of nylon and of acrylics are not technically as good as those of wool, nevertheless they are of an acceptable standard of quality. Two other types of carpets made from polyolefin and polyester fibres which were produced in comparatively small amounts in 1966 are now becoming much more important and will increase the competition from synthetic fibres.
New Zealand Crossbred Wool

About 80 per cent of the New Zealand clip is of Crossbred wool predominantly of from 46s to 50s count. Our partners in the International Wool Secretariat, Australia and South Africa, do not grow similar coarse wools of this type, nor are our crossbred wools made into the same products as fine Halfbred and Merino wools. New Zealand therefore can only look to itself in problems concerning the sale and utilization of Crossbred wools.

Ten or fifteen years ago it was considered that synthetic fibres were more of a threat to fine wools than to coarse wools because it was simpler for the synthetic fibre producer to make a fine even fibre of the Merino type, rather than a coarse variable fibre of the carpet wool type. Events have not borne out this prediction and today it is the coarse fibre producer who is most feeling the effects of competition from synthetics. It may be cold comfort for us to know that today fibre costs to the manufacturer of synthetics or wool for carpet production are very similar. In the case of fine wool products however, the manufacturers' fibre costs are much higher than for similar synthetic fibre products. The synthetic fibre producer is increasing his efforts to engineer fibres and products to capture more of the fine wool quality goods' market.

What Does the Manufacturer Want Us to Grow?

The answer to this question presupposes that firstly the overseas manufacturer knows all about the large number of wool types that we grow in New Zealand and secondly that he knows how these perform in the mill in making specific wool products. In fact, the overseas manufacturer usually has only a very limited knowledge of the types of wool which we grow, and because New Zealand wool is, in general, used as one of several components in a blend he can only obtain a very general estimate of the technical merits of our wool. Consequently the manufacturer is not able to closely specify his requirements. We as fibre producers are going to have to find out for ourselves just what is the importance of the main fibre parameters of fibre diameter, fibre length and wool faults so that we can sell our fibre on the basis of its technical merits just as is done by the synthetic fibre producer who can closely specify the properties of his product.

Wool Manufacturer to Fibre Convertor

One result of the development of synthetic fibres has been that many manufacturers who at one time used only wool have shifted all or part of their production to processing synthetic fibres. By so doing they are no longer dependent for their livelihood on only one fibre, wool, and they have become general fibre converters with no specific fibre loyalty. They then see wool as just one of several fibres which they might choose to make a particular product. They probably wonder why they never complained before about that fibre which was delivered in odd-shaped, dirty bags, from which it often poked, and which were hard to handle and stack. Further, a raw material that was full of dirt, grease and other impurities. They then looked at the delivery of synthetics in neat clean packages easy to store, and read the labels on, and free from grease, dirt and a multitude of
other impurities. The manufacturer would like to be able to pick up the telephone at any time during the year and order with confidence, deliveries of specified wool types, to be delivered at once, in acceptable packages.

The Farmer—The Fibre Producer

A synthetic fibre manufacturer produces synthetic fibres to sell at a profit. His fibres are bought to convert into saleable end-products by converters who also want to make a profit. If his fibres cannot be converted into saleable end-products he won’t be able to sell them to the manufacturer and finally he will stop producing them.

Now the sheep farmer is just as much a fibre producer as the synthetic fibre manufacturer, and in the long run he too can only sell his product when someone wants to buy it to convert it, at a profit, into end-products.

While the synthetic fibre producer would be surprised if he was not considered as an integral part of the textile industry, the wool fibre producer would be surprised if he was. Yet the producer of natural fibres plays a similar role in the textile industry to the producer of synthetic fibres. The wool producer is in fact even more dependent on the product making section of the textile industry to convert his fibre into a saleable end-product than is the synthetic fibre manufacturer.

The synthetic fibre manufacturer has taken steps to aid in ensuring outlets through which his fibre is converted into either end-products or to stages in manufacture closer to end-products, such as sliver or yarn.

1. Producer Sliver and Yarns

With the development of continuous filament yarns the fibre producer moved much closer to the end-product. In the case of carpets he sells these yarns in a bulked or crimped form ready for tufting into carpets. In the case of staple yarns some fibre producers may themselves convert the continuous filament sliver into short fibre top from which staple yarns are drawn and spun.

2. Buying, Spinning and Weaving Firms

Courtaulds, the large British synthetic fibre producers have invested £23 million in spinning and weaving plant in Britain. This huge investment is to ensure outlets for their fibres. While some wool is still processed on this plant there can be no doubt that their aim is to replace the wool with their own fibres. What will be the position for wool if this trend continues and a large part of the fibre converting equipment is owned by synthetic fibre manufacturers? How then will the wool producer ensure an outlet for his product?

3. Product Development and Technical Service

Synthetic fibre producers have further ensured the demand for their fibres by engineering them for specific end-products. They make a wide range of samples of those products for which their fibre is particularly well suited. These samples of finished consumer goods are engineered in product development pilot plants which may be
situated in the market in which the fibre producers are trying to sell their fibres and yarns. For instance, the American firm of Du Pont have just opened a new product development and technical service laboratory of 48,000 sq. ft in Geneva, just to service their textile fibres in the European market. The samples from these pilot plants are shown to the manufacturers so that they can see the types of consumer products which they might make. The fibre producer also supplies technical service from his pilot plants so that should the manufacturer encounter any problems in introducing these new products, free technical help is available.

The Wool Grower and His Product

If the wool grower wants to stay in the textile industry as one of many fibre producers, he should consider the very successful selling methods of his competitors. He must take an active interest in his product well past the farm gate or the auction floor right up to the stage of conversion into final consumer products. How many of you know what sort of products your fibres finish up in, or by what path and method they are converted into products?

There is undoubtedly a great potential for emulating the synthetic fibre producer in New Zealand by carrying our wool through the early manufacturing stages such as scouring, carding, sliver making and some particular types of Crossbred yarn making. The development of large overseas markets for these products however; will not be simple but it will be one further step towards ensuring outlets for New Zealand Crossbred wool.

I have talked a lot in this address about the need to ensure that your fibres are converted into saleable products. What do you, as a fibre producer do, when your wife returns from town and tells you that she couldn’t buy this or that article made in wool? If you, whose livelihood is at stake do not act individually and collectively to remedy this situation, then you must be prepared to accept that you are the producer of a fibre without a future. This is not true. For many products wool has outstanding technical virtues. In this connection, and in conclusion, I would like to repeat what I have previously said about wool as a carpet fibre. This comment applies in varying degrees to the use of New Zealand Crossbred wool in other products.

Wool is still the outstanding carpet fibre. However, technical excellence alone is only one factor a carpet manufacturer takes into consideration when selecting his raw material. In marketing, merchandising and technical service, wool is at a severe disadvantage compared with synthetic fibres, while its advantage in technical excellence compared with synthetics, decreases year by year. Technical excellence alone is not sufficient to ensure the continuing use of wool in large quantities in the carpet industry, at prices which will give a satisfactory return to the grower.
THE FINAL REPORT OF THE WOOL MARKETING STUDY GROUP

Mr. J. D. Fraser, General Manager, New Zealand Wool Board, Wellington.

1. INTRODUCTION

I am addressing you today not as an executive of the Wool Board, but as an ex-member of the Wool Marketing Study Group. My purpose is to explain the contents of the Final Report and some of the considerable background of research and thinking that preceded the writing of that document. The Board and Commission have not yet reached a decision on the Study Group’s Report and at the end of my address I will indicate to you what they are doing about it. Since no firm decision has been reached, despite the fact that I was co-author, I am not here today as an advocate or a protagonist— I merely wish to clarify perhaps, some of the matters in the report that worry you as farmers.

2. ESTABLISHMENT OF THE GROUP

The Study Group was set up in December, 1964, by the Wool Board and Wool Commission. At that time it was evident that the peak wool prices that had occurred in 1963-64, when wool averaged 46 cents per pound, had allowed the relatively cheaper synthetics to replace wool in many textile uses. The Board sought the opinion of a number of farming leaders as to their interpretation of the effects of violent wool price fluctuations. From the replies received it was evident that many shared the concern of the Board and Commission that wool price fluctuations were adversely affecting demand from wool users. Further, it was evident that woolgrowers generally were interested in methods of marketing their clip. Accordingly, a Wool Marketing Study Group was established. The membership of the Group, during its term of office, was drawn from the staff of the Board, the Commission and the Economic Service; representatives of the N.Z. Woolbrokers’ Association; members of the professorial staff from Massey and Lincoln, and research scientists from W.R.O.

At this stage I should say that considerable criticism has been levelled at the Group on account of our so-called “lacking of men of practical experience” or our consisting of “theoretical economists.” However, I am still sure that the Group was correctly constituted in that this was not a body of people called together to sit around a table and air their sectional views. Rather it was a group charged with undertaking a large programme of research, much of which required the knowledge and skills of the “theoretical economist.”

Moreover, it was always the intention of the Group that we would consult with sections of the wool trade during our work, which indeed we did. I know that there never would have been a Final Report if every section of the trade had a vote upon its content.

3. TERMS OF REFERENCE

The Board and Commission gave the Study Group the following terms of reference:

1. To investigate the causes of price fluctuations in the present wool marketing system and report on any suggested method of containment, within the existing system.
2. To report on methods of wool marketing.

3. To report on any other matters relating to wool marketing that in the opinion of the Study Group should be established.

Hence, while the first term of reference dealt with fluctuations which were the motivation of the setting up of the Group, the additional terms of reference gave the Group a wide charter on matters relating to wool marketing.

4. THE GROUP'S WORK PROGRAMME

At this stage, I would like to give a brief account of some of the more important background work that the Group undertook. This has been published in more detail in Report No. 2—"Review of Work Undertaken."

(a) The Nature of Price Fluctuations

In dealing with the first term of reference—the causes of price fluctuations—the Group first had to document the way in which prices had actually fluctuated. It is not possible to prescribe a cure until you have isolated the disease. In this analysis the Group was fortunate in having available the Wool Commission data since 1952-53.

Briefly the Group examined the way in which wool prices had varied compared with other fibres, both natural and synthetic; the way in which prices of different wool types had changed over the last fifteen years, and how price differences between types had varied; the degree of price change within a selling season that could be explained by trends; and the extent to which prices differed between different lots of the same wool type at any sale.

The Group’s conclusions from this analysis were:

a. In the past, fluctuations in wool prices have been larger than the fluctuations in prices of other fibres, especially synthetics.

b. There have been considerable variations in the average seasonal price margins between types. (For example, 56s B grade fleece wool has held between a premium over 50s B grade from as little as 1.1 cents/lb in one season to as much as 8.2 cents in another.)

c. Prices at any one sale have exhibited much wider differences than is apparent in the seasonal average. (For example, at one sale over the fifteen years' period, 50s actually held a premium over 56s of half a cent, while the maximum price advantage of 56s over 50s was 12.9 cents.)

d. The movements that occur in prices over a single selling season obscure the trend in price differences between types. It is therefore almost impossible to accurately gauge the trend as it occurs—for example, whether coarse crossbred wools are moving away from fine crossbreds, or vice versa.

e. The degree of random movement in prices of individual lots of the same type are sufficient to obscure the true premiums and discounts for both style and quality number.
f. The lack of consistency of prices of comparable types on a single selling day, and the degree of price fluctuation between sales over the course of a selling season means that there is no equity as between growers of comparable types, i.e. grower's returns are subject to a degree of chance as to the date of the sale, or the particular time of the day on which the wool is sold.

(b) The Causes and Effects of Price Fluctuations

Having documented the way in which wool prices had varied since 1951-52 the Group then turned to an examination of the causes and effects of these changes. This work divided itself into two parts viz. (1) the seeking of opinions from various sections of the trade and, (2) the construction and analysis of available statistics. The former involved "the men of practical experience" on the Group, while the latter involved the "theoretical economists."

In the opinion surveys, the Group consulted with farmers; farm advisers; lending institutions; Government departments; the Woolbrokers' Association; the Federation of Wool Merchants; the Wool Marketing Co-operative; auction buyers; and wool users both locally and in the six most important consuming countries overseas.

In the statistical studies, analyses were made of causes of long-run price trends; the causes of short-run (three-monthly) changes in prices in the raw wool market; the effect of the flow of type offerings and lot sizes; and the relationship between raw wool, wool tops, futures and yarn prices. In addition, an attempt was made with only partial success to obtain more detailed statistics from the wool users themselves.

From the surveys and statistical analyses, two points were clear.

(1) In its simplest terms, the major cause of raw wool price fluctuations was demand for, rather than supply of wool. The underlying causes of short-run fluctuations in demand could not be adequately analysed by the Group. The broad conclusion was extremely significant, however, to the Group's subsequent work on containment of fluctuations.

(2) The effects of price fluctuations were of importance chiefly to the grower and the user of wool. Others such as woolbrokers and woolbuyers stated they were not greatly influenced by price changes.

(c) Effects on the Grower

The Group made an extensive study of the effects of price fluctuations on the grower. We sought opinion from farmers, farm advisers, stock and station agents, Government bodies and lending institutions. We also analysed the available statistics on farm production, farm income, product prices, and expenditure.

The conclusions we reached were that wide fluctuations in wool prices had an adverse effect upon the planned development of sheep farming. The rate of farm development in the past had been erratic on account of changes in the amount of money available for invest-
ment either from farm income or from borrowing. And further, changing price levels were associated with changes in the confidence of farmers and farm lenders to invest in development.

The Group concluded that if farm incomes could be stabilized farmers could plan investment expenditure with confidence. They could implement development programmes more efficiently and therefore achieve greater profitability than in the past. The Group considered that the stabilization of wool prices would make a significant contribution to the stabilization of farm income.

It should be stated here, that the Group did not advocate farm development for its own sake. We considered that the profitability to the farmer must always be the chief reason for development. However, we did state that if wool prices fell to a permanent level at which development was no longer profitable, the case for stability was no less important. Under such a situation the farmer would still need to plan both maintenance expenditure and readjustments to his production patterns.

(d) Effects on the User

During the course of the survey of overseas mills, the Group gave specific attention to the effects of wool price fluctuations on the user. Of the 263 firms surveyed, 86 per cent stated that they would welcome greater stability of raw wool prices.

Firms were asked the extent to which they altered their fibre mix as a result of price changes. They indicated that little substitution took place unless prices changed by more than 10 per cent. Above this level, firms substituted different wool types or other fibres at an increasing rate.

5. THE CONTAINMENT OF PRICE FLUCTUATIONS

The Group's conclusion that price fluctuations were of importance to both the grower and the user of wool, led us to examine the second part of the first term of reference, viz., methods of containment. You will recall that we concluded that the elements of demand were of more importance than the elements of supply as a cause of price fluctuations. This conclusion was of particular significance to our consideration of methods of containment.

The Group examined a number of alternative schemes for containing price fluctuations within the auction system, including:

(a) Those designed to provide stability to the user and grower simultaneously.

(b) Those designed to provide stability to the grower alone.

The former schemes all attempted to stabilize prices by regulating the supply of wool onto the market—essentially through the use of buffer stocks. The later involved either a pooling scheme for growers or the use of a stabilization or buffer fund.

The Group first considered the relative cost of achieving stability to the market versus stability to the grower alone. We carried out a series of simulation studies, using Wool Commission data, setting a range of floor and ceiling prices for the study.
The conclusions we reached were that:—

(1) Attempts to stabilize market prices by means of a central authority buying and selling wool could only be successful if the authority had a very large capital backing.

(2) In contrast, the funds required to stabilize the price received by growers alone, were relatively modest.

On this basis the Group considered that the stabilization of prices to the user, while desirable, was not practicable for either the N.Z. farmer, or indeed the nation, to undertake. The most that wool-growers acting in isolation could hope to achieve was the stabilization of their own returns.

This concluded the work on the Group’s first term of reference viz., price fluctuations and their containment.

6. IMPROVED METHODS OF MARKETING

The Group then turned to examining alternative marketing methods, and matters relating to wool marketing as laid down in the second and third terms of reference.

(A) The Introduction of Quality Control

Dr Ian Fraser, a W.R.O. scientist who was a member of the Group, submitted a series of proposals to the Group concerning methods of improving the handling, classification and marketing of N.Z. wools. These proposals were that:—

(1) Wool prepared for sale should be preclassed into a series of standard N.Z. types.

(2) Instead of displaying whole bales for valuation prior to sale, representative samples only would be shown.

(3) After being classed into standard types the wool would be pressed directly from bins into dense bales for shipment.

The successful implementation of the proposals required that a more accurate method of assessment of wool properties be developed, than the present visual assessment. Dr Fraser proposed that a series of instruments should be designed to accurately measure staple length; fibre length and its distribution within a staple; fibre diameter and its distribution with a staple; yield and scourability.

The Group saw in these proposals two possibilities, namely that if N.Z. types could be standardized and accurately specified to the world trade, N.Z. wool should hold a preferential advantage over wools from other origins, and hence the demand should be enhanced. And secondly, a system of sale by sample should lead to considerable cost savings in the present method of display and disposal. As a consequence, the net return to the grower would be increased.

The Group was conscious of the methods of quality control employed in the marketing of other industrial fibres. The world textile trade is demanding these standards more and more. The proposals suggested a positive method by which quality control could be introduced into the raw wool market. The Group recommended to the Board and Commission that these proposals be implemented, which they agreed to, and a project was set up at W.R.O. under Dr Fraser’s supervision.

At the present time, the instruments necessary for scientific measurement have been developed, largely by Dr Edmunds who was also a member of the Group. Samples are being drawn and measured
from a number of bins in brokers' stores around New Zealand. The N.Z. Woolbrokers' Association are in close collaboration with the W.R.O. on this project and are receiving the results of the measurement made. It is envisaged that next season the sampling will be expanded considerably.

(B) Alternative Marketing Methods

During the course of its investigations the Group gave consideration to the methods by which wool should be sold. These investigations included discussions with woolbuyers, private merchants, the N.Z. Wool Marketing Co-operative, and overseas merchants and wool users.

As a result of its examination the Group concluded that it could see no more efficient way of disposing of the bulk of the N.Z. wool clip at present than the auction system. It must be remembered that New Zealand now sells two million bales of which over three-quarters are sold at auction. It must also be remembered that the woolbuyers and overseas wool merchants perform a valuable and definite function in wool marketing. They are the people who arrange transportation and storage, who carry the risks associated with the marketing of a product with a fluctuating price, who provide finance, and who deliver to their customers wools that are required.

The Group has been criticised by some for not coming down in favour of direct sales to wool users. But proponents of direct sales should remember that the farmer or farmers' organisation would need to perform all of the functions at present carried out by buyers and merchants, for direct sales to operate. And further, to justify such a change, these functions would need to be carried out more efficiently than they are at present. The Group could not see that this could be done for 1,500,000 bales. Consequently, we favoured the retention of the auction system as the major method of disposal, but recognised the merits of the present alternative disposal methods.

7. THE RECOMMENDED MARKETING SCHEME

At this stage the Group considered how best the conclusions they had reached could be implemented. To recapitulate, these were:
1. Stability of prices to the grower was worthwhile and achievable.
2. Stability to the user was desirable, but not practicable.
3. The introduction of quality control into raw wool marketing was desirable.
4. The auction system was the preferred method of disposal for the bulk of the clip.
5. The prices paid to the grower at auction obscured market premiums and discounts, disguised trends in prices, and resulted in inequalities as between growers of comparable types.

The Group considered that the system of sale which best met with these conclusions was:
1. Appraisal and purchase by a Wool Marketing Authority of all wool produced in New Zealand. Purchase would be at prices which were completely stable within a season, and relatively stable between seasons.
2. Sales by the Authority through existing channels of disposal.

The scheme proposed by the Group would operate as follows:

At the beginning of each season the Authority would announce prices to be paid to growers for all greasy, slipe and scoured wools. Those
growers who chose to sell their wool at auction would send their wool to brokers' stores as at present. They would retain the right to market under their own brand, or to reclassify, or sell through the bins. The Authority would appraise the wool for type and yield in the show stack prior to sale, and would purchase the wool from the grower at the announced prices. They would then sell the wool to the trade at market prices.

The Group considered that private merchants should be retained as a method of disposal. They were unable to determine, however, whether it was possible to appraise in merchants' stores, or whether this wool would have to be appraised at auction centres. They also recommended the inclusion of slipper wools, appraisal of scoured wool if this is feasible, and the retention of London auctions where it proved to be profitable for certain types.

To assist the Authority in establishing its seasonal bareme of growers' prices, the Group recommended that a market intelligence service be incorporated into the structure of the Authority. The information would also enable the Authority to operate a flexible reserve price in the market, if it so wished.

The question has often been raised by farmers and members of the trade as to why the Group recommended the scheme it did. The answer is that it provides relative stability between seasons in wool growers' prices and complete within season stability; it provides equality of prices throughout the seasons to growers of comparable types; it ensures that market premiums and discounts are paid; and it ensures that market trends are accurately indicated to the grower. In addition it provides a means for the establishment, maintenance, and guarantee to the trade, of standard New Zealand types. Further, the scheme causes a minimum interference with established trading channels.

8. CONCLUSION

The Study Group's Report was submitted to the Board and Commission last November. It should be remembered that the Group was specifically required to report to those two bodies, but because the issues of marketing were causing the farmers so much concern, the Board and Commission chose to release the Final Report before they had considered it.

At this stage, a Wool Marketing Committee consisting of members of the Board and Commission, as well as the respective chairmen of the Electoral Committee and Meat and Wool Section of Federated Farmers, are examining the Group's conclusions. The Committee have called for and received submissions, from a wide variety of interested parties. They will reach a conclusion on the report and recommend to the Board and Commission what action, if any, should be taken to implement the Group's proposals.

This does not mean that farmers should cease to concern themselves with the Final Report. The Study Group after conducting an exhaustive analysis, produced a series of recommendations which we considered provided the best solution to the problems of marketing, on the evidence we were able to obtain. However, it is now over to the growers to decide for themselves whether they are prepared to accept the Group's interpretation of the facts.
CONFORMATION AND LAMB CARCASS QUALITY*

Dr A. H. Kirton, Scientist, Ruakura Agricultural Research Centre, Hamilton.

Carcass shape or conformation has been traditionally used by the meat trade as an indicator of carcass quality. In all species of farm animals carcasses that are short in the leg, plump or blocky are believed to contain more high-priced cuts, more meat and less bone than carcasses that are longer in the leg. The roasts from blocky lambs are claimed to be better eating and to dry out less in cooking. New Zealand lamb carcasses of the former type are said to have Down conformation and it is often implied that the leggy type carcasses have inferior conformation. Separation of North Island lamb carcasses into the Prime Down Cross and Prime Crossbred grades (which the Meat Board amalgamated into one grade this past season) has primarily been a separation on the basis of conformation. In the South Island this separation wasn't made and only one prime grade was used.

Recent overseas and New Zealand evidence has shown that blocky conformation in beef and sheep gives very little indication of carcass quality, and if anything, it is the leggy carcasses that have a higher proportion of high-priced cuts and a greater quantity of red meat. In this paper I intend to cover some evidence recently obtained at the Ruakura Agricultural Research Centre which gives some factual information on the influence of conformation on lamb carcass quality. The results come from three experiments carried out over a two-year period.

A large number of lambs are slaughtered at Ruakura which have exactly the same nutritional background and are the same age at slaughter, but come from a variety of sires. At the end of various days' slaughter, pairs of carcasses were picked on the basis of conformation for this study. Both carcasses of each pair were of about the same carcass weight, but they differed widely in conformation, one carcass being short in the leg and blocky (Down-type conformation) and the other carcass was the leggy type. In the first experiment, a works export grader who has subsequently been promoted to a supervising grader by the Meat Board, inspected the pairs of carcasses and agreed that each pair contained a carcass of blocky and leggy conformation. The carcasses selected in the last two experiments were even more extreme in conformation type. The carcasses were graded after they had been placed in their conformation groups.

In total, 85 lamb carcasses of blocky conformation were compared with 85 carcasses of leggy conformation and the carcasses came from three separate experiments. Measurements of leg length showed that the differences between conformation types were least in experiment 1 and greatest in experiment 3. The average carcass weights of the blocky and leggy carcasses are given in Table 1. The method of selection has effectively eliminated differences between the two conformation types with respect to hot carcass weight in each

*The complete details on the experiments to be described can be found in the N.Z.J. agric. Res. 10: 183 (1967).
experiment. For practical purposes this also applied to age at slaughter.

With respect to carcass composition, Table 1 shows that in all cases the lambs of blocky conformation contained more fat than those of leggy conformation with the difference being as great as 2.7 lb in experiment 3 where the differences between the two conformation types were most extreme. The figures for protein and water together indicate the amount of red meat or muscle in the carcasses. The table shows that the leggy carcasses in all cases contained the greater amount of protein and water and are thus the meaty animals. These findings are in direct contradiction to the commonly held trade opinion that the blocky carcasses have the highest meat content. The heavier cannon bone weights from the lambs with the leggy carcasses is indicative of a greater bone weight which is usually found in conjunction with a greater weight of muscle in any breed or cross. This finding is in agreement with trade opinion.

Table 1. Carcass Information from Lambs Selected as Differing in Conformation

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Blocky Conformation</th>
<th>Leggy Conformation</th>
<th>Difference (B–L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (14 pairs carcasses)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot carcass (lb)</td>
<td>34.4</td>
<td>34.4</td>
<td>—</td>
</tr>
<tr>
<td>Fat weight (lb)</td>
<td>10.5</td>
<td>9.8</td>
<td>0.7</td>
</tr>
<tr>
<td>Protein weight (lb)</td>
<td>4.86</td>
<td>4.96</td>
<td>-0.10</td>
</tr>
<tr>
<td>Water weight* (lb)</td>
<td>17.8</td>
<td>18.3</td>
<td>-0.5</td>
</tr>
<tr>
<td>Cannon bone (grams)</td>
<td>23.9</td>
<td>28.2</td>
<td>-4.3</td>
</tr>
<tr>
<td>% leg</td>
<td>31.0</td>
<td>31.9</td>
<td>-0.9</td>
</tr>
<tr>
<td>Cut leg length (inches)</td>
<td>14.4</td>
<td>15.0</td>
<td>-0.6</td>
</tr>
<tr>
<td>2† (56 pairs carcasses)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot carcass (lb)</td>
<td>32.0</td>
<td>31.9</td>
<td>—</td>
</tr>
<tr>
<td>Fat weight (lb)</td>
<td>9.1</td>
<td>7.6</td>
<td>1.5</td>
</tr>
<tr>
<td>Protein weight (lb)</td>
<td>4.53</td>
<td>4.81</td>
<td>-0.28</td>
</tr>
<tr>
<td>Water weight (lb)</td>
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<td>Cannon bone (grams)</td>
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<tr>
<td>% leg</td>
<td>32.2</td>
<td>33.5</td>
<td>-1.3</td>
</tr>
<tr>
<td>Cut leg length (inches)</td>
<td>14.6</td>
<td>15.8</td>
<td>-1.2</td>
</tr>
<tr>
<td>3† (15 pairs)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot carcass (lb)</td>
<td>32.4</td>
<td>32.4</td>
<td>—</td>
</tr>
<tr>
<td>Fat weight (lb)</td>
<td>10.8</td>
<td>8.1</td>
<td>2.7</td>
</tr>
<tr>
<td>Protein weight (lb)</td>
<td>4.30</td>
<td>4.81</td>
<td>-0.51</td>
</tr>
<tr>
<td>Water weight (lb)</td>
<td>16.3</td>
<td>18.3</td>
<td>-2.0</td>
</tr>
<tr>
<td>Cannon bone (grams)</td>
<td>22.7</td>
<td>29.3</td>
<td>-6.6</td>
</tr>
<tr>
<td>% leg</td>
<td>31.1</td>
<td>33.0</td>
<td>-1.9</td>
</tr>
<tr>
<td>Cut leg length (inches)</td>
<td>14.4</td>
<td>16.0</td>
<td>-1.6</td>
</tr>
</tbody>
</table>

*From hot carcass.
†The experiment numbers 2 and 3 have been swapped from those previously reported (Proc. Ruakura Farmers' Conference p. 9, 1966) so that now the experimental numbers increase as the differences in conformation between the two carcass types increase. The figure for % leg in experiment 1 also differs from those previously reported in the above publication due to the use of a more accurate method of calculating the percentage. For a full explanation see N.Z.J. agric. Res. 10: 183 (1997).
The carcasses were divided into cuts with the leg always being removed by a cut at a well defined point in the vertebral column. The legs were sectioned with a meat bandsaw to give a visual impression of what makes up shape. The sections suggested that the carcasses of blocky conformation contained a little more fat, and this fat build up was more obvious in the region of the crutch.

It is sometimes said that the legs from blocky carcasses are shorter and plumper and so can be more easily fitted into a roasting dish. The figures for cut leg length are given in Table 1 and reveal that although the blocky legs are shorter, the differences between conformation types are small. In experiment 3 with the biggest differences in conformation between types, the cut legs differed on average by just over one and a half inches and this small difference would be reduced even further when the tip of the leg is cut and folded back as is often done commercially.

Cut out information showed that in all experiments the leggy carcasses had a higher proportion of leg which is one of the most valuable cuts. Similar data were collected on the other carcass joints as well as the leg. Although the results were not as clear-cut as for the leg, the general conclusion could be reached that the blocky carcasses had a higher proportion of the fatter cuts such as the ribs, loin and flap and the leggy carcasses had a higher proportion of the leaner cuts such as the breast and shank, shoulder as well as the leg. The blocky carcasses also had more kidney fat. It is clear from the above information that the blocky carcasses do not have a higher proportion of high-priced cuts and so are not more valuable to the retail trade.

The export grade of the carcasses is given in Table 2. The blocky carcasses graded mainly Prime Down Cross with 10 carcasses of the conformation normally found in this grade being graded Prime Crossbred only because their weights were over 36 lb which was the upper limit of the Down grade. In contrast to the blocky carcasses, the leggy carcasses were mainly graded Prime Crossbred and Y. Although this conformation grading is of interest it should be noted that under the South Island and current North Island system of lamb grading the main effect of conformation is that more leggy carcasses grade Y than did blocky carcasses indicating a greater lean content. The data confirmed that lean blocky carcasses can grade Y.

The information on the sex of the lambs given in Table 2 shows that more ewes than wethers have blocky conformation and the opposite is the case for the leggy carcasses. These results support other
Table 2. Sex and Export Grade of Selected Carcasses (Numbers of Carcasses).

<table>
<thead>
<tr>
<th>Blocky conformation</th>
<th>Leggy conformation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime* Down cross</td>
<td>Prime* Down cross</td>
</tr>
<tr>
<td>Prime* Cross-bred</td>
<td>Prime* Cross-bred</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Blocky conformation</th>
<th>Leggy conformation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment 1</td>
<td>12 2</td>
<td>2 12</td>
</tr>
<tr>
<td>Experiment 2</td>
<td>34 15</td>
<td>— 26 27</td>
</tr>
<tr>
<td>Experiment 3</td>
<td>12 3</td>
<td>— 7 8</td>
</tr>
<tr>
<td>Grade totals</td>
<td>58 20 7</td>
<td>2 45 35 3</td>
</tr>
<tr>
<td>Wether totals</td>
<td>36</td>
<td>50</td>
</tr>
<tr>
<td>Ewe totals</td>
<td>49</td>
<td>35</td>
</tr>
</tbody>
</table>

*These two grades have now been amalgamated into one Prime grade, information from Ruakura and Massey which shows that the advocates of blocky carcasses in the meat trade are to some extent showing a preference for the female figure.

Although the data on carcass composition and cut-out show that there is little difference in quality between carcasses selected as extremes of the blocky and leggy types, and to the extent that there were differences they have tended to favour the leggy type carcass, it has to be admitted that the most important opinion as to the quality of the meat is formed by the person eating it. In order to get such information, one leg from each of the carcasses from experiments 2 and 3 were subjected to palatability assessment. The Ruakura taste panel comprised about 150 cooperating families who purchase their meat from the Station butcher shop. Each family was asked to roast the leg they purchased at a specified temperature for a given time and to taste the meat before adding condiments, sauces or gravies. Each family member was asked to score the meat independently. Using a 9-point scale (Table 3), the tasters were asked to rate the cooked meat in terms of general preference (like extremely—dislike extremely), tenderness (extremely tender—extremely tough), flavour (like extremely—dislike extremely) and juiciness (extremely juicy—extremely dry). The preferences were converted to a numerical scale with like extremely scoring 9 and dislike extremely scoring as 1, with the mid point of neither like nor dislike scoring as 5. Thus the higher the score for any characteristic the better the meat is liked. Scores were averaged within a family to give a mean value for each leg. The scores for the legs from the carcasses of different conformation are presented in Table 4.
Table 3. Taste Panel Score Sheet.

<table>
<thead>
<tr>
<th>General Preference</th>
<th>Tenderness</th>
<th>Flavour</th>
<th>Juiciness</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 Like</td>
<td>Extremely</td>
<td>Like</td>
<td>Extremely</td>
</tr>
<tr>
<td>Extremely</td>
<td>Tender</td>
<td></td>
<td>Juicy</td>
</tr>
<tr>
<td>8 Like Very</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Much</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Like</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderately</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Like</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slightly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Neither Like</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nor Dislike</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Dislike</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slightly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Dislike</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderately</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Dislike Very</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Much</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Dislike</td>
<td>Extremely</td>
<td>Dislike</td>
<td>Extremely</td>
</tr>
<tr>
<td>Extremely</td>
<td>Tough</td>
<td>Extremely</td>
<td>Dry</td>
</tr>
</tbody>
</table>

Table 4. Leg Taste Panel Scores from Carcasses of Different Conformation Types.

<table>
<thead>
<tr>
<th>Blocky conformation mean</th>
<th>Leggy conformation mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of tasters</td>
<td>134</td>
</tr>
<tr>
<td>No. of legs*</td>
<td>68</td>
</tr>
<tr>
<td>Mean taste panel scores:</td>
<td></td>
</tr>
<tr>
<td>General preference</td>
<td>7.2</td>
</tr>
<tr>
<td>Tenderness</td>
<td>7.3</td>
</tr>
<tr>
<td>Flavour</td>
<td>7.0</td>
</tr>
<tr>
<td>Juiciness</td>
<td>6.5</td>
</tr>
</tbody>
</table>

*Three less than the total number of carcasses because three sets of forms were not returned.

These results showed that there were no differences between the legs of the two types of lambs when judged by a large number of consumers. All values were well on the "like" end of the scoring scale and we would expect the addition of mint sauce and gravy, etc., in the normal course of most meals to improve the scores of all lambs even further. The present results and the carcass analyses given earlier indicate why British butchers in recent years have been as happy to pay as high a price for the Y-grade and Prime Crossbred lambs as they have for the Prime Down Cross lambs of blocky conformation and show why the former are perfectly acceptable even if they don't win export lamb contests. Some French evidence* on the palatability of legs from blocky and leggy lamb carcasses has shown that those from leggy carcasses do not lose more weight in the cooking process.

Other N.Z. Evidence on Carcass Conformation

Two other New Zealand experiments have information on the meat content of blocky and leggy carcasses and should be mentioned as supporting the evidence in the above experiment.

The relationship between bone length and amount of muscle in lamb carcasses has been studied at Massey University by Mr A. J. F. Russell,† who looked at data resulting from the complete dissection of a large number of carcasses into fat, muscle and bone. The carcasses were selected as representatives of the different grades normally found in a New Zealand freezing works and had been dissected several years previously. The results showed that carcasses with longer legs had more muscular tissue than those of the same weight with shorter legs and bones. To quote Mr Russell: "Longer bones are associated with greater amounts of muscular tissue than are shorter bones."

In another experiment, Dr Fourie,‡ a South African working at Ruakura carried out a muscle by muscle dissection on the carcasses from straight Southdowns, straight Romneys and Southdown x Romney sheep from birth to maturity as part of a study on the relative growth of animals of these three types. He commented that the sheep industry still places great emphasis on a blocky and compact carcass which is believed to contain a high proportion of muscle to bone and fat. In the light of the results of Fourie’s experiments it seems as if this belief is not based on fact. “In slow-growing animals which are too early maturing as regards fat deposition, e.g. some Southdown strains, this strive to blockiness and compactness has been over-emphasised. Such animals lack weight for age and put on fat at too early an age. For the economic production of meat the trend appears to be towards a longer-bodied animal which is wide in the loin and through the thurls, with a fast growth rate and with a certain minimum of fat covering.” The importance of conformation was further questioned by the finding that certain muscles of the more expensive retail cuts show no significant differences when expressed as a proportion of the total muscular tissue, not even between the leggy Romney and blocky Southdown breeds. The differences in shape that are visually noticeable apparently mainly result from differences in skeletal structure and here I would also add differences in fat covering.

Although I do not agree with all Dr Fourie’s ideas, I think that in general terms, his experiment and that of Mr Russell are in complete agreement with the results of the experiment I described earlier and all evidence shows that blocky carcasses have no advantage over leggy carcasses in terms of muscle content or muscle distribution.

Market Information on Carcass Conformation

If it could be shown that overseas buyers genuinely believed that carcasses of blocky or of leggy conformation were of higher quality, to the extent that they would pay a premium for such carcasses, then the commercial lamb producer would be well advised to continue to pay attention to carcass conformation, irrespective of the results of


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scientific cutting tests and other factual information on carcass quality. However, such is not the case and evidence of two types suggests that in our main lamb market, the United Kingdom, the blocky carcasses that have been traditionally described as superior, in actual fact fetch no premium and there is an indication that blocky carcasses have fallen into disrepute.

(1) Schedule Prices and Market Reports

For many years, North Island farmers have noted that Prime Down Cross carcasses (Downs) were quoted on the “meat schedule prices” at exactly the same figure as Prime Crossbred carcasses (Primes). It is equally well known that the Down grade mainly contained blocky carcasses and the Prime grade contained the leggier carcasses. Prices from the Smithfield market similarly showed that Downs and Primes of the same weight range have the same value.

Y grade carcasses tended to have poorer conformation than Primes and in addition they were very much leaner than both Primes and Downs. Nevertheless, New Zealand schedule prices in very recent years have been the same for Ys and Primes (with minor exceptions) and the farming community has known for several years that Y grade carcasses sometimes fetch a premium on the British market. Thus on a price basis there is no evidence to suggest that British butchers regard carcasses of blocky conformation as having superior quality.

(2) Report of Meat Export Grade Investigation Committee.

In 1964 the Meat Board set up a committee to investigate all aspects of our export grading system. Many comments in the report, which was published in October 1965, were of considerable interest in relation to the market reaction to carcasses of differing conformation and the type of carcass that the market considers ideal. As our North Island grading system resulted in a separation of carcasses into groups differing in conformation the evidence in the report on market acceptability of the different grades was of particular interest.

The report pointed out that the Ys being a lean grade, were favoured in the Midland industrial areas of England and Wales, and with the Alphas, in Continental markets. The Ys were bought extensively in self-service stores.

The North Island Downs, once a premium grade, had lost favour on account of past experience of excessive fat and most self-service stores will not buy this grade. Even in the Greater London area and the south-west of England where the Down grade is mainly sold, the butchers would readily take the North Island Prime Crossbreds in the place of the Downs. The report noted that in the South Island the inclusion of leggy lambs of poor conformation were the cause of some complaint and recommended that a special grade to be called “Omega” should be formed for such carcasses. However, it should be mentioned that the carcasses that would fall into the Omega grade are more extreme in leg length than any of the carcasses described in the present experiments, all of which would still fall into the Prime Crossbred grade.

The Grades committee recommended that the less popular North Island Down grade should be amalgamated with the completely
acceptable Prime grade and considered that on this basis we could continue to produce and sell the carcasses of blocky conformation. This recommendation has been accepted by the Meat Board and the Downs and Primes were placed in the one prime grade this past season.

The Grades Committee Report has thus given a clear indication that blocky conformation is no longer an advantage on a market that now associates this carcass shape with excess fat and that at the other extreme some carcasses that are leggier than those normally produced in the North Island should be segregated into a new grade.

Conclusions

Carcass cutting tests, palatability tests and information from our overseas markets have shown that the blocky carcasses which have in the past been regarded as the best by the meat trade can no longer be regarded as superior to the carcasses of leggy conformation and in some regards they may even be inferior. In the light of this information it is obvious that the commercial export lamb producer should forget about conformation and confine his attention to the productive characteristics that place money in his pocket. He should aim at using sires that will let him draft most of his lambs at a time that suits his overall management plan and should use sires that produce lambs with a faster growth rate than at present. The owner of breeding flocks should place emphasis on sires that increase ewe wool weight, lambing percentage and lamb growth rate as judged by criteria such as weaning weight. Some prominent members of the meat industry have recently suggested that commercial farmers should not depart from the use of traditional fat lamb sire breeds because of the importance of lamb carcass conformation; however, in the light of the evidence given in this paper I believe that most breeds of sire available in New Zealand would meet the necessary conformation requirements in their progeny. Farmers should therefore forget conformation and place increased emphasis on other characteristics likely to increase the productivity of the sheep industry.
EXPORT POTENTIALITY OF SEEDS
Mr Rex Ballinger, Export Manager, New Zealand Farmers' Co-operative, Christchurch.

Introduction:

New Zealand has a good climate for seed production, and Canterbury is the most favoured province. After visiting Europe I would say that if our chief overseas competitors, such as Holland, Denmark and Belgium, enjoyed our climatic conditions they would price us out of the market. However, with our natural advantage we can still compete on overseas markets if we work as hard as our competitors. Having visited most of the seed producing countries of the world, I am satisfied that New Zealand farmers, with their knowledge and ability, can compete as seed producers.

New Zealand is free of the main stock diseases, including the dreaded foot and mouth disease. We are also relatively free of most of the undesirable pasture weeds, and these are export advantages.

Our seed export history goes back over one hundred years when we sold $40 worth—our first sale. By 1868 it had climbed to $4,000 and, although the value continued to increase to $200,000 at the turn of the century, it was not until 1944 that we passed the $2.0 million mark when we shipped 8,000 tons of seed valued at $2.9 million. The peak of our seed exports was reached in 1954 when we earned $5.4 million on shipments of 9,200 tons. Ten years later we shipped approximately the same tonnage of seed but earned over $2.0 million less.

This falling off in value is due to supply and demand. On the one hand other sources have increased their supply, including British farmers for the home market. On the other, we have failed to breed types suitable for buyers' needs, and consequently the demand for our seed has fallen.

Thanks to men like Sir Bruce Levy, Sears, Cockayne, Corkill and Barclay, New Zealand developed pure strains of pasture seed suited to our climates and to our conditions. When coupled with a Certification tag and certificate, this seed quickly won recognition overseas. For years, our seed was sown in most pasture mixtures throughout the United Kingdom, but today you can look right through the English Seed Trade Review and not one firm advertises New Zealand seed. In fact, recent editions have contained folded pamphlets published by an English seed firm advertising the merits of six Dutch hybrid ryegrasses.

Increasing Competition:

For years, the quality of our seed and the resulting pastures were the best available, but since the last war vast strides have been made in breeding new strains of ryegrass, especially by private breeders on the Continent. European breeders, particularly the Dutch, have paid special attention to cold hardiness, and these strains are more suitable for Britain where the winter is more severe than ours.
Over the past two or three years our English ryegrass buyers have been going elsewhere, and last year Denmark replaced us as the largest supplier to Britain. During the year England imported 4,000 tons of Italian ryegrass, of which we supplied only 12 per cent. This was in spite of our low price, which returned around $1.20 a bushel gross to the grower.

It has, however, taken 100 years to build up this valuable export market. We could retain and expand it if we were prepared to breed plant types to suit our buyers, as well as breeding for our own conditions.

**Plant Breeders:**

The private breeder has the advantage over Government breeders in meeting the needs of a market in that his activities are more versatile. If there is a demand for a small alteration in type, he is able to make these changes in the quickest possible time without being encumbered by a certification and registration scheme. Small improvements in yield and performance can be converted to commercial gain more quickly, whereas new types bred by a Government breeder have to show marked improvement in performance, and be tested in trials over several seasons, before they are released. Minor alterations could be short-lived in a variety unless they are fixed by continued and painstaking selection. However, some instability of type is not so serious to a firm that is prepared to devote huge funds to promotion and which brings out a new variety or two every year. These varieties may soon revert but the private breeder is not so concerned because he has several more varieties in the pipeline. A Government body representing the whole country usually has to be certain of the results, and the delay while finding out costs time and money. The new white clover cross is an example of the delay involved.

I feel we have become too complacent. Our perennial ryegrass was really good in its day, and still is, under certain conditions. However, during my visit to Britain last year I was shocked to find that the bulk of our seed went into lawn mixtures and not into pasture. I have here a cable dated 15th September, 1967, asking us to quote 99/90 Mother Perennial up to 50 tons (5,600 bushels) for lawn grass mixture. This perennial ryegrass is virtually the same as when it was first produced for Certification 38 years ago.

Short rotation (Manawa) released here in 1943 was the first hybrid to be put on the world seed market, and from preliminary information the new hybrids cannot yet exceed it for yield potential. In spite of this record, however, Manawa is not sufficiently winter hardy for the United Kingdom and the demand is poor.

The Bank of New Zealand report from London dated March 15th concerning our latest release was not very encouraging. It stated: “Ariki Ryegrass. This variety is still not considered to merit a place in British Agriculture.”

We must face the fact that our export customers are losing interest in us because they can buy more suitable seed elsewhere, often at lower cost. If we are to remain in the market we will have to pro-
duce seeds that are in demand. This means, either, produce seeds promoted by someone else, or produce and promote our own. In either case, we shall probably have to increase our efficiency of seed production, thereby lowering our price to meet the market. Fortunately, the demand for grasses is increasing step by step with the demand for greater food production. Moreover, the pure ryegrass swards introduced in Holland are becoming popular in England, where it has been shown that an average vigorous mixed pasture produces only 5,000 to 6,000 lb dry matter compared with 10,000 to 12,000 lb where 250 to 300 units nitrogen over a season have been applied to a pure ryegrass sward.

Our white clover has continued to give splendid results in many countries, but with the increasing use of nitrogenous fertilizer, the increased breeding programme and multiplication schemes of other countries, the outlook for our exports is not quite so bright.

New Markets:

However, there are possible new outlets. Three of the world's largest undeveloped areas, namely, Australia, Africa and South America, are all in the early stages of pasture expansion. They are all virtually on our door-step, and are all conversant with the pastures produced from our seeds.

It is in these newer "grassland development" countries that the same kind of market can be developed as we have enjoyed for ryegrass and clover seed in Great Britain in the last 25 years. The grassland development programmes of countries such as Japan, Chile, Argentina, Uruguay and the East African highlands, have often been inspired by New Zealand principles and practices. They are "New Zealand-prone," but we cannot be complacent about our markets there if we do not promote our products.

Promotion:

These new markets, such as South America, Africa and Japan are necessary to maintain our exports, but more intensive advertising and selling will be necessary to develop and retain them.

A booklet in Spanish, together with photographs and descriptions of the types of pasture seed produced in New Zealand suitable for South American countries, was published by our firm and posted to prospective buyers before my trip to South America two years ago. From the interest this booklet created I am satisfied that if the Department of Agriculture made similar publications for use overseas by exporting firms, no better method of promotion could be obtained.

We are all guilty of the lack of advertising our pasture seeds overseas, but without co-operation by all concerned very little can be done by individual merchants. A source of advertising funds could be a small levy on all growers' machine dressed seed. This would benefit the grower, whether his seed was sold locally or exported, because the quantity of seed sold overseas affects the quantity on the local market and hence the local price.

Even our relatively new markets could be short-lived due to the vast potentiality of the country concerned. One grower in the Argentine last year harvested 400 tons (50,000 bushels) of ryegrass seed.
from an area sown with New Zealand strain, and this seed can be purchased and retailed at 75 pesos compared with 220 pesos for the New Zealand imported seed. To show the scale of operation, a neighbouring estancia grows an average of 10,000 acres of wheat and 1,000 acres of potatoes.

The export seed trade will become more difficult through increasing regulation of seed imports by individual countries, and we shall suffer a severe blow if the European Economic Community (E.E.C.) introduce their over-all seed import policy.

The New Trend:

This year, our best customer—England—has planned to grow its own strains of timothy, fescue, red clover and white clover in Canada, U.S.A., Denmark, France and New Zealand—a total area of approximately 1,350 acres.

Thirty-four acres of $100 white clover are being multiplied this year in Mid-Canterbury and 36 acres of $184 in North Canterbury, the first under the O.E.C.D. (Economic Co-operative and Development) scheme, a body which New Zealand joined last year after many wasted years of deliberation.

This multiplication of seed for other countries, as well as for overseas private breeders, could become a big part of our future seed production programme, but as some countries have such vast areas of lower cost land available for this type of work competition will be very keen. For instance, this year Canada is multiplying nine varieties for England. The margin of profit will be smaller than if we were developing our own varieties.

Multiplication of overseas varieties will not only lead to reduced profits but will also involve greater restrictions on the grower and also his neighbours. At present, ryegrass seed-growing districts show a preference for one variety, and under our New Zealand certification scheme this one variety can be grown in adjoining fields and still be certified. However, if a foreign grass is grown in the area, this will prevent any fields within 100 yards from being certified, as well as disqualifying the seed that is being multiplied. You can quickly realise the implications if, say, ten different types of grass were being multiplied in the Lincoln area. Being a seed grower myself, I looked at the possibility of multiplication on an area of 15 acres at Tuahiwi but, after counting as many as 13 different land owners within 100 yards of my paddock, I realised it was hopeless to find out what their final programme would be for the season on these adjoining areas.

Threshold short rotation ryegrass straw when sold will pay for the nitrogen fertilizer used to produce a greater seed crop, but under multiplication regulations this has to be burnt. Greater care will be necessary in cleaning out drills, headers and seed-dressing machinery, as one act of carelessness could restrict the future multiplication programme for the whole country.

While in Holland last year I was approached by private grass breeders on the question of multiplication of ryegrass in New Zealand, but no finality could be reached as the firm concerned stated
that they were having it multiplied for about one dollar (N.Z.) per bushel in the U.S.A. This is too low for us to compete. Another problem was germination. In the Oregon, where seed production and multiplication are carried out on a very big scale, the ryegrass straw and stubble are burnt off after harvesting and this apparently greatly reduces blind seed disease, and they can guarantee a 90 per cent germination. We could give no 90 per cent germination or even 80 per cent guarantee as no solution has been advanced by our grass growers or breeders to overcome this problem. This year, of the first 500 samples of ryegrass tested, only one-third were 90 per cent or better, while some seed was practically worthless at 28 per cent.

At one research station visited last year in Northern Ireland they claim that, after years of crossing and back crossing, they now have stock ryegrass plants virtually immune to blind seed disease. If our growers could be sure of a 90 per cent germination or better, we could produce a cheaper seed. Another cost-reducing factor would be to produce more seed per acre but, apart from adding more fertilizer such as nitrogen, no new methods have come from our research stations because no work has been done on this problem. Some individual farmers have come forward with improved methods to increase production. One is based on the European idea of cutting ryegrass and threshing after two or three days instead of the usual seven to 10 days and then drying the seed immediately, thus avoiding loss in the windrow due to bad weather. It is fortunate that we have these innovators amongst our farmers.

Expanding Possibilities:

The multiplication of seed in New Zealand is not new. During the past eight years our firm has twice multiplied chou mollier for a firm in Western Germany as well as for English firms, and this year we are multiplying ryegrass on the Lincoln College farm for an Australian firm, but I feel that the future multiplication of peas and beans in this country could grow significantly. Africa, once the country for bean and garden pea multiplication, is no longer a dependable proposition, nor is the reliable cheap labour still available. Already, Northern Hemisphere firms are multiplying their crops in New Zealand where, by shipping immediately after harvest, it is in time for their spring sowing, and thus the multiplication scheme is reduced by a year.

American firms have grown beans, peas, corn and cucumbers, for seed in the Marlborough Province; in many cases, at prices far in excess of those normally paid, while in Canterbury and Marlborough this year peas have been multiplied and shipped back to the country of origin, some even air-freighted at a freight rate of $2 per pound weight. Devaluation has made this type of multiplication a possibility. But, here again, New Zealand has been too slow and we are beginning to lose our established overseas garden pea markets, which in the past have been very profitable to us.

The largest garden pea seed buyer in England last year stated that, in the past his company had purchased hundreds of tons of pea seed from New Zealand every year, but their trials had shown them
that the pea breeders in the U.S.A. were continuing to improve the existing freezing varieties as well as breed new ones, while the New Zealand peas remained unchanged and, even though he had to pay far more for the American peas, the results obtained justified the extra money.

The peas used in New Zealand are all from imported origin and, although the Crop Research has kept the most popular of these true to type, and bred in such desirable characteristics as "wilt resistance," they have, as yet, never released a new variety. I am pleased to report that a breeding programme at the Crop Research has achieved very encouraging progress.

As a result of devaluation our export pea trade, particularly for Maple and White splitting peas, should increase. For the past two years our pea exports, chiefly garden peas, have amounted to over one and a half million dollars, and this year the figure should be much higher due to the failure of the Australian crop.

Shipments of pasture seeds and peas made by most firms to Australia for the first four months of this year have increased substantially compared with the same period last year.

There is certainly room for greater diversification in the growing of beans for seed purposes, particularly haricot, butter, tic and broad beans. Farmers planted 350 acres of soya beans in Canterbury and Marlborough as well as the North Island this past season. This shows that the growers are willing to cooperate in an endeavour to widen our range of possible exports. An increasing demand from Australia and Japan for canning beans could be supplied from New Zealand. The most recent development comes from the U.S.A. where large seed firms have put forward proposals to have flower seeds grown in New Zealand.

One must bear in mind, however, that the sample of the finished product must be good for overseas requirements and that the outlet in our own country for rejected lines is practically nil.

The New Look:

Last year, Mr A. V. Lithgow was appointed as Superintendent Seed Industry in the Department of Agriculture, a step which should broaden the seed trade outlook. Production has in the past been the main objective of the Government but assistance can now be extended to distribution and marketing. Had we joined up with the O.E.C.D. (formerly O.E.E.C.) when it was set up in 1959 by 19 European countries we would have kept abreast of the changing times and had all our seeds tested and no doubt accepted by the French Government. Manawa ryegrass and Huia white clover are now both registered in the "French Seed Catalogue," but these are only two varieties out of nine.

The Plant Varieties and Seeds Act passed in England in 1964 has led to field testing by the N.I.A.B. and the N.A.A.S., of wheat, barley, oats, potatoes, ryegrass, French beans, peas and lucerne. These are all indexed and only varieties included in this index may be sold in the United Kingdom. This new trend to protect producer and user or, to put it more broadly, production, distribution and marketing,
is leading to greater trust and confidence in the trade and we must be a member of such bodies. At present, the N.Z. Grain and Seed Merchants are making an approach to join up with the F.I.S. (International Seed Traders' Association).

Breeders' rights now protect private breeders and, although these rights have, to a great extent, led to present strong overseas competition, it also opens the door to the breeding of new strains in New Zealand by private individuals or seed firms.

In recent years, seed exporting firms have greatly increased the number of outlets overseas and, although the present seed export prospects are becoming more difficult, I feel that these can be met by:

(1) Breeding more suitable varieties locally.
(2) Multiplication.
(3) Research into increased yields.
(4) Research into loss and damage of seed through case bearer moth, blind seed disease, and more efficient harvesting methods.
(5) Specialisation in seed production rather than looking upon seeds as a catch crop.
(6) Increased co-ordinated effort by all concerned in production, marketing and distribution.
(7) Through promotion sell greater quantities of seed from our existing varieties to newly developing countries.
COSTS AND RETURNS OF HORTICULTURAL CROPS

Mr G. F. Thiele, Senior Lecturer in Horticulture,
Lincoln College.

Introduction:

Diversification of farm production is very much of a “hot potato” lately. In my six years at Lincoln I cannot recall a horticulturist being invited to enter the hallowed field of a farmers’ conference and it is certainly a reflection of the times that an industry looked on by many in agriculture as dealing mainly with production on a kitchen garden level should be recognised and in fact hold some promise for intensification of New Zealand agricultural production. Let me assure you at the start that horticultural production is not a matter of setting out a few plants or sowing a few seeds and letting them grow, as some of you have discovered to your cost this last season. The returns per acre can be very high indeed with regular pest and disease control and skilled husbandry generally, but the losses can be equally high if the crop is grown as a “spec” with little attention.

There are several points which must be made initially before looking at some detailed costs.

1. Horticulture itself is extremely diverse. It can range from the production of tea to growing nuts; from hop growing to mushroom culture; from tobacco to gherkins; from grapes to avocados; from maiden hair fern to orchids; from forest tree nurseries to house plants and it even includes peas, beans and potatoes. Somewhere, some time, some place when you least expect it you will find most of these crops, except the truly tropical, growing commercially in New Zealand.

2. Secondly, we must face the fact that, by and large, horticultural production is still on a small scale in this country; we still grow many small half-acre areas of cabbage, of tomatoes for processing, of strawberries and in fact most other horticultural crops. Speaking of berry fruit, I understand that there are only seven berry fruit properties in New Zealand of 15 acres or more. In short, economies of scale have not been realised to any extent yet in New Zealand horticulture.

3. Horticultural crops generally have a high labour requirement unless large scale production allows mechanisation. Our high labour costs have been one of the main reasons why we cannot compete with our horticultural products more readily on export markets.

4. Fourthly, with very limited marketing stabilization schemes, horticultural produce is susceptible to very wide price fluctuations. The change in prices of tomatoes from the 1966-67 season to the 1967-68 one, makes the change in the wheat price look like “chicken feed” for those intimately involved. The extra 20 or 30 acres of out-
door tomatoes grown last season (perhaps as the result of farmers attempting to diversify) was sufficient, along with a good production year, to tip the scales very much in favour of the buyer and cause market prices to be as low as two to three cents per pound at the height of the season.

I was speaking with one farmer last week who had produced about half an acre of good quality lettuce for the February market and at one stage he was getting a gross return of just over half a cent per lettuce. The average price was one cent each which produced a net loss after marketing costs had been deducted for case, commission, levy and transport.

I do not wish to deliver a negative type of paper at a farmers’ conference but I am forced to agree with a newspaper headline last Saturday that there is “No easy, early answer” to farm diversification and all my enquiries about immediate New Zealand markets for horticultural produce have not been encouraging. If I were to persuade New Zealand farmers to plant horticultural crops ad infinitum, encouraged by present day gross margin figures, I would lose your respect and the respect of growers at present engaged in horticultural cropping. They are worried about the farmers’ interest in their crops and I do not blame them. At the same time, increased competition is going to demand increased efficiency and this can do the industry nothing but good at a time when devaluation gives horticulture in this country tremendous incentive. Stabilization and increased production can come to the industry in two ways:

1. By increased exports of fresh produce.

2. By increased production of processed products, but costs of production in most cases need to decrease several cents per pound to allow this.

You have not come here to listen to speakers speculate. We know that there are thousands of acres of land in Canterbury and New Zealand suitable for production of horticultural crops in the same way as they produce good yields of agricultural crops, particularly (and sometimes only) if irrigation is available. Given the condition that market research or processing outlets must precede any large scale increase in production it is possible to look at some detailed costs and returns.

Costs and Returns of Berry Fruit:

My main interest in this regard during the first year has been in strawberries. The following figures set out costs and returns recorded at Lincoln College this season.
### Strawberries First Season

**Gross Revenue**

- Dessert (average punnet price 33.4c) . . . . $1,798
- Jam (average price per lb 19.6c) . . . . 448

**Total** $2,246

### Direct Costs

**Materials—**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plants (25,000)</td>
<td>$375</td>
</tr>
<tr>
<td>Plastic (3ft x .0015in)</td>
<td>262</td>
</tr>
<tr>
<td>Fertiliser</td>
<td>41</td>
</tr>
<tr>
<td>Straw</td>
<td>20</td>
</tr>
<tr>
<td>Spray materials</td>
<td>13</td>
</tr>
<tr>
<td>Punnets</td>
<td>105</td>
</tr>
<tr>
<td>Rubber bands and cellophane</td>
<td>32</td>
</tr>
</tbody>
</table>

**Total Costs for Materials** $1,798

**Machinery (at 30c per hour)** . . . . 23

**Labour (casual only at $1 per hour)** . . . . 100

**Irrigation** . . . . 1

**Harvesting (contract at $0.05 per lb)** . . . . 379

**Transport** . . . . 53

**Commission at 10% (including containers)** . . . . 237

**Gross Margin for first year** . . . . $605

The total labour charge both casual and permanent was $603, about one-third of the total costs. In Canterbury, provided virus infection is prevented by adequate aphis control, the strawberry crop can be left in for two, three or even more years.

Although we have no accurate figures for the second and third years of the crops, sufficient records are available to be able to predict accurately the likely margins.

### Strawberries Second Season

**Gross Revenue**

- 6 tons at 25c per lb . . . . $3,360

**Direct Costs**

**Materials—**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertiliser</td>
<td>$40</td>
</tr>
<tr>
<td>Straw</td>
<td>20</td>
</tr>
<tr>
<td>Spray materials</td>
<td>40</td>
</tr>
<tr>
<td>Packing materials</td>
<td>300</td>
</tr>
</tbody>
</table>

**Total Costs for Materials** $1,824

**Machinery** . . . . 20

**Casual labour** . . . . 130

**Harvesting** . . . . 672

**Commission** . . . . 500

**Irrigation** . . . . 2

**Transport** . . . . 100

**Gross Margin for second year** . . . . $1,536
The crop in the third year is likely to be less than the second year by 1-2 ton/acre reducing the gross margin to the vicinity of $1,000/acre.

Based on past years' tonnage and prices these margins are low (average of approximately $1000/acre). Well produced strawberries in Canterbury in the second year have yielded ten tons/acre and more which would increase the gross margin in the second year by about $1,300. At the same time prices have been gradually falling over the last three or four years and a gross price of 20c instead of 25c used in the calculations is quite feasible for next season.

This would reduce the margins as follows:

<table>
<thead>
<tr>
<th></th>
<th>25c/lb</th>
<th>20c/lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>First year</td>
<td>$605</td>
<td>$213</td>
</tr>
<tr>
<td>Second year</td>
<td>1,536</td>
<td>864</td>
</tr>
<tr>
<td>Third year</td>
<td>1,000</td>
<td>550</td>
</tr>
<tr>
<td>Average for three years</td>
<td>$1,047</td>
<td>$542</td>
</tr>
</tbody>
</table>

Bearing in mind that the enterprise of strawberry growing has a very high input of permanent labour (at least 500 hours per acre per year) the profit of the venture will very much rely on a stable price.

Although the cost of establishing is relatively high (initial materials approximately $700 per acre) the costs (excluding irrigation equipment) can be recouped within the first year. Besides capital for establishment the other limiting factor is labour for harvesting. At the height of the second year crop, which usually falls in the two or three weeks before Christmas, ten pickers per acre would be required regularly. With such a highly perishable crop any scarcity of harvesting labour will drastically reduce returns as over-ripe fruit is difficult to sell and left on the plant too long can lead to a sudden increase in botrytis infection.

The future of strawberry production in this country (and in fact berry fruit as a whole) depends simply on two facts.

1. The continual expansion of export markets for fresh fruit.
2. The development of processing for jam, cans, freezing, juice and even wine. (Strawberry wine is big business in California).

Other berry fruits are also profitable crops to grow at present and an area of strawberries can help to overcome establishment costs in the first two to three years.
Boysenberries, first year

**Direct Costs**

**Materials—**
- Plants (660) ................................... $198
- Plastic (3ft x .0015in) ...................... 73
- Fertiliser ..................................... 25
- Spray materials .............................. 21
- Clover ........................................ 4
- Packing materials ......................... 1

**Machinery (at 30c per hour) .................. 15**

**Labour (casual only at $1 per hour) ........ 10**

**Irrigation .................................... 1**

**Harvesting (contract at $0.05 per lb) and**
**including other marketing charges 1**  

$322

The use of plastic for boysenberries is probably unwarranted where irrigation is available. Sixty hours of permanent labour was also involved. Revenue for the first year was a mere $5.00 and normally revenue is considered unlikely at all in this year.

The main items of capital expenditure in the second year are:
- Posts—180 at $1.90 ............................ $342
- Wire—10cwt at $8.00 .......................... 80

$422

The estimated revenue (net of harvesting and marketing costs) in the second and third years is:
- Second year—$448 (1 ton).
- Third year—$2,240 (5 tons).

It is obvious that boysenberries will not produce a net profit until the third year.

The same situation exists with raspberries.

Raspberries first year

**Revenue**
- Jam and punnets .............................. $138

**Direct Costs**

**Materials—**
- Plants (3,000) ............................... $120
- Fertiliser ................................... 25
- Spray materials ............................ 5
- Packing materials ......................... 6

156

**Machinery (at 30c per hour) .................. 14**

**Labour (casual only at $1 per hour) ........ 15**

**Irrigation .................................... 1**

**Harvesting (contract at $0.05 per lb) ........ 14**

**Transport .................................... 2**

**Commission .................................. 14**

216

**Gross Margin ................................ $78**
In addition 90 hours of permanent labour was also involved. The main items of capital expenditure in the second year are:

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posts</td>
<td>224</td>
<td>$130</td>
</tr>
<tr>
<td></td>
<td>80</td>
<td>152</td>
</tr>
<tr>
<td>Wire</td>
<td>14cwt</td>
<td>112</td>
</tr>
</tbody>
</table>

The estimated revenue (net of harvesting and marketing costs) for the second and third years is:

**Second year**—$504 (1 1/2 tons).

**Third year**—$1,344 (4 tons).

Depending on the cost of stakes and wire and also on the variety, raspberries could yield a positive enterprise margin in the second year and certainly in the third year.

**Black Currants first year**

**Revenue**

58 lbs at 25c per lb . . . . . $14

**Direct Costs**

**Materials**

- Cuttings (1,458 at $0.05 each) . . . . . $73
- Plastic (3ft x .0015in) . . . . . 51
- Fertiliser . . . . . 19
- Spray materials . . . . . 8

Machinery (at 30c per hour) . . . . . 23
Labour (casual only at $1 per hour) . . . . . 15
Irrigation . . . . . 1
Harvesting (at $0.05 per lb) . . . . . 3
Marketing costs . . . . . 2

**Gross Margin** . . . . . $181

With irrigation the use of plastic may be questionable.

Thirty-five hours of permanent labour was involved.

The use of one-year-old plants instead of cuttings would add $290 to the cost (assuming plants cost $0.25 each) with very little advantage in growth at the end of the first year.

The estimated revenue (net of harvesting and marketing costs) for the second and third years at $0.15 per lb is:

**Second year**—$336 (1 ton).

**Third year**—$1,008 (3 tons).
Although processing firms are taking all the black currants they can at present at 20c per lb there is interest being shown by one large firm in acreages of the order of 300-500 for juicing. To allow economic juice production for export the price to the grower would have to be cut to at least 15c and possibly 12c per lb. With modern management methods, close planting and machine harvesting, 12c per lb would still produce an average gross margin in the vicinity of $300-$400 per acre.

The scope for red currants also is at yet untired. To help promote New Zealand lamb, a pot of red currant jelly with each joint was suggested recently by Mr H. Brown, president of the New Zealand Berry Fruit Growers’ Federation.

Gooseberries, another crop which we are in the process of costing, lends itself very well to mechanical harvesting and cheaper production for processing.

Before leaving fruitgrowing I want to mention briefly the present situation existing in New Zealand viticulture. Wine contractors are offering, in some instances, 20-year contracts for production of grapes at 15c per lb for all varieties except Albany Surprise (10c per lb). Average grape yield/acre is about five tons giving a gross revenue of $1,680 per acre.

Estimated cost of establishment is $1,800 per acre.

There is unlimited scope for the New Zealand wine industry for both local and export trade in areas most suited to grape production.

Vegetables for Processing and Export:

Although Unilever are contracting in Canterbury for peas to the extent of about 2,000 acres and beans about 100 acres the production of other vegetables for processing either frozen or canned is not so bright in the Canterbury district. The processing demand for sprouting broccoli is about 30 tons (15-20 acres), brussels sprouts 40 tons (20 acres) and spinach 40 tons (10-15 acres).

The prices per ton offered based on packed weight are:

- Sprouting broccoli—$170/ton.
- Brussels sprouts—$160/ton.
- Spinach—$56/ton.

In comparison with the gross margin of peas up to $100 and beans $140 the margin for brussels sprouts in this case would be in the vicinity of $300 per acre.

Christchurch processors also use cauliflower although the price of 4 or 5c per lb for the curd alone does not encourage production specifically for processing. The processing firms help to stabilize the market price to some extent in periods of glut by buying on the market floor.

Perhaps the best prospect for brassica food crops at present is in the fresh export of brussels sprouts. The average market price in Sydney is about 10c per lb although the current price is about 15c to 18c per lb. Even at this price it is not economical to air freight with freight costs at least 10c per lb. The shipping rate is about 2c per lb
but the unknown factor at present is the possible effect on price of a four or five day delay in marketing as the result of shipping. Even the possible introduction of “Jumbo” jets is unlikely to reduce the freight rate.

Air freighting of fresh vegetables can only be economical if the market value is high in relation to its weight. This is the case with celery at the moment where prices of 40c to 45c have been paid for a stick of top quality New Zealand celery. However the quantity demanded is small for a relatively high-class market.

Asparagus is another high-priced vegetable with which New Zealand is gradually breaking into world markets by using air freight, but in this case the crop is perennial and takes three years to bring to full production. Although processed asparagus is a lucrative proposition in the North Island there is no demand for this purpose as yet in Canterbury.

Less perishable vegetables have quite good prospects for export by ship. The Vegetable and Produce Growers’ Federation has been making strenuous efforts to supply the needs of the Japanese market with onions. Gross margins of $200-$600 per acre depending on yield and price can be expected for onions and this is one vegetable crop where there is a distinct possibility of increased production in Canterbury.

Tomatoes

There are two distinct methods of producing tomatoes: staked or wired for market and dwarf or bush for processing.

The average market price for staked outdoor tomatoes over the last few years has been 9.5c per lb. With a two-acre area and a yield of 5lbs per plant (18 tons per acre) it is possible to cover all capital expenditure of posts, wire, grader and sprayer (total of approximately $2,000) in the first year of operation. At the other extreme the prices during this last season of as low as 2c per lb resulted in a negative gross margin in many cases, with no contribution to capital repayment.

The same situation was revealed in a recent costs and returns survey conducted by the New Zealand Vegetable and Produce Growers’ Federation in the main processing districts. A break-even tonnage to allow a 5 per cent return on capital, a wage of $39 per week and 6 per cent interest on overdraft was calculated for each district and the Nelson figure suggested was 12.0 tons per acre. (Canterbury was not included in the survey.)

Two local sauce factories take only a limited supply of tomatoes for processing at $40-$50 per ton but the area required to fill the demand of 400-500 tons is not more than 30-40 acres.

There is also a limited demand for crops such as beetroot and cauliflower from these processors but again the market surplus usually fills the requirement.
Other Market Crops

A number of farmers have tried lettuce during the last season. An average gross margin for summer lettuce commonly quoted is $200 per acre based on an average market price of 60c per case or 5c per lettuce. At 20c per case though, a common price during February this year, the loss, based on direct costs of $410 per acre and a good yield of 1,200 (x12) cases per acre, is $170. The break-even point is approximately 34c per case.

Similar variation can occur with silver beet where gross margins range from $60 to as high as $700-$800 with an average of about $300 per acre.

Potatoes also are noted for their variation in return. Losses can be as high as $120 per acre and profits as high as $350 per acre.

Pumpkins, even at $1.50 per sack and 150 sacks per acre can return a reasonable gross revenue of $225 per acre with the greatest costs in harvesting and marketing.

Bunching carrots are an extreme example of the relationship between growing and harvesting costs. To take the crop to the marketing stage the estimated cost is $96 per acre and to harvest and market the crop the figure is $460 per acre.

Value of Vegetable Crops as Stock Food

One of the extremely important points which we have yet to learn thoroughly in horticulture is that it sometimes pays to leave crops unharvested. If the market return for bunched carrots for instance is likely to be less than $460 per acre there is no point in marketing them provided the resources such as labour can be used profitably in some other enterprise. Marketing at a loss in times of glut can do nothing but depress the market further.

There is a tendency in New Zealand to move towards prepackaged vegetable marketing which of course increases the marketing costs. I watched recently a line of carrots from the North Island sold on the Christchurch market. They were splendidly presented, washed, in 3lb plastic bags all enclosed in a large plastic bag holding about 90lbs. They sold at about 1.5c per lb, a price which would not cover the grower’s harvesting and marketing costs. Who bought them? A farmer for horse food!

With precision drilling and close between-row spacing, yields of 20 tons per acre are not impossible for main crop carrots today. With an average dry matter content of 12 per cent there is no reason why carrots cannot be lifted and sold in the paddock as stock food during the June, July, August period if market prices are low. I understand that fodder beet is worth about 10c/stock unit/week and a good crop of carrots would not fall very far below this value (perhaps a gross value of $40 per acre). Brassica food crops could also have a value as stock feed. Sprouting broccoli and brussels sprouts for instance could have a stock food value similar to chou moellier even after harvesting for market. In fact all vegetable crops have some stock food value; pumpkin and corn are other good examples.

75
Conclusion

I think my main message is one of caution as far as the marketing of fresh horticultural produce in New Zealand is concerned. The New Zealand population is not large enough to absorb any large scale increase in production.

As far as processing is concerned, the New Zealand market is also well satisfied but for export I am very enthusiastic provided we can reduce our production costs.

The possible export of fresh produce to Australia, the South East Asian markets and Northern Hemisphere markets is exciting but dulled to some extent by high air freight costs, high production costs on relatively small areas and lack of enthusiastic market research. Given the will to attempt fresh export, or given a guaranteed processing outlet, I encourage the farmer with good soil and irrigation to diversify into horticultural crops as part of his rotation. On the other hand, steady progress towards large scale, mechanised production for steadily developed overseas markets could do much more for New Zealand and the horticultural industry in the long run than haphazard, speculative production for wildly-fluctuating New Zealand markets.

Acknowledgement

I am indebted to Mr A. Smith, Horticultural Advisory Officer, Department of Agriculture, Christchurch, for some information on crop costing in Canterbury.
IRRIGATION FOR INTENSIFYING MIXED CROP FARMING

Mr J. R. Cocks, Farmer, Ashburton.

It is interesting to recall that twelve years ago I sat at this Conference while several farmers related their experience of spray irrigation, and referred confidently to its value in the future. Later in that year I bought my first irrigation plant. At that time there would not be many more than half a dozen irrigation plants in the area in which I farm. Today there are more than 60, as well as some surface irrigation.

My paper this morning is simply a story of what we have done in the intervening years, and why we have done it. I will give you a few brief details of our farm, our programme, and our irrigation equipment; tell you something of the use we have made of it, and the benefits we have had from its use; and at the same time make a few comments on the broader issues that are involved if irrigation is to play its full part in the intensification of farming in the future.

I have been irrigating now for 12 years a 400-acre property in Eiffelton, Mid-Canterbury, comprising 220 acres of heavy land, and 180 acres of light to medium land three miles away. Three years ago we purchased additional land and at the same time a second irrigation plant. At the beginning of this past season we purchased a third irrigation plant.

We are now farming approximately 1100 acres of land in several separate blocks.

Our basic aim with our farm programme is to have 50 per cent of the land in arable crops, 30 per cent in seed production and 20 per cent in grass, stocked at 10 ewe equivalents per acre; this rate being achieved with some irrigation and some fairly late closing of seed areas.

This season, on an effective acreage of 1060 acres we harvested 353 acres of wheat, 188 acres of barley and linseed, 219 acres of ryegrass, 36 acres of cocksfoot, and 41 acres of timothy, leaving 223 acres in grass. Of this remaining acreage 16 acres were shut for white clover in late December and 60 acres intended for spring crop next year were ploughed for turnips at the same time.

The property wintered 2,200 ewes, mainly Border-Romneys and 875 ewe hoggets. We breed our own replacements.

Our labour force is one man to 200 acres and in addition we employ two students at harvest time. Our average rainfall is 28 inches to 30 inches.

Each irrigation plant is a direct-coupled diesel unit capable of delivering upwards of two cusecs of water. Each plant comprises 2000ft of 20ft pipes, mainly 5-inch, operating 30 to 45 sprinklers at 40ft intervals.
Our average pumping rate is approximately 600 gallons per minute pumping mainly from creeks. There are two wells on the light land block but their output is not always reliable.

We apply three or four inches at each irrigation, moving the plant an average 70 ft. This usually involves three shifts per day of four to five hours duration with a coverage of approximately two acres per shift.

We have coverage of almost the entire property at a capital cost of $16 per acre.

This has involved some diversion of existing creeks to give better reticulation, some realignment, and in some cases permanent removal of fences to improve design; so that the entire physical layout, the planning of crop rotations, and every management decision that is made, hinges round the use of the irrigation plants.

Our soil types range from Lowcliffe stony silt loam, to Waterton shallow silt loam, to some Wakanui soils and some Waimairi shallow peat loam. A big proportion of the land is extensively pipe drained.

Our Government valuation ranges from $120 per acre on the lighter block to $250 per acre on the best land with an average of $200.

I give these figures because I hope in this paper to illustrate my belief that an investment of say $20 or even $40 per acre in irrigation equipment will show a much greater return than investment in additional land, and is a relatively small outlay to safeguard an original investment. Because our resources of land can not be increased I feel that we must look to such means as irrigation if we are to further intensify our production.

**USAGE**

For the past 10 years the original plant has averaged 825 hours pumping per year applying three to four inches of water to 300 acres but as we have learnt the value of irrigation, we are making greater use of it each year. We have now reached the stage where irrigation is a routine practice, and the more the rain helps us, the better we like it.

In the following table I have set out the programme carried out in the past two seasons.

**FARM PROGRAMME 1967-68**

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<tr>
<th>Crop</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>353</td>
</tr>
<tr>
<td>Barley and linseed</td>
<td>188</td>
</tr>
<tr>
<td>Ryegrass</td>
<td>219</td>
</tr>
<tr>
<td>Cocksfoot</td>
<td>36</td>
</tr>
<tr>
<td>Timothy</td>
<td>41</td>
</tr>
<tr>
<td>White clover</td>
<td>16</td>
</tr>
<tr>
<td>Grass</td>
<td>207</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1060</strong></td>
</tr>
</tbody>
</table>
### Irrigation Programme

<table>
<thead>
<tr>
<th></th>
<th>1967-68</th>
<th>1966-67</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spring</strong> (up to Dec. 25)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small seeds</td>
<td>293</td>
<td>113</td>
</tr>
<tr>
<td>Spring crop</td>
<td>188</td>
<td>155</td>
</tr>
<tr>
<td>Wheat</td>
<td>95</td>
<td>109</td>
</tr>
<tr>
<td>Grass</td>
<td>220 (+ 99) (twice)</td>
<td>143 (+ 20) (twice)</td>
</tr>
<tr>
<td><strong>Total for season</strong></td>
<td>895</td>
<td>540</td>
</tr>
</tbody>
</table>

**Summer Grass** (Dec. 20-Jan. 15) 55

**Autumn**

<table>
<thead>
<tr>
<th>Bare ground (Newly sown areas)</th>
<th>10in rain between Jan. 15</th>
<th>84</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fallow</td>
<td>12th, between Jan. 15</td>
<td>33</td>
</tr>
<tr>
<td>Autumn saved pasture</td>
<td></td>
<td>88</td>
</tr>
<tr>
<td><strong>Total for season</strong></td>
<td></td>
<td>983</td>
</tr>
</tbody>
</table>

I would point out here that in both these seasons good spring rainfall was experienced.

The irrigation season begins on the grass paddocks towards the end of September, and we are able to water all the grass acreage before moving onto the small seed areas in October. This usually ensures our carrying capacity until weaning. As we come into November we move on to the wheat and spring crop as well as more seeds and some grass. November is a key month, and the period of peak demand. In December we are watering later spring crop, such seeds as timothy, and usually more grass during this peak stocking period.

This programme gives us a good spread of work over a practically continuous 12-week period, and I would stress the point that on a mixed cropping farm it is the carrying capacity and production achieved during this vital 12-week period that largely determines the income for the year.

### Benefits

What benefits have we had from irrigation?

1. Higher average yields.

   With irrigation we have raised the average yield of all crops grown.

   Our average barley yield over the past three years (in fact for the past eight years) has been 79 bushels per acre and linseed 23 cwt. On the light land block our average yield in five seasons of irrigating wheat has been 68 bushels per acre.

   When you realise that to pay for one irrigation it takes approximately 1½ bushels of wheat, 2½ bushels of barley, 2 of a cwt of linseed, 2 bushels of peas or 2 bushels of ryegrass seed, the scope for
profitable yield increases can be readily seen. In fact I cannot over-emphasise the value of higher average yields in achieving maximum net profit. A 25 per cent increase in yield can mean a 100 per cent increase in profit, and in many instances this sort of increase is not difficult to obtain with an irrigation plant.

Furthermore, as competition to grow various crops intensifies, the farmer who can grow consistently high yields will stay in the business while his counterpart is forced to turn to other avenues of production.

2. Different programme possible.
Not only have we been able to achieve higher yields, but irrigation has enabled us to adopt an entirely different system of management and crop rotations and enabled us to grow larger areas of top-paying crops.

On 50 per cent of the land we farm the programme I have outlined would be entirely possible without irrigation—many farmers are doing more—but on the other 50 per cent such a programme would be far too vulnerable to failure and completely out of the question.

Because irrigation has made it possible to produce consistent yields, and I stress the word consistent, we have been able to adopt our present programme with confidence. Even on the light land block, much of which is subterranean clover country, we have been through two cycles of this programme using nitrogen only on the seed crop, and yields are as good or better than ever.

3. Faster rate of fertility build-up.
In this connection I believe that the fact we have been able to water our grazing area and stock it heavily has increased the rate of fertility build-up, enabling us to shorten our grass break and maintain a higher ratio of crop to grass.

The fact that we farm in an area where white clover yields are somewhat variable and peas are not always reliable, has precluded us from adopting some of the more enlightened rotations in vogue at the present time, and tended to make us rely on other forms of seed production plus a heavily stocked grass break to build fertility and maintain a balance with our cereal acreage.

4. Full benefit from nitrogen.
We obtain full value for every cent we spend on nitrogen. In the past, this was not always the case particularly on the light land in a dry year. Now we use it with certainty, and our usage is increasing.

Nitrogen is used on all seed crops and our experiments over the past three years suggest that we will probably make greater use of it on cereals in future. For instance this season a third crop of wheat which was grazed in the spring and received 1cwt of urea, yielded close to 80 bushels per acre. However, we have much to learn, and there are plenty of pitfalls for beginners. An acre of linseed drilled with a mixture of superphosphate and urea failed to come up at all!
Application of nitrogen through our irrigation plants is another use of irrigation with which we intend to experiment further this season.

I also feel that there is a profitable place for the use of nitrogen on our grass paddocks, at the period of peak demand.

I would like to say that I consider that the two key factors in attaining really high production in Canterbury are water and nitrogen, whether per medium of clover pasture or out of the bag, and this whole field warrants further research work being carried out.

In this connection I feel that some thought should be given to breeding varieties, particularly wheat, for this type of situation, as well as further testing our existing varieties under these conditions.

5. Later closing of seeds.

We can close our small seeds paddocks later with absolute confidence. For example, this year on a paddock of Manawa ryegrass sown immediately following three white straw crops, and stocked with the aged ewes, we drafted all the ewes and 75 per cent of the early August lambs before closing for seed in early November. The crop which was irrigated and received 1cwt of urea yielded 65 bushels of seed per acre.

We harvested one paddock of timothy for five consecutive seasons and drafted two-thirds of the lambs and the ewes before closing for seed each year. The same technique applies equally to white clover seed production.


We have also been able to plough a proportion of our spring crop ground as late as October or even November. Last season we ploughed one paddock on October 27th after the lambs were drafted and weaned, and drilled linseed two weeks later. The crop yielded 22cwt per acre with the aid of one irrigation.

This season we rotary-hoed one paddock in mid-November and drilled barley on November 30th which yielded 70 bushels per acre also with one irrigation.

7. Establishment guaranteed.

We can guarantee establishment. This applies in several ways. In one dry season, a single watering of barley undersown with cocksfoot seed both lifted barley yields and saved the cocksfoot from dying.

Reliable establishment of seeds after crop on our peaty loam was a serious problem. It is no longer a problem.

Usually we water the ground thoroughly, work the paddock again, and then drill, but on the lighter land we often drill and then water.

Moderate, but consistent crops of turnips have been grown with ryegrass seed established in this way, immediately following a grain crop.

8. Autumn saved pasture assured.

Watering our seeds has given us more autumn feed and better clover content in the resultant pasture, particularly when these paddocks are watered again after harvest. This also ensures ample flushing feed for early tupping. Being able to ensure a consistent
volume of A.S.P. is a considerable management advantage. If it were not for the unsatisfactory winter conditions on much of our land we could probably eliminate root crops entirely.


However, irrigation has allowed us to grow reliable root crops on some of the lighter ground intended for spring crop the following year after a very short fallow, thus enabling the winter feed crops to be grown while also obtaining a full cash return from all paddocks each year.

The reliability of these two factors has eliminated the need to maintain expensive hay reserves as a buffer to high stocking.


On the other hand, if hay is needed we are able to produce a given quantity from a limited area with complete assurance. There is also scope for producing some of this from irrigated grass paddocks in January and February when the ewes are grazing stubble paddocks and newly harvested seed areas.

11. Different stock policy possible.

Irrigation has enabled us to adopt a self-contained mixed farming system which does not involve destocking at critical times on to markets that are sometimes depressed. Because we can assure our pre-Christmas stocking rate we are able to maintain a breeding policy, thus, we think, improving the quality of our stock.

The knowledge that we can always feed our stock to the level we desire has a wonderful effect on our peace of mind.

This state of mind is further enhanced by our ability to make management decisions we would not otherwise have made even though we do not always have to use the plant.

12. Consistency.

Many of the management practices I have described were not consistently possible without irrigation, and again I stress the words consistently possible. It is this consistency, this ability to maintain a constant volume of production that is so valuable in farm planning, farm budgeting, and in retaining the confidence of your bank manager. We have been able to eliminate most of the weak spots, and the points at which the management of an intensive mixed cropping programme is subject to break-down.

However, please do not imagine that this has all been plain sailing.

People who wade through crops in high gumboots carrying irrigation pipes at 6 a.m. in the morning are often regarded as "nut-cases," and there is possibly justification for this view, even if the ranks of the "nut-cases" are steadily increasing.

There are also times when irrigation plants can indulge in all sorts of tantrums. In fact, my wife considers that an irrigation plant offers a greater variety of excuses as to why we are late for meals than anything else on the farm.

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We have made many mistakes, and will no doubt make many more. These have mainly been watering too late or not watering when we should have watered. But it has all been well worthwhile. We have achieved greater financial security, and certainly greater peace of mind.

COST

Well, what of costs and returns?

Since we started irrigating we have kept a full record of our costs. I have outlined a typical season’s programme for one of our irrigation plants servicing 350 acres, together with a budget of expenditure.

**PROGRAMME**

<table>
<thead>
<tr>
<th>Spring</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>50% grain</td>
<td>175 grain</td>
</tr>
<tr>
<td>30% seeds</td>
<td>105 seeds</td>
</tr>
<tr>
<td>20% grass</td>
<td>70 grass</td>
</tr>
<tr>
<td>Plus 130 acres twice</td>
<td>130</td>
</tr>
</tbody>
</table>

350

<table>
<thead>
<tr>
<th>Autumn</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 acres autumn saved pasture</td>
<td></td>
</tr>
<tr>
<td>30 acres fallow or newly sown</td>
<td></td>
</tr>
<tr>
<td>20 acres turnips</td>
<td></td>
</tr>
</tbody>
</table>

Total for season 630 acres

Allowing for rain doing some of it for us:

470 acres at 21 hours per acre, say 1050 hours.

(4½ hour runs covering two acres per setting, pumping 600 gallons per minute applying 3½ins of water per acre).

1050 hours per year at $1 per hour pumping 1600 inches at 66c per inch.

= $1050.

= $3 per acre.

A farm of this nature requires two men, and I suggest that two men sharing the work can carry out a very remunerative programme on a mixed farm without difficulty; certainly there is no more productive work that they could be engaged in.

The figure of 66c per acre-inch includes depreciation, overtime and truck running, and tractor shifting between paddocks. The actual running cost for fuel and repairs is approximately half this figure.
RETURNS

Finally, what has this been worth?

I consider that irrigation has raised our gross returns by at least $10 per acre over the whole farm, even though we have not irrigated all the farm, and that we have shown substantial returns on the capital invested in irrigation equipment.

I would emphasise that this can only be an estimate, but it is an estimate based on 12 years' observation and experience and I honestly believe that it is very close to the mark.

I make this statement simply because I believe that the economic value of irrigation to mixed farming must receive recognition.

I would also point out that these results, and the whole design and lay-out depend on the provision and the use of a given quantity of water in relation to a given area of land. If costs are to be kept to economic levels four factors are vital.

1. Adequate water—a cusec per 100-150 acres.
2. Good design.
3. Effective utilization.
4. Sound management.

I believe that reticulation schemes for irrigating our better class soils in Canterbury by both spraying and surface methods are sound and practical, and we should be working towards this goal.

RELATIVE MERITS OF SPRAY AND SURFACE METHODS IN MIXED FARMING.

At this stage I would like to comment briefly on the relative merits of both types of irrigation in a mixed farming system.

It is my firm belief that there is a definite place for surface irrigation on good cropping land, and without doubt we will see much more of this in the future. Its principal advantage at present is that it is an easier method of application.

In many instances, because of topography and other factors both types may well be desirable on the same farm.

I also believe that spray irrigation can be profitably used on any soil type in Canterbury.

A decision as to which type to use will depend on soil type, topography, and the programme that is decided on.

I would like to point out that intensive arable farming involves proper mechanization. There is a trend to bigger and faster machinery. Speed and timeliness of operation are important factors.

In the type of programme I have outlined today each paddock is being harvested four years out of five. Three-quarters of the farm is being ploughed, cultivated and sown annually. Seed residues have to be cleared from 30 per cent of the farm by baling or sweeping. On average the whole farm is top-dressed at least once each year. Extensive crop spraying is necessary and constant boom height is important. One quarter of the farm is being sown down after harvest, and speed is imperative. If weeds such as couch are to be effectively controlled the remaining stubble ground must also be cultivated as quickly as possible and cross-working is essential.
Level paddocks are a tremendous advantage in keeping speed up and costs down.

I feel that the inconvenience and extra cost of carrying out all these operations over border-dyked paddocks, no matter how flat the border, could outweigh many of the advantages of surface irrigation. Furthermore when the cost of re-bordering is taken into consideration even with only one thorough re-bordering when the paddock is sown to grass at the end of the cropping cycle, spray irrigation could well be the cheaper method. Not only that, but a full return is received and full production achieved in the first year of operation.

I mention all these factors because there is a need for them to be thoroughly examined if the future use of our water supplies in Canterbury is to be properly planned.

I would like to leave one final thought with you.

I am convinced that irrigation as an adjunct to a mixed farming system has tremendous potential, both now and in the future. We have only scratched the surface of what can be accomplished.

If we are going to maintain our living standards and provide for an increasing population, our limited area of arable land will have to produce considerably more in the future. The demand for water and the value of water in our farming will increase accordingly.

I believe that now is the time to be considering further some of the matters we have been discussing today, so that in planning for the future, capital spent on irrigation by both the farmer and the nation can be spent to best advantage.
HOW TO AVOID ACCIDENTS ON THE FARM

Mr G. V. Williams, Extension Officer, National Safety Association.

By its very nature, agriculture is a dangerous industry. On any farm in New Zealand there are more hazards to be faced than in secondary industry. A farmer and his family have to work in all weathers, in all types of country, for long hours; they have to drive tractors, implements and vehicles; they use hand tools and machinery; on their property are poisons and chemicals, firearms and explosives, electricity and animals, rivers and dams.

The accident record on the land in this country is a bad one. An average of sixty persons has died in accidents on New Zealand’s farms since 1949, when detailed statistics were first kept, and the total in these nineteen years is now 1115, including 386 children under the age of fifteen years.

They died in the following types of accidents:

- Tractors: 464
- Drowning: 206
- Machinery: 99
- Animals: 77
- Firearms: 74
- Fire and chemicals: 71
- Electricity: 33
- Trees: 27
- Miscellaneous: 64

1115

This, of course, is not the whole story. Besides these deaths thousands of farmers and their employees have suffered serious injury during that period. Accurate numbers are impossible to estimate, but in one year 1522 farm accident cases were admitted to hospital, including 205 caused by tractors and 215 by other machinery and implements. The year before there were 1499 admissions. Every year something like 400,000 days of work are lost by farm employees insured under the Workers’ Compensation Act. This time does not include that lost by farmers themselves and most of their families who do not receive compensation under the Act. Lost-time accidents to farm workers cost, on the average, $100 to $120 per accident.

ECONOMIC EVIL

These figures alone show that accidents and injuries to the farming population of this country pose a problem which must be solved. It is an economic evil, a shocking and wasteful drain on the economy of an industry which, in these times of lower incomes due to fallen prices, is already faced with serious difficulties.

Accident prevention in New Zealand’s secondary industries, by enforcement and education, is meeting with significant success. Management and labour, gradually awakened to the seriousness of the problem, have responded magnificently to the efforts being made by Government Departments and the National Safety Association to
reduce the accident rate, which in 1966, fell to the lowest level since 1952. (The figures for last year are not yet available.) The rate in 1966 was 3.34 lost-time accidents for every 100,000 man-hours worked in industry. In 1959 it was 3.89.

The accident rate in the agricultural industry in 1959 was 2.76 and in 1966 it was 3.21 an increase of 11 per cent over the previous year. The increase, however, is not as great as these figures would suggest, as over the years the Department of Statistics has twice reduced the estimated number of weekly hours worked by the farming community, and one accident based on a 50-hour week gives a higher frequency rate than one based on a 60-hour week. It must be confessed, however, that, in spite of this mitigating factor, little real progress has been made in reducing the accident rate on farms over the past nine or ten years. There is a reason for this which will be discussed later. Another point is that the rate of accidents in agriculture is lower than the rate of all industry combined. In other words there are considerably more hazardous industries than farming—quarrying, mining, forestry and construction to name several.

But there is an important factor to remember. In industry the great bulk of injuries occur to workers, not to management. Agriculture does not employ labour to nearly the same extent, with the result that the injuries are, for the most part, suffered by farmers themselves, their wives and their families. As an example: between 1957 and 1966 there were 297 deaths due to accidents involving tractors, of this total 183 or 65 per cent were farmers, their wives or their children.

The death or permanent disablement of a farmer can have a serious effect on the future of that family; it can mean, and it has, that the property has to be sold because there is no one left in the family to work it. Severe injury, resulting in a long time off work, can cause serious loss of income because of disrupted schedules.

THE TRACTOR PROBLEM

A glance at the causes of accidents shows that tractors are the biggest killers on our farms. Since 1949, just over 40 per cent of all fatalities have been due to these implements and of the 464 persons killed sixty of them have been children under the age of fifteen and sixty-seven have been under twenty-one.

The campaign for the compulsory fitting of safety frames to agricultural tractors, culminating in proposed legislation to take effect in 1970, has drawn the attention of the farming community to this method of saving the lives of the drivers. As with car seat belts, there must always be argument whether they will perform the task for which they are designed. It has been said they may cause more accidents because tractor drivers will tend to take their machines on to steeper slopes and that the frame itself may kill the driver.

In the first place it has to be made quite clear that a safety frame will not stop a tractor accident, although it probably will prevent the tractor rolling more than ninety degrees, and the vast majority of deaths have been caused by machines which roll 180 degrees or more. A safety frame is a piece of protective equipment, like the safety helmet and safety spectacles, which are designed to protect workers from injury when an accident occurs.
This is exactly the same with car seat belts, of which it has been said they would encourage greater speed and they could trap the driver and cause his death. It can be stated categorically that there is no evidence that motorists with seat belts are travelling any faster because of them. Nor is there any evidence that drivers and passengers have been killed because they were wearing seat belts. There have been instances where motorists wearing belts have died of broken necks, but they would have probably been killed anyway. On the other hand there is plenty of evidence to prove that seat belts have saved the lives of persons involved in car accidents.

A close survey of rolling tractors has been made by Mr C. J. Crosbie, of the Department of Agriculture. After studying carefully 198 applicable accidents out of a total of 240 in eight years, he has given the considered opinion that 127 lives would have been saved, 53 could possibly have been saved, and 18 would most certainly have died.

In the face of this evidence by an expert whose sincerity cannot be questioned it would be difficult for anyone to state flatly that safety frames would cause more deaths. Already the National Safety Association has collected evidence which shows as conclusively as possible that at least twelve lives have been saved because the operators were driving tractors fitted with frames.

One man has died in a frame-fitted tractor. It was a home-made frame, which collapsed when the tractor rolled. This surely justifies the regulation that all tractor frames must first meet the required tests by the Agricultural Engineering Institute at Lincoln College and be certified by the Department of Labour.

CHILD DEATHS

A particularly sad aspect of the toll of death on New Zealand farms is that of the total of 1115 since 1949, 386 of them have been children under the age of fifteen years. Drowning heads the list of killers of youngsters, 172 of the total of 206 under this heading being children. Water is the biggest hazard to them on any farm and it is found in rivers and streams, sheep dips and stock troughs, races, ditches, dams and tanks and more recently swimming pools. Many of these hazards cannot be guarded in any way but many of them can and should be. A study of drowning cases over the past nineteen years shows that at least eighty lives would have been saved had some elementary precautions been taken for the safety of the children involved.

Tractor accidents have taken the lives of sixty children since 1949. A law passed in 1960 makes it an offence for a child under the age of twelve to drive a tractor, to ride on a tractor drawing an implement or to ride on an implement unless it is designed principally for the carriage of goods or persons. It is obvious the law is being flouted up and down the country. Each year since 1960 children have been killed in circumstances which prove that statement. There can be no other answer to this problem—children should not be allowed on tractors.
Forty-five of the sixty tractor deaths have been of children under the age of ten and many of them were on the machine itself when the accident occurred. It has been said by some members of the farming community that their children have to learn to drive tractors someday and that by playing on them and generally becoming familiar with their controls they are gaining valuable experience. It is perhaps unfortunate that a person does not require a driving licence to operate a tractor on a farm. If he did then children would have to be properly taught to drive these lethal machines. Even although a boy of thirteen or fourteen may be a good driver, as many of them are, it is extremely doubtful if they have the experience or the maturity to meet a crisis when it occurs. Far too often the first crisis means a fatal accident.

By far the most pitiful aspect of these child deaths is the age of the victims. Three hundred and eighty-six children have been killed in nineteen years and two hundred and sixty-seven of them have been under the age of five years. The four main headings under which these fatalities occurred—drownings, tractors, machinery and burns and chemicals—have produced three hundred and twelve deaths and two hundred and thirty-nine or seventy-seven per cent, have been under the age of five.

Practically the whole answer to this farming problem lies, therefore, in the protection of the pre-school age child, but in spite of the efforts being made to educate the farming community little success is being achieved. It has to be remembered that young children are not aware of many of the dangers which surround them; they do not realise that to play on a tractor can be a fatal thing to do. We have, therefore, to look at hazards through the eyes of children, to be aware of the fact that what will not hurt us may kill or severely injure a child.

IMPOR TANCE OF SUPERVISION

Experience in New Zealand and all over the world has shown that where supervision is good and close, the prevention of accidents is not a difficult task; where it is loose or non-existent it is not so easy. The supervisor is the key man in industry so far as accident prevention is concerned. But in the homes, on the roads, and on the farms there is no close supervision and therefore, accidents are harder to prevent. A farmer or his employee on a tractor in the middle of a twenty-acre paddock is on his own; he has no supervision. He has, therefore, to think for himself; to cultivate the art of working safely at all times; to realise that something he may do, or something he may not do, can cause an accident; that everywhere on any farm are hazards, obvious or hidden, which can cause him injury or even death.

This may seem to many to be an impossible task, but it can be done, and is being done in industry and on some farms. Hazards can be removed—before an accident, not afterwards. Good housekeeping is just as important, and just as easy to obtain, on a farm as it is in a factory.

Farmers owe it to themselves, their wives and their children, to tackle this problem now.
POSSIBILITIES IN FROZEN PEAS AND BEANS

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

The recent drop in prices received for wool and meat has resulted in greater interest in diversification of our farming in New Zealand. One suggestion is to expand cropping in New Zealand, and in particular, to introduce new crops. If an increase in cropping is to occur then from a national point of view it should be in those crops which have an export potential. Unfortunately many of our major crops—wheat, barley and oats for example, are grown for local consumption and have little or no export future. However, processed vegetables are one group of crops which are likely to have a considerable future. New Zealand has a combination of climate and soil which is ideally suited to the efficient production of a wide range of vegetable crops. By far the most important crop in the processed vegetable industry at present is green peas, with green beans increasing rapidly.

There has been a spectacular increase in the pea and bean industry in recent years, particularly in frozen products. In the early 1950s only a token amount of frozen vegetables was produced, but today it is the major part of the processing industry. Table 1 lists the present areas and production of green peas in New Zealand.

<table>
<thead>
<tr>
<th>Area (Average 1962-66):</th>
<th>11,600 acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Districts, 1965-66:</td>
<td></td>
</tr>
<tr>
<td>Hawke's Bay</td>
<td>59.5%</td>
</tr>
<tr>
<td>Canterbury</td>
<td>15.1</td>
</tr>
<tr>
<td>Nelson</td>
<td>8.2</td>
</tr>
<tr>
<td>Marlborough</td>
<td>7.3</td>
</tr>
<tr>
<td>East Coast</td>
<td>7.0</td>
</tr>
<tr>
<td>Wellington</td>
<td>2.7</td>
</tr>
</tbody>
</table>

Production (Average 1962-66) (Canned and Frozen) 16,300 tons

In the period 1962-66 the area of peas has remained fairly constant at between eleven and twelve thousand acres. Hawke's Bay is the main producer although the acreage in Canterbury is increasing. The majority of the peas are frozen, and canned pea production is tending to decline. Green bean production has increased rapidly from just over 3,000 tons in 1962 to nearly 6,000 tons in 1967. Export markets in Australia, England and South East Asia have been developed over the last decade, but over 75 per cent of our pea and bean production is still used locally.

Frozen vegetables have been accepted rapidly by the New Zealand consumer. The consumption during the 1962-1965 period averaged nearly 11 pounds per head annually, with frozen peas and beans predominating. In fact New Zealand is almost certainly the world's leading consumer of frozen peas and beans per person, and probably also of total frozen vegetables per person. Table 2 lists the consumption of frozen peas and beans in New Zealand, Australia, United States and Great Britain.
Table 2. Annual Consumption of Frozen Peas and Beans (pounds/person)

<table>
<thead>
<tr>
<th></th>
<th>Peas</th>
<th>Beans</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Zealand (average 1962-66)</td>
<td>7.9</td>
<td>1.3</td>
</tr>
<tr>
<td>Australia (1965)</td>
<td>5.0</td>
<td>0.8</td>
</tr>
<tr>
<td>United States (1965)</td>
<td>1.9</td>
<td>0.8</td>
</tr>
<tr>
<td>Great Britain (1964)</td>
<td>2.4</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Annual consumption of frozen peas in New Zealand although much higher than the other countries listed, seems to have levelled off at about 8lbs per person, although frozen bean consumption is still tending to rise.

Processed peas have become a popular crop with farmers and contracts are eagerly sought. The monetary return is high and can be added to by sale of pea hay. Peas do not impoverish the soil and improve soil structure. They are in the ground for only three and a half to four months and are harvested in early summer, thus giving the farmer an excellent opportunity to grow an autumn crop, establish new grass or cultivate for twitch control in the dry summer weather. For example, the inclusion of freezing peas in the cropping rotation on the Lincoln College mixed cropping farm has enabled the growing of two cash crops and a forage crop in 18 months. Freezing peas are sown in September and harvested in early January. This is followed by greenfeed or soft turnips sown in late January and utilised in April, May and early June. Wheat is sown in June and harvested in the following summer.

The area of processed peas and beans will need to be expanded if export markets are developed. Additional areas suited to processed legume crops are limited in Hawke's Bay, Gisborne, Blenheim and Nelson. Potential exists in the Auckland Province, particularly for green bean production; but Canterbury undoubtedly has the greatest potential for expansion of pea growing. The climate is favourable and there is a large area of suitable soils. (See Table 3.)

Table 3. Canterbury Soils Suited to Processed Pea Growing

1. Variable moisture, droughty in some seasons

<table>
<thead>
<tr>
<th></th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Templeton</td>
<td>151,000</td>
</tr>
<tr>
<td>Waimakariri</td>
<td>111,000</td>
</tr>
<tr>
<td>Barrhill</td>
<td>24,000</td>
</tr>
<tr>
<td>Highbank, Lyndhurst</td>
<td>48,000</td>
</tr>
<tr>
<td></td>
<td>334,000</td>
</tr>
</tbody>
</table>

2. Moist soils, well drained

<table>
<thead>
<tr>
<th></th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wakanui</td>
<td>92,000</td>
</tr>
<tr>
<td>Mayfield</td>
<td>72,000</td>
</tr>
<tr>
<td>Kowai</td>
<td>21,000</td>
</tr>
<tr>
<td>Kniaiapo</td>
<td>28,000</td>
</tr>
<tr>
<td>Willowbridge</td>
<td>16,000</td>
</tr>
<tr>
<td></td>
<td>229,000</td>
</tr>
</tbody>
</table>

91
3. **Moist soils, gleyed, relatively poorly drained**

<table>
<thead>
<tr>
<th>Soil Name</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temuka</td>
<td>96,000</td>
</tr>
<tr>
<td>Tai Tapu</td>
<td>38,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>134,000</strong></td>
</tr>
</tbody>
</table>

4. **Rolling downlands**

<table>
<thead>
<tr>
<th>Soil Name</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timaru</td>
<td>74,000</td>
</tr>
<tr>
<td>Claremont</td>
<td>117,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>191,000</strong></td>
</tr>
</tbody>
</table>

| Total acres | 888,000 |

The Wakanui-Mayfield group of soils are the most suited to processed pea growing. They are deep, fertile, well drained and with a fairly reliable moisture supply during the growing season. The Templeton-Waimakariri group show greater moisture fluctuations and yields of peas may be low in dry seasons. Irrigation is likely to be extremely valuable on these soils. Temuka and Tai Tapu soils, although very fertile and well supplied with moisture, are heavy and relatively poorly drained. Consequently peas cannot be sown early in the spring and yields may be reduced by excessively wet conditions if heavy rains fall during the growing season. Peas may also be grown successfully on Timaru and Claremont soils of the rolling downlands where topography permits. If irrigation were available pea growing could be extended to the lighter Eyre-Paparua, Chertsey and Hatfield soils.

In 1967, the area of processed peas in Canterbury was just over 3,000 acres. If peas were included in cropping rotations only once in eight years sufficient suitable soils are available to grow over 100,000 acres in the future.

Further expansion of the processed pea and bean industry in New Zealand depends primarily on the development of overseas markets. First, let us look at Australia. Until recently, a tariff of 10c a pound greatly restricted the quantity of peas and beans entering from New Zealand. Under the Free Trade Agreement, however, this tariff is being progressively reduced and will disappear completely in 1973. In addition, devaluation has placed New Zealand in a much more competitive position than it was previously.

Against this must be balanced the spectacular increase of the frozen vegetable industry in Australia itself. Production is geared primarily to supplying the expanding domestic market, and in 1966 67,000 acres of peas and 17,000 acres of beans were grown. Imports into Australia as a percentage of apparent frozen vegetable consumption have declined steadily from 30 per cent in 1961 to less than 5 per cent in 1967. The available evidence suggests that at present, frozen vegetables are imported by Australia mainly because of seasonal drops in local production and not because of price or quality advantage of the overseas product. As the growing season for peas in New Zealand coincides with that for Australia, it is impractical for New Zealand processors to arrange for additional acreages to be grown when it becomes known that Australian production will be light and imports required.
Therefore, if New Zealand is to expand its market in Australia, it is likely to be in direct competition with the Australian product. Both price and quality advantage must therefore be obtained. Devaluation and tariff removal may assist considerably in creating a price advantage but other comparative advantages will need to be exploited. For example, the pea processing season in Australia is considerably shorter in all states except Tasmania than it is in New Zealand and yields are more variable from year to year. New Zealand processing factories should therefore have an advantage in lower overheads and more efficient planning. In addition long distances between field and factory, coupled with high temperatures at harvesting cause considerable problems in maintaining pea quality in Australia. This problem is much less in New Zealand.

The average Australian eats only 5lbs of frozen peas each year as compared with the average New Zealander's 8lbs. This would suggest that there is still a large potential market in Australia which could be developed by well-planned advertising and selling.

South East Asia is another potential market for New Zealand peas and beans. Already a small but increasing export trade is developing to Singapore and Malaya. In Japan, frozen vegetables are little-used at present, but a very large market may eventually develop as industry expands, the standard of living rises and more families own refrigerators and buy their vegetables instead of growing them.

New Zealand exports frozen peas to Great Britain in some years but exports possibilities seem to be less there than in Australia or South-East Asia. Supplies from New Zealand are sought only when the British crop is unsatisfactory and imports are required to meet the demand. Cost of transport to Britain is also higher than to Pacific markets.

If New Zealand is to compete effectively in overseas markets our growing, harvesting, processing and marketing techniques will need to improve and become more efficient. This means a considerable increase in research and development. New markets will not develop without a considerable effort on our own part. We have only five years to prepare for the tariff-free Australian market and certainly no longer for the South East Asian markets. In the final part of this paper then, I intend to discuss some points where research and development, mainly in agronomy, may improve the efficiency of the processed pea and bean industry.

First—Improvement in Yield

The average yield of frozen peas in the Christchurch area is about 1.6 tons per acre, although in favourable seasons (e.g. 1966-67) over two tons have been obtained. In Australia the average yield is 1.5 tons per acre, ranging from three tons in Tasmania to one ton in Victoria (1965-66). In Britain the average yield is approaching two tons per acre. The relatively low yields in Canterbury as compared with Tasmania and Britain suggest that there is considerable scope for improvement. Even with present yields however, the gross margin received from frozen peas compared favourably with that received from wheat in the Christchurch area in the 1967-68 season. (See Table 4).
Table 4. Gross Margin, Frozen Peas and Wheat, Christchurch Area 1967-68

Gross Revenue
1.6 tons at $56 per ton (Tenderometer reading 101-105) $89.60
30 bales pea hay at 45c per bale 13.50
Total $103.10

Direct Costs
- Cultivation—5 hours at $0.30 1.50
- Seed—4 bushels at $4.00 16.00
- Fertiliser—1 hundredweight at $1.12 1.12
- Cartage—seed and fertiliser 0.20
- Spraying 3.50
- Raking and baling—
  Raking $0.10
  Twine 0.75
  Baling 0.10
Total 0.95

Gross Margin for Frozen Peas $62
Gross Margin for Wheat (Aotea wheat ex peas) $76

In Table 5 are listed the effects of variation in yield and price on the gross margin from frozen peas.

Table 5. Gross Margins ($) Frozen Peas, Christchurch Area Effects of Variation in Yield and Price

<table>
<thead>
<tr>
<th>Price /ton</th>
<th>Yield—tons/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>$/ton</td>
<td>1.0</td>
</tr>
<tr>
<td>30</td>
<td>16</td>
</tr>
<tr>
<td>40</td>
<td>26</td>
</tr>
<tr>
<td>50</td>
<td>36</td>
</tr>
<tr>
<td>56*</td>
<td>42</td>
</tr>
<tr>
<td>60</td>
<td>46</td>
</tr>
</tbody>
</table>

*1967-68 price. †1967-68 average yield.

It can be seen that if yield could be raised to 2.0 tons per acre a price of between $40 and $50 per ton would return farmers the same gross margin as at present. If yields were 2.5 tons per acre the same gross margin would be received at a price between $30 and $40 per ton. An increase in yield therefore, could enable New Zealand processors to create a price advantage overseas.

The main factor limiting yield of frozen peas in Canterbury is water shortage at critical periods of crop development. Work by Salter (1963) in England showed that so long as the soil is moist at drilling, dry soil conditions up to flowering had little or no effect on
the ultimate yield of peas, although haulm growth was reduced. On the other hand irrigation at the start of flowering increased yields by over 30 per cent and further irrigation at pod swelling increased yields by 20 per cent. Irrigation offers great scope in raising yields of frozen peas on most soils in Canterbury although it is also obvious that research is required on times, rates and methods of water application under our local conditions. Water is freely available and easily tapped in Canterbury and the time is long overdue for farmers to change from irrigation of pasture to the irrigation of peas, potatoes and other vegetable crops. These crops will produce a much higher return per unit of capital invested on irrigation than will fat lambs and wool.

Diseases such as Fusarium wilt, and the aphid-transmitted viruses, mosaic and top yellows can seriously reduce yields in peas and beans in New Zealand. Crop Research Division has been actively engaged for a number of years in the production of resistant lines of the more popular pea varieties, Victory Freezer, Greenfeast and William Massey, and has already released several resistant selections for commercial use.

In Canterbury, freezing peas are normally sown in 7-inch rows at four bushels per acre. Although it is well established that 7-inch rows will give a higher yield than wider spacings, there is some evidence from overseas work that rows narrower than 7 inches may increase yields still further. It is also known that spacings closer than two inches down the row may reduce the yield of later maturing branching varieties, but may have little effect on, or even increase the yield of quick maturing varieties which show little basal branching. Research on optimum spacing for peas and beans may give the farmer worthwhile yield increases for little or no extra cost. Fertiliser requirements, particularly under irrigation, and weed control, are other agronomic factors requiring further investigation.

Although processing companies in New Zealand are already very efficient there is little doubt that new technical developments could improve their efficiency still further. For example the factory season for frozen peas in Christchurch is about 60-70 days, commencing in the first week of December. If the season could be extended by commencing operations earlier, then factory overheads could be reduced. Earlier commencement may be possible if sowings of cold-resistant pea varieties could be made in July or even in the first week of May, when field peas are often sown. May-sown peas would be ready for processing in mid-November. A problem with early sowings is the risk of bacterial blight disease, but this should not deter research in this field.

If processed pea sales are to be expanded overseas, the peas themselves must be of high quality and of good flavour. Breeding and selection for quality in peas is already being undertaken at the Crop Research Division.

A new mechanical pea harvester is being developed in U.S.A. which removes the intact pods from the vine. In Australia, C.S.I.R.O. have developed a machine which will squeeze peas out of the pod. A combination of these two machines would result in less damage than at present and therefore a higher yield of marketable peas.
Although I have been mainly discussing peas in this paper, most of my remarks apply equally well to beans. Green beans have a very great potential in New Zealand particularly in areas such as Waikato and the Bay of Plenty. Relatively cool temperatures and high wind incidence may restrict the expansion of bean growing in Canterbury although 100 acres were successfully grown in the 1967-68 season.

In conclusion, I would again point out that New Zealand has a combination of soil and climate which makes it ideally suited to the efficient production of processed peas and beans. If overseas markets are developed these crops could contribute increasingly to our exports. To do so, however, means expanded research into growing, harvesting and processing of these crops, and into their marketing overseas.

Acknowledgements

I wish to thank my colleagues, Professor B. P. Philpott (Agricultural Economics), Messrs G. A. G. Frengley and B. P. J. Ryde (Farm Management) and Mr E. J. B. Cutler (Soil Science) for their help in the preparation of this paper. I am also grateful for assistance received from Dr L. E. Watts and Mr M. J. Crampton, Crop Research Division, D.S.I.R., Lincoln; Mr W. J. Lowe, Unilever N.Z. Ltd., Christchurch; and Mr H. M. G. Daniel, Australian Government Trade Commissioner, Christchurch.

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OVERSEAS TRENDS AFFECTING NEW ZEALAND AGRICULTURE

Professor B. P. Philpott, Professor of Agricultural Economics; and Director, Agricultural Economics Research Unit, Lincoln College.

I. INTRODUCTION

My purpose in this address is to record some impressions about some agricultural economic developments overseas which I observed during my sabbatical leave tour in 1967 and which I think bear on the current economic situation and prospects in New Zealand. I should like then to briefly discuss this situation as I see it and finally make some comments and suggestions about policy.

I should warn you that my review of overseas and domestic trends is not meant to be exhaustive. I have simply selected from my experience, which was heavily concentrated on matters of agricultural trade and policy, those things which seemed to me either most important to us in New Zealand or most interesting to a public audience. In some senses then my review of overseas trends may appear to be an economic travelogue. For this I make no excuse—it is meant to be.

The main overseas trends about which I want to talk are:
2. The wool situation.
4. Lamb in North America.
5. Horticultural crop development.

II. WORLD INTERNATIONAL TRADE AND THE LIQUIDITY CRISIS

The most important and fundamental fact which must never be lost sight of in all our interpretations of overseas market developments and the market situation, is that the world economy as a whole has been going through the severest economic crisis since the 1930s. This has shown itself in a slower rate of economic growth in Europe, Britain, Japan and America and in an unprecedented retardation in the growth rate of world international trade.

In some ways this was I suppose inevitable as an emanation of the world trade cycle which has been with us for two centuries, and one is bound to say that the situation would have been far worse and could have approached the crisis proportions of the 1930s had there not been a reasonably good degree of economic management on the part of Governments reflecting the lessons that had been learnt from the 'thirties and reflecting also I hope the views of Government's economic advisers.

However in one respect Government's economic management has not been good and the advice of economists has not been taken and this has caused the trade crisis to be deeper than it otherwise needed to be. This is in the field of international monetary affairs or as it is fashionably called international liquidity. For a long time now governments have been urged in vain, to establish arrangements for the steady and controlled creation of international credit to maintain
growth in international trade. Arrangements involving the I.M.F. along these lines have only now been approved (over the stern objections of the French) and one hopes it won't be too late.

A steady expansion in international credit or international money in line with the potential growth in world trade, is just as important and indeed necessary as it is internally and which we now accept as the normal state of affairs for the proper organisation of the domestic economy. If there is more international business each year there must be more international money to finance it unless there is to be a drastic fall in prices. If there is not more money created each year then countries finding themselves short of overseas reserves, either because of the normal expansion of business or because of the inevitable fluctuations of trade, have to try to build up reserves by reducing imports and expanding exports, i.e. earning balance of payments surpluses. And it is a truism which is nonetheless often not appreciated that every country can't earn a balance of payments surplus at the same time—by definition some countries have to go into deficit. If they do not wish to do so then the universal attempt to increase exports and reduce imports is simply doomed to frustration and all that will happen is a general downturn in economic activity multiplied throughout the world.

A steady, controlled, and non-inflationary annual increase in international reserves, either given to countries or loaned to them, is therefore required to prevent this happening and in particular to allow countries the time and freedom to adjust to changes in the circumstances of international trade.

For the last 20 years or so the supply of international money has been largely in the form of gold or dollar and sterling deposits. As far as gold is concerned, its supply has been quite inadequate to meet monetary demands because its price has been kept at the same level, viz. $35 an ounce. And it is suspected that it won't be long before this will represent its true market price solely as an industrial metal. At this price it is hardly economic to mine it in many countries hence it is not surprising that its supply has slowed down. If gold is to perform its function as an international money (and I might as well say here and now that I do not believe it should) then it will have to be raised in price to about double its present value otherwise people and countries will hoard gold, not for trade purposes, but in anticipation of capital gain and its whole purpose as an international money is thereby frustrated.

The other main form of international money has been dollars, not created specifically at such, but simply through the accident of United States foreign investment, foreign aid, military spending, etc. The amount of money which the U.S.A. has spent abroad in these ways has been far greater than what she has earned in her current balance of payments.

It should be noted that it is just the accident of U.S.A. worldwide spending which has filled the gap in world money supplies and if it had not been for that the economic situation would have been far worse than in fact it already is. Nevertheless however beneficial in fact has been this flow of dollars into the reserves of central banks throughout the world, it has not been regarded as such by General de Gaulle and the court which surrounds him, who view with alarm this evidence of American domination and who instead urged a return
to a revalued gold as the basic international money. Hence the recent run on gold and the prospects of further attacks on the dollar which is of course the obverse of a run on gold.

The Americans for good or ill (and I think probably for ill) refuse to budge from a gold parity of $35 an ounce partly because they do not believe that there should be any further enthronement of gold; but also because by raising the price an unwarranted benefit would be conferred on the South Africans, the Russians, and above all the French and other speculators against the dollar. The Americans feel along with most of us that the proper route is the demonetisation of gold and the setting up of new arrangements at the I.M.F. under which credit created by that institution will eventually take over the role of gold. Such arrangements known as Special Drawing Rights (S.D.Rs.) have now been agreed to over stern opposition from the French but there are lots of hurdles to jump and a lot of time will be required before they become operative.

In the meantime, in their determination to stick to the present gold parity the Americans are doing or are going to have to do all the things we don't want, that is, deflation at home, cutting down on overseas spending and overseas investment and there is even a danger especially in an election year of a resurgence of strong protectionist forces against imports.

These actions, some of which have now occurred, while others are dangers for the future, all have a damaging effect on world trade and economic activity which as I said earlier was in any case in the middle of a cyclic downturn and if anything, required the reverse treatment. The only light one sees on the horizon is the possibility of a settlement in Vietnam which could reduce military spending abroad and thus avoid some of the need to reduce other types of spending.

I have gone into this analysis of the international trade and liquidity business in some detail as I feel it is of salient importance to us all to appreciate what is happening outside if we are to understand what is happening to some of our export prices.

Incidentally I think this is something which might also be borne in mind by those remorseless and often ignorant critics of the present British Government's handling of economic affairs which must be judged in the light of the depressed world situation in which the British economy is operating and of course also remembering that the British Government is at the same time attempting something of an economic and social revolution.

Lastly just to dispel any illusions that, in this field of international finance, it is the economists who have been at fault—let me hasten to say that the professional economic literature for twenty years has been full of warnings of the present financial crisis and full of suggested reforms mainly based on the I.M.F. Indeed in Lord Keynes' original design for the I.M.F. rejected at Bretton Woods in 1944, there were provisions for international credit creation of the type now grudgingly accepted for implementation in 1969 or 1970.

It has been the resistance to the advice of economists from European central bankers and French nationalists which has brought the situation so near to the collapse which I hope has now been averted by timely if tardy action.

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III. WOOL

In my view the slump in wool prices in 1967 is compounded of three separate influences and the severity of the slump results from the unusual conjuncture of all three factors at once.

(i) Overall Wool Economic and Trade Trends

The first and I consider the most important factor to be continually borne in mind is the general downturn in world trade about which I have just spoken. This has led to lower levels of economic activity resulting from falling exports as in Germany, which is an important crossbred wool user; plus the same thing in Britain reinforced by self-imposed deflation of a dimension unequalled since the war.

As a result of the severity of the recession in Britain, retail textile sales were in 1967 running at a level up to two per cent below 1966 and, to the best of my knowledge, this is the first time since the war when retail sales have dropped—though there have been plenty of occasions when the rate of increase has markedly slowed down. We can presume that the same thing has happened in Germany and probably other areas in West Europe. The latest British Budget of Mr Jenkins aims at continuing and indeed reinforcing this process by reducing retail consumption by one per cent in 1968 so the process is far from over yet.

There is no evidence that the fall in retail sales affected wool textiles more than other types, indeed the fall in synthetic fibre output suggests that synthetic textiles have been even more affected.

In addition there has been a marked downturn in world trade in wool textiles (reflecting a general slowing down in all exports of manufactured goods) and this has been particularly noticeable in British wool textile exports to Germany and to the U.S.A.

The fall of 20 million pounds clean in mill consumption of wool in Britain in the first nine months of 1967 compared to 1966 can be wholly accounted for by the following two influences: as to about 50 per cent by lower textile retail sales at home and the other half by lower exports.

These trends have not been confined in their effects to wool alone and we might note that there has been a general fall in all commodity prices of about 20 per cent compared with 1966. The extra severity of the price fall in wool results from two further developments which must be discussed.

ii. Synthetic Price Reductions

To some extent these were of course expected (and predicted by the I.W.S.) with the lapse of patents in the production of polyester fibre, but an additional factor, which increased the severity of the reductions, has been the textile recession mentioned above, the below-capacity working of many plants in Britain and U.S.A., and the lower level of wool prices. To the extent that the latter factor was operating we can construe the synthetic price cuts as defensive in nature—small comfort as this may be to woolgrowers. Nevertheless synthetic company profits in Britain and U.S.A. have been markedly reduced in the last two years (dramatically so in U.S.A.) and one may reasonably hope that this will lead to some slowdown in the rate of expansion in plant capacity in the future.
The rate of penetration of synthetic into traditional wool markets (steady and frightening as this appears to be) does not appear to have been markedly increased by the lower synthetic prices—indeed in the wool textile industry itself the ratio of wool to other fibres consumed has risen. The main effect of synthetic price reductions has therefore been not so much on shares of the market but on prices of wool and future synthetic price reductions will have similar effects.

That some part of the recent synthetic price reductions has been temporary in nature is indicated by the fact that in early December Courtalds raised the price of some of their fibres (with very adverse reactions from the textile trade). Nevertheless I think we can expect continued synthetic price reductions over the next decade at a rate of somewhere between one and two per cent per annum. These reductions will spring largely from increases in productivity and technical change in the industry. Wool producers will have to achieve similar increases in productivity if they are to be able to meet synthetic price reductions of this order and survive.

There is one further very worrying feature relating to synthetic fibres which must be mentioned. This is that any country facing balance of payments problems (and this seems to be most countries nowadays) must be under strong temptation to lay emphasis on the development of synthetic fibre industries using local raw materials, as a form of replacement for imports of wool. In the case of Britain this has been assisted by British devaluation—in the case of the E.E.C., U.S.A. and Japan it wouldn't surprise me if we hear talk of tariffs on wool imports naturally with strong support from synthetic fibre interests. I only hope that through our diplomatic representatives and through I.W.S. we are vigilant in our opposition and indeed our lobbying against such possible moves.

(iii) Specific Crossbred Factors

It appears that there has been occurring for some time, and likely to continue, a basic swing in consumer demand away from coarser, heavier textiles made from crossbred wool and a move towards softer, lighter materials. Nevertheless there is no evidence that in 1966-67 there was any acceleration of this trend and as far as Britain is concerned the statistics support this view—if anything mill consumption of Merino fell more than crossbred. It would be wrong therefore to think and talk too much about a specific crossbred slump.

One factor which has however contributed to the severity of the crossbred decline is the carpet situation. There has, it appears from the statistics, been some penetration of synthetic into the carpet market in Britain and the U.S.A. But here again in the carpet industry we need to take account of general economic trends to which carpet sales are very responsive and which have led to lower levels of total carpet production. In the U.S.A. in particular, sales of new carpets are very closely related to the rate of new house building and this has been depressed for some time due to the high level of interest rates and extreme tightness in the U.S.A. mortgage market. These conditions have applied in spite of a general upturn in U.S.A. busi-
ness activity in 1967 and in mid-1967 new house building was running no less than seven per cent below the 1965 levels with consequent effects on total carpet sales, even apart from any differential effect on wool carpets.

This particular conjunction of wool market factors, as I have described them, has produced one of the worst wool slumps in our history, what then of the future?

Well, some of the factors at work are by their nature reversible, just as they were eventually in the 1930s and, let's face it, there are very great similarities in nature if not in degree between the present situation and the great depression of 1930.

In the first place there will eventually be a resumption in world economic growth and in high levels of international trade. This is not going to come quickly and a lot will depend on the speed and success which attaches to the introduction of the new international monetary measures I discussed earlier. A faster growth rate is predicted for 1968 for most of the developed economics especially the countries of Europe but some of these predictions may now be somewhat upset by the unexpected success of the United States' President in getting his new tax bill through Congress and the effect this may have on other economies. In the long run however a resumption of steady world economic growth must emerge.

Further, to the extent that erosion by synthetic fibres of the crossbred carpet wool market followed the boom prices of 1964 then the low prices of 1967 ought to provide the spring-board for counter attack. From our own research studies at Lincoln we know that the price elasticity of demand for carpet wool in the U.S.A. is high and recent statistics from America give encouragement to the view that mill consumption of carpet wool is at long last on the increase. This has no doubt been assisted by some new technological developments in the use of carpet wools but price above all has been the important factor.

The recovery of wool values which I have always been sure would come and which has been cautiously under way this last few months, will however be a slow process; I don't think we will see a return to pre-1966 wool values though I see no reason why we shouldn't get back to somewhere nearer 30 cents per pound. But even when we have reached the end of this cycle we must take account of my suggestion earlier that synthetic prices would probably decline in the future by about one per cent to two per cent per annum and so, therefore will wool prices.

IV. SOME E.E.C. QUESTIONS

Though a lot has been said on the topic of the E.E.C. there are one or two fresh observations I would like to make, if only because the problem of British entry having been shelved for the present, the whole question of its effect on New Zealand has been swept under the carpet whereas I believe it should still be out in the open as sooner or later we are going to have to deal with it again.

i. The Question of British Entry into E.E.C.

The first point to make is that entry into the E.E.C. is, in my view, a cardinal central item of British policy, accepted by British
civil service advisers, and it is not a policy from which they will allow themselves to be deflected by some diplomatic reverses at the hands of the French President, or because the economic cost appears too high—and most of the calculations already done suggest that the cost in terms of higher food prices, contributions to agricultural funds, etc., is going to be very high indeed—something of the order of £500-800 million per annum. The main long term economic gain offsetting this is the security of markets offered by the E.E.C. and I am sure that, to the extent that economic considerations have been taken into account, this matter of economic security has been very important. Growth with security, is something which Galbraith has recently characterised as the major goal of the modern corporation, along with size or scale. Perhaps security in trade is also becoming the goal of countries and perhaps there is a minimum size of country for effective political administration, development of education, research, new technology and so on. Britain has benefited enormously in the past from unrestricted free trade, but in recent years it has been an uphill fight, rendered even harder by the chaotic conditions characterising international monetary arrangements during 1967 and 1968. The attraction of the large E.E.C. market is not so much, in my view, that it offers economies of scale, as that it offers the advantage of qualified free trade with security.

But, as it happens, I believe the major reason for Britain’s E.E.C. policy is not economic but political. Europe is the last place for Britain to exercise political influence on world events and to make the contribution which, by the qualities and energy of her people, she is well fitted to make. All other political avenues are now closed or ineffectual—the British Commonwealth; the United Nations; the special British relationship with America. The suggested alternative of a North Atlantic Free Trade Area, while perhaps meeting more adequately the British economic objectives, fails to meet the political ones and has no support in America.

If, as I take it, entry into Europe will come sooner or later, then a number of things follow of which the most important is that we must not regard the continued existence of General de Gaulle as our salvation and as a substitute for policy to meet British entry; and furthermore we must not rely too heavily on British assurances of protection of our dairy interests on which, in view of the British determination to enter, they could quite easily yield when the crunch comes.

ii. Markets for Meat in Europe?

I should like to talk now about more positive aspects of the E.E.C., namely the possible potential market there is for New Zealand meat.

During the three-month period I spent at F.A.O. in Rome last year I studied some aspects of beef production and supply in Europe and my tentative conclusions are that European beef production is unlikely to keep pace with rapidly growing demand already forecast by F.A.O. in their commodity projection work—not only for Europe but also for other parts of the world.

There are a number of reasons for this which I don’t wish to develop here as they have been well enough publicised already, but
the most important is that specialised beef production is a very costly operation especially for an area as short of land as Europe; that as a consequence beef production is based almost entirely on the dairy industry and that an adequate supply of beef will depend on raising of milk prices to increase dairy cow numbers which in the current state of the European and world dairy market I feel is unlikely.

For these reasons one is able to suggest that there could be a growing market for beef—especially manufacturing beef in Germany—in the years ahead and if beef prices did go up much more there could also develop a growing market for lamb given a stepped up level of promotion and advertising and provided we are allowed entry for it.

I don't wish to imply from the foregoing that I think we are on the edge of a big European beef or lamb boom but my major concern has been to point out that everything about the E.E.C. is not all gloom and that, as with so many other cases, the facts of economics may, in the end, prevail over the transient considerations of politics.

To judge the extent to which the E.E.C. will adopt a liberal trading posture with regard to beef and lamb requires a comment about some of the anomalies and absurdities in the whole E.E.C. overall agricultural policy as at present framed, all of which I consider support the possibility of change towards freer trade, at any rate in meat:

(i) The present method of maintaining incomes in agriculture is the method of price supports and this has proved expensive, inefficient and ineffectual in relation to its purpose.

(ii) The method of fixing relative prices for key products (based as it is on a haggle between member states and the striking of some sort of acceptable average) is inefficient.

(iii) Prices paid to farmers and therefore charges to consumers are vastly in excess of world prices make nonsense of the common agricultural policy which is to provide consumers with food at reasonable prices. I think we will hear consumers' voices raised on this matter as their political power strengthens and that of the farmer declines.

(iv) The process of industrialisation is raising farm wage rates and sucking labour out of agriculture at a fantastic rate and this, more than any effect of the structural aspects of the farm policy, is leading to the regrouping of farms into larger units with fewer labour units, more machinery, larger scale operation, and improved technology. These trends certainly reduce costs mainly by reducing high cost labour content, but they don't necessarily raise output per acre and certainly haven't had much effect in raising output of livestock products, like meat. Indeed my impression is that, if anything, these factors have reduced meat output because so much of this comes from small dairy farms which, when amalgamated into bigger farms, have been switched into grain where the big cost and technological economies are to be gained. This is a development which further reinforces the need for a more liberal meat trade policy in the long run.
Lastly, and most important of all, the prices paid to farmers for dairy products are subsidised out of the agricultural fund financed largely from levies on imports. The subsidies are needed because the excess production over and above what can be sold in Europe has to be dumped on world markets at hundredweight prices.

The New Zealand dairy industry has already suffered severely in new markets because of competition from such dumping and I would regard this as the most worrying feature of the current dairy scene.

There are some ameliorating features: New Zealand has been successful in getting set up a special GATT committee to consider the question of surplus disposal of dairy products and it may be possible to devise arrangements to make the costs of dumping lie on the shoulders of those countries responsible. Some financial discipline of this sort, if it were introduced, ought to lead to a reassessment by the French in particular and the E.E.C. in general of their current agricultural policy arrangements.

Further than this, there have developed (as I suggested earlier this year would occur) severe strains within the E.E.C. itself. The cost of dairy support is rapidly rising to nearly $U.S.1000 million and the E.E.C. commission is anxious to reduce this enormous sum by reducing the dairy support price. In this they are supported by the Italians and the Germans as is to be expected since they do not have surpluses (and indeed are importers) and find it difficult to understand why they should pay up for the benefit mainly of the French.

I have no doubt but that it will take a long time for the E.E.C. commission to convince the E.E.C. politicians that radical change in dairy policy is required but eventually they will succeed as they have in other matters in the past.

For all these reasons I believe that in the long run and it may be five years, the E.E.C. will have to adopt a more liberal trading attitude towards imports of meat especially manufacturing beef.

It might be said—in countering this view—that the United States of America, which has gone through a similar process of industrialisation as the E.E.C. has, through thick and thin, retained its own E.E.C. type farm policies of high price supports, import controls, etc. Why then should we expect things to change in the E.E.C.?

The answer is of course that there are great differences in the U.S.A. situation—a very much faster rate of technological change, and because of better education, a more receptive farming community than in Europe. But more important the U.S.A. has not the same relative shortage of land per head as in Europe and the production of meat, especially beef, is very expensive in land required. Even in the U.S.A., with the great mountain range beef areas of the West, beef is expensive and manufacturing beef unobtainable, hence the valuable trade New Zealand has built up.
I wonder what the reaction would have been to anyone who sug­gested in 1948 that the United States would eventually be an importer of beef, lamb and even (for a short time until political interests inter­vened), butter and cheese. I think it is far less unrealistic to assume that in the long run basic economic forces will drive the E.E.C. much faster into the position of a net importer, at any rate of meat. The moral for New Zealand is, I think, obvious when Britain enters the E.E.C. we will find our dairy market in Britain severely reduced but equally there may by then have dawned some common sense in E.E.C. dairy policy so that we can develop markets in Asia without fear of competition from dumped European supplies. There is of course the problem of whether or not demand for dairy products in Asia especially Japan is adequate by then to take our supplies. I think it will be because the Japanese will become major net importers of food, but in case they don’t we ought to be given consideration here and now about alternative structural policies for the New Zealand dairy industry and of course the obvious direction to take in view of what I have said is beef. We are at present doing some research on this in the Agricultural Economics Research Unit at Lincoln and hope as time goes by to expand it into a major project.

V. LAMB IN AMERICA

I want to switch ground now very briefly from Europe to America and in particular say a few words about the development of our export lamb market in the United States.

In spite of the great difficulties so far experienced in selling lamb in the U.S.A. I am convinced that there is a large market wait­ing for us. We should not let the present difficulties discourage us, but should persevere as time is on our side, but the selling problem will have to be attacked with fairly massive financial resources.

Time is on our side because I feel that consumers’ opposition to frozen meat is crumbling, largely because the marketing of U.S. produced meat (which is recognised as being the least efficient of American agricultural marketing operations) is, I am told, eventually going to move towards freezing, in order to rationalise distribution and inventory arrangements. Already a large proportion of meat eaten in restaurants and institutional cafeterias, etc., is frozen without consumers really being aware of the fact. Furthermore all the trends suggest that beef will continue to rise in price and this will tend to raise the demand for other meats.

The first requirement, if we are to sell more, is, I think, to get the price down. Studies at Lincoln are confirmed by work in the U.S. showing that consumers’ responsiveness to lamb prices is very high. New Zealand’s sales performance in 1962 confirms this fact. Retail prices for lamb are high. One reason for this, apart from the price New Zealand charges, is the very high retail marketing margin occasioned by the sporadic throughput enjoyed by supermarkets with this product and the need to add special cutting and display facilities.

The second requirement is a greatly expanded promotion cam­paign. The present expenditures on advertising and promotion are too small and experience shows that anything of quality can be sold in America if enough is spent on promoting it. Lower prices and
expanded promotion, however, immediately bring political opposition from the U.S. producers and this can only be met by a wholehearted effort to join them, or get them to join us, in promoting and selling lamb, as such, regardless of its origin. The U.S.A. lamb industry has reached a parlous state, with rising prices of feed, falling demand for their product, and a tendency to produce an overfat grain-fed product. In many people's opinion, the only thing which is saving the industry from extinction is the imports of quality New Zealand grass-fed lamb with a good eye of lean meat.

It would be in New Zealand's interests to pay a small levy on all lamb entering America as a contribution to a joint promotion fund and even further to consider the setting up of a joint cooperative selling company to rationalise the sale of fresh and frozen lamb on a price discriminatory basis, i.e. let the U.S. producers take the small volume, high priced, fresh market, and New Zealand the large volume, low priced, frozen market, particularly in the lower income areas, and set prices for both which maximise the U.S. procurers' incomes and New Zealand's returns. If by measures such as these we could relieve the American producers of their irrational fear of our competition, and give themselves the needed freedom of manoeuvre in supply and pricing policy, I think the results might be remarkable.

However, before any such arrangements could be considered, let alone wisely administered, there is need for a greatly expanded programme of market research and this, I think, is the third requirement for success in the U.S.A. market. To some extent this should take place in commercial market research firms, but not only is there terrific variability in the quality of these agencies, but they are expensive and would not contemplate a long term continuing programme of work which is what is required. Most of the best U.S. market research of this type is to be found in the marketing departments of the universities, often under contract with producer groups. There has now developed in marketing departments in American universities, a large volume of expertise on problems of market research and most departments have carried matters to a point where there are groups of specialists for each of the major agricultural products. These groups have people with a profound practical knowledge of the marketing of the product concerned as well as others whose expertise lies in market research methods and analysis.

At none of the university departments which I visited did I find anyone specialising per se in lamb marketing, presumably because of the minor nature of the product in U.S. agriculture. If, as I believe desirable, there is to develop some specialist work in the American universities on lamb marketing, then New Zealand is going to have to organise it and pay for it. One way of going about this would be for one or a group of New Zealand academic(s) to be seconded to the marketing department of an American university, to observe the marketing research being done for other products and to develop a body of similar work on lamb.

I mentioned this idea to one or two of the universities I visited and the response was enthusiastic. Cornell, Purdue, Berkely and Guelph all welcomed the idea, provided New Zealand (or more specifically, I suppose, the New Zealand Meat Board) paid for it.
It might be asked why we cannot use New Zealand students doing American Ph.Ds. for this sort of work. The disadvantage of this is that it takes such a long time before they get to their research work and, when they do, are unlikely to find supervisors who are familiar with the lamb question and whose natural inclination in any event is to seduce Ph.D. students away from such fairly humdrum research, useful as it is to New Zealand, into more exciting if less useful theoretical fields relating to the U.S.A. The present proposal really aims at getting some work under way straight away and building a body of information and expertise which would, in due course, be available to Ph.D. students and supplemented by them.

To get down to the practical level, the very first topic for study ought to be the lamb merchandising and pricing policies of supermarkets, the reasons for high marketing margins, and ways of reducing them and what needs to be done to make lamb an attractive high volume sales proposition to the American supermarket.

VI. HORTICULTURAL AND CROP PRODUCTS

There is not time to say much about horticultural products but they are becoming too important to omit.

In Britain there is a very noticeable trend in horticultural production away from the traditional multi-product market garden areas such as Evesham and Pershore, towards the large scale specialised production units in the Eastern counties. In these latter areas, which have always been traditionally involved in arable farming, it has been natural to integrate economically large-scale mechanised production of main crops such as carrots, parsnips, cauliflowers, Brussels sprouts and celery. The old traditional market garden areas are turning more and more to the more valuable, perishable and glass-dependent products such as salad crops, tomatoes, runner beans and rhubarb. This development towards large-scale production in arable areas may have implications for New Zealand and particularly for Canterbury.

Associated with the trend towards large-scale specialist production, there has also occurred a similar tendency in marketing. There has been a rapid growth of Eastern counties merchanting firms who have large areas of vegetables grown on contract and who, along with many of the large growers, are now using up-to-date methods (including radio-telephones to maintain contact with harvesting gangs and control the rate of cutting), to keep supplies in line with demand day by day.

Rapid development of large scale horticultural production is very appropriate to the present and projected economic situation. We need much more intensive use of our land and labour is not now as scarce as it was or as expensive in real terms as it was before devaluation. Furthermore it has now become fairly obvious that we shall need to get increased exports from all sorts of non-traditional areas outside of the traditional meat, wool and dairy trio.

Furthermore devaluation has assisted the situation by making us very competitive in overseas markets such as Australia.

Nevertheless we would need to be very careful before we jump to the conclusion that in new cropping and horticultural ventures, the sky is the limit—in fact the extent of overseas markets is the limit.
and about this we know very little. It will need to be demonstrated that there are good continuing and growing markets before we can justify large scale horticultural and cropping ventures especially if we recall that it only needs one cent per pound more for wool to earn us $6,000,000.00 and it would take a lot of new crops to beat that.

In some cases the market situation is assured by long term contracts such as is the case with the dried lucerne plant proposed for the Ashburton area where, from its inception, the design of the project was based on an assumed market at firm prices in Japan. This is a well worthwhile venture and one hopes that there will be many more like it but they will either have to be based on firm overseas contracts or on the results of a lot of overseas market research of a thorough-going and penetrating nature.

VII. CONCLUSIONS AND IMPLICATIONS FOR NEW ZEALAND

I should like now to conclude by drawing together my observations into a coherent summary of points as follows:

(i) The Word Recession
We are still in the middle of a severe world economic recession and everything that is happening in our markets must be judged in this light.

(ii) Australian-New Zealand Free Trade
There is a trend, which partly accounts for British desire for entry into the E.E.C., for countries to opt for trading blocs and arrangements that provide a measure of benefit from trade together with a degree of stability and security which is not found in world trade as a whole. Moreover size of country or group has become as important as it has in business.

I regard it as imperative that New Zealand adopt similar policies—in this case by steady reinforcement and development of the New Zealand-Australian Free Trade Agreement into a full scale common market. Not only can we and the Australian reap advantages in increased trade in agricultural products, and in many specialist types of manufactured goods (in which New Zealand, for all our fears on the matter, has a distinct comparative advantage), but we could if we moved towards a full scale common market reap economies of specialisation from joint arrangements for defence, research, education, overseas political and trade representation, etc.

I am not one of those who think that just because a tougher line is being taken by the Australian Government towards dairy farm subsidies, that we will see big markets opening up there for New Zealand dairy exports. But neither am I one of those who thinks that structural change in the Australian dairy industry—amalgamating farms into larger units, will necessarily lead to rapid increases in output through greater technical efficiency any more than it has done in Europe. The thing that has increased dairy output in Europe is farm prices and if these were lower and more in line with world prices, output would fall. Similarly, the critical thing in Australia will be the level of dairy prices (including subsidies). If these were to fall towards the New Zealand level, output of dairy products would
fall, technical change notwithstanding, and we would be able to
sell some dairy produce.

With meat or more specifically lamb we are already selling
increasing quantities of air-freighted lamb partly to take advan-
tage of seasonal deficits. Sporadic as this trade may appear to
be, we must remember that lamb production in Australia hasn't
increased in recent years, consumption is rising and exports are
decreasing.

Australia is a very big country and, with modern transport,
one state can be just as easily supplied with lamb from New
Zealand as from some other Australian state.

(iii) The E.E.C.

I have suggested that in the long run there could be a market
in Europe (as there has opened up in U.S.A.) for manufactured
beef and furthermore that over the next five years the E.E.C.
dairy surpluses will be rectified and our problems of competing
in third markets with dumped dairy produce will be alleviated.

The general view of agriculture in the New Zealand economy
to which one is led is that the next five years will be one of
some difficulty in overseas markets. Undoubtedly, we will sell
more in various new markets but it will not be easy until the
mid-70s when one can reasonably expect Japan and South East
Asia to become major growth markets for New Zealand food
exports.

Agriculture is still going to be of enormous importance over
the next decade, but I think it is fair to say that New Zealand
is going to have to look to other industries for the marginal
exports required to maintain growth rates in living standards—
new industries such as forestry, and efficient economic manu-
factoring industries. These are going to be the growth areas
and these are going to be the industries where incentives, etc.,
are going to be provided. If farmers feel they have some special
place in the economy they are going to have to fight for it and
not just with slogans like "Farming is the backbone of the
country," and so on, but they will have to fight on the basis of
properly documented assessments of the worthwhileness to the
economy of further investment in agriculture as compared
with other areas of production's accent on what we might call
the "production economics" of the situation but also on market-
ing and overseas market research. Indeed this question of
overseas market research has cropped up almost continuously
throughout this paper since I regard it as of prominent import-
ance to the industry.

We at Lincoln are doing our share by training some graduates
in the field of marketing and we hope, in the future, to do a lot
more.

Your job as farmers is to ensure that you achieve the right
sort of marketing organisation for your products especially
wool and meat—be they boards or authorities or whatever—in
which there is the fullest development of the newest marketing
and market research techniques available, if only to catch up
with our competitors.

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THE PROCESSED VEGETABLE INDUSTRY
IN OREGON AND ITS RELEVANCE
TO NEW ZEALAND

Professor M. D. Dawson, Visiting Professor of Soil Science,
Lincoln College, from Corvallis, Oregon, U.S.A.

Oregon is the size of the British Isles. Western Oregon, which includes the Willamette Valley is the size and topography of Marlborough, Canterbury and Otago. The 45th Parallel North dissects Western Oregon in much the same way as the 45th Parallel South dissects the South Island. Oregon's population of 1,800,000 represents one per cent of the United States.

While Western Oregon experiences almost a Mediterranean climate with cool wet winters and a dry summer, the mean temperatures during the growing season are similar to Canterbury's. Like Canterbury and Otago, Western Oregon has ample water resources available for irrigation. While the potential for irrigated land in Western Oregon is far from realised, irrigation development schemes are considerably further developed than in the South Island. Soil associations in Western Oregon are comparable with those of Marlborough-Canterbury-Otago, differing mainly in the amount of stoniness prevalent in much of the Canterbury area. A higher proportion of imperfect to poorly drained soils prevail in Western Oregon.

In excess of 100,000 acres are under irrigation in Oregon, much of this acreage is devoted to the intensive production of vegetables, berries and fruits.

Oregon's income is derived from forestry, agriculture and tourists. Most of the agricultural products are exported. Oregon boasts a total agricultural income from raw products of $500 million; of this total, horticulture produces $100 million and the total value of raw vegetable products is roughly $30 million. The importance of vegetable processing is obvious.

Snapbeans, corn and peas are among American people's most popular vegetables and these are the principal vegetable crops grown in Oregon.

Vegetables are grown at elevations ranging from sea level to 3,000ft in a near Utopian climate featuring low humidity, good light intensity, warm days and cool nights. The vegetable processing industry in Oregon has grown from almost nothing to one of the greatest in the United States in 25 years. Wars provided the stimulus and irrigation provided the magic by which whole new garden areas were created. As processors developed markets, there were opportunities to increase the number of items processed and also to keep the plants running longer each year.

The highest labour costs in farming and in processing plants in the United States exist in Oregon and California. In addition, freight rates in Oregon are very high. Nevertheless, modern machinery and automation have offset labour costs, resulting in the costs per case of processed product to decrease. Oregon's expansion in vegetables cannot be explained on modern automation. Premium prices for the processed product have contributed mightily to the favourable economic environment of vegetable and fruit production in Oregon.
On approximately 50,000 acres in Western Oregon there are grown 50 different vegetable crops, 20 for processing. Growers of vegetable crops for processing also almost always grow cherries or plums, strawberries and other berries. Generally, the main enterprise consists of two or three crops grown concurrently or in sequence. Additional enterprises bear a complementary or supplementary relationship rather than being competitive.

The principal vegetable crops are Blue Lake beans, sweet corn, beets, carrot, broccoli, peas, Brussells sprouts and cauliflower. Oregon's vegetable production acreage, tonnage value and rank in the United States is presented in the following table:

<table>
<thead>
<tr>
<th>Crop</th>
<th>Acreage 1,000</th>
<th>Million Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snap beans</td>
<td>30.7</td>
<td>14.916</td>
</tr>
<tr>
<td>Onions</td>
<td>5.9</td>
<td>7.876</td>
</tr>
<tr>
<td>Sweet corn</td>
<td>36.4</td>
<td>6.911</td>
</tr>
<tr>
<td>Peas</td>
<td>55.6</td>
<td>5.729</td>
</tr>
<tr>
<td>Broccoli</td>
<td>3.3</td>
<td>1.574</td>
</tr>
<tr>
<td>Cabbage</td>
<td>1.4</td>
<td>0.918</td>
</tr>
<tr>
<td>Carrots</td>
<td>1.7</td>
<td>0.890</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>1.6</td>
<td>0.856</td>
</tr>
<tr>
<td>Lettuce</td>
<td>0.6</td>
<td>0.775</td>
</tr>
<tr>
<td>Table beets</td>
<td>2.0</td>
<td>0.665</td>
</tr>
<tr>
<td>Asparagus</td>
<td>1.2</td>
<td>0.496</td>
</tr>
<tr>
<td>Watermelons</td>
<td>1.2</td>
<td>0.479</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>0.4</td>
<td>0.461</td>
</tr>
</tbody>
</table>

Total vegetables (17 crops) 143.4  43.388

In parts of Eastern Oregon in regions more arid than those of Central Otago, tomatoes, watermelons, cantaloupes, asparagus, carrots, lima beans and sweet corn are grown at low elevations under sprinkler and furrow irrigation. In the "Palouse County," a region where the climate and soils resemble those of the Methven area, peas are grown in rotation with wheat, without irrigation. In the far eastern portion of the state sugar beets under irrigation commonly yield in excess of 30 tons per acre.

What is the Secret?

Oregon, like New Zealand, is predominantly a rural state. The development of Oregon's horticultural industry continues to be rapid but it is not an overnight conquest of lands.

Oregon's vegetable and fruit development has grown through prudent use of its natural resources of soil, water and climate that is ideal for the green leaf plants. To a very large measure similar natural resources exist in the arable areas of New Zealand. The sound enterprising use of these resources by the competent arable farmers in New Zealand can produce vegetables for processing that will compete on the basis of perfection of products as Oregon producers are doing.

Optimized Cropping Systems for Vegetable Crops

High yields and a quality vegetable product will require implementing an optimized cropping system. Irrigation is usually essential —so is weed control. Yet irrigation must be accompanied by using
responsive high-yielding varieties on well fertilised soil, followed by sound insect and weed control practices. Top vegetable yields will also require a high plant density with proper arrangement, planted with precision seeding equipment and harvested by multi-row harvesters. This package of cultural practices of course requires excellent management ability.

It is time to challenge some of our traditional ways of managing large acreages of vegetable crops and to find out what types of new equipment, materials and methods we need to attain top yields. Optimum plant densities and equidistant spacings promise yield and efficiency advances equal to the discovery of hybrid vigour.

Herbicides have eliminated the need for cultivation and the need for wasted space between rows. Judging from research in Oregon and in England, it would seem that all of our principal vegetable crops many produce their highest yields at equidistant spacings between 4 and 12 inches.

All root vegetables may best be grown on raised beds 4 to 5 feet wide to facilitate lifting. Careful control of plant densities (6 x 6 inch spacing) tends to control the size of carrots, beets and potatoes.

High levels of fertiliser are used, that is double the usual maximum commercial rates commonly used. Luxury levels of fertilisation eliminate (1) nutrition as a possible limiting factor under intensive culture; (2) variations in natural soil fertility; (3) uneven growth known as the “border” effect. Balanced nutrients are needed which will mean the increased inclusion of micronutrients at high fertiliser rates. Undoubtedly as far as New Zealand is concerned, soil nitrogen will need to be supplemented with fertiliser nitrogen. With ample water in the rivers and lakes, nitrogen in the atmosphere, available electricity and the recent discovery of natural gas, the potential to produce anhydrous ammonia here in New Zealand must be carefully considered. No cheaper source of N fertiliser exists.

Optimum plant density plantings and high fertiliser applications require careful control of soil moisture levels. Automatic self-move and solid set sprinkler irrigation systems activated by electronic soil moisture devices when the soil requires water will be needed.

**Vegetable Yields Under Optimised Cropping Systems:**

Beans, sweet corn, table beets and carrots provide examples of yield increases due to implementing optimised cropping systems. Oregon’s newly released Bush beans, a plant developed for mechanical harvesting which incorporates the tenderness and quality of the old pole bean yielded 13.5 tons/acre in a 5 x 5 spacing. Bean size and tenderness were excellent.

With sweet corn unhusked, total yields increased from 11.7 tons/acre to 16.5 tons/acre on reducing from a 36-inch to 12-inch row. At the same time yield of acceptable husked ears increased 47 per cent when the plant population was increased from 14.5 to 43.6 thousand plants/acre, 36-in versus 12-inch row. In the triangular spaced sweet corn; with kernels at planting orientated in the same direction, the 12 x 12-inch spacing produced 66 per cent higher weight of husked acceptable ears than the 24 x 24-inch spacing.

It is of interest to note that optimum moisture was supplied under sprinkler irrigation and 400lb N, 250lb P and 150lb K fertiliser was applied to obtain these yields.
With table beets at similar fertility and moisture levels, reduced row spacing increased the percentages of 3-inch or smaller roots (most acceptable) from 41 per cent at 24 inches to 94 per cent at 6 inches. Carrots responded similarly to increasing the plant population per acre, at the 6-inch spacing 88 per cent of the carrots were 2 inches in diameter or smaller. Carrot yield was increased at the same time by 33 per cent under the optimised cropping system to 28 tons per acre.

**Vegetable Processing and Employment Needs:**

Where the vegetable industry as in Oregon produces $30 million raw vegetable products annually and the processed products approximately $100 million, it is not surprising that the processing and marketing activities employ considerable labour. Labour engaged in generating real wealth in accordance with a commodity which has a comparative advantage in the region it is produced.

It is perhaps of interest to consider the kinds and approximate numbers of people engaged by a big processing plant like Blue Lake Packers. First there are the agronomists, entomologists, agricultural engineers and other field advisers who work with the vegetable producers. Secondly, there are the plant engineers and maintenance men, the clerical staff and the various foremen. Thirdly, is the big group of seasonal semi-skilled help in the processing plants themselves. The transport personnel, first in conveying the raw products to the plant, and later the processed plants away to the market place. High tonnages of vegetables and fruits involve much hauling and handling. Often pre-processing is done at a grading station.

Then there are the services that are associated with such an industry. These include finance, sales, fuel, supplies, chemicals and equipment. It is little wonder that scores of people are required by a single processing plant to produce the marketable product.

**The Impact of Vegetable and Fruit Processing in Oregon**

It is estimated that the vegetable and fruit industry in Oregon created about 2,000 new job equivalents in processing and handling in the last five years. This figure does not include the seasonal employment to high school, college students, women and children. The vegetable and fruit industry employs up to 80,000 seasonal workers.

The amount received by vegetable and fruit growers, the value added in processing and year job equivalents is presented in the following table:

**Vegetables:**

- Total received by growers: $49,994,000
- Total added in processing: $84,145,000
- Total F.O.B. processed value: $134,139,000
- Total number of year around employee equivalents ($4000/year): 6,182

**Fruits:**

- Total received by growers: $42,293,000
- Total added in processing: $49,705,000
- Total F.O.B. processed value: $91,998,000
- Total number of year around employee equivalents ($4000/year): 3,550
Values added in processing include not only payroll for packers, canners, freezers, cleaners, and grading but also includes depreciation, repairs, power, heat, water, advertising, supplies, taxes, insurance and rent, etc.

Among the vegetable crops grown for processing, green beans are king while green peas are a crop like beans which have great potential in New Zealand. It is of interest therefore to examine the impact of these two crops on the economy.

**Green Beans**

<table>
<thead>
<tr>
<th></th>
<th>Tons</th>
<th>$</th>
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<tbody>
<tr>
<td>Amount paid to growers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total tons sold ($116/ton)</td>
<td>127,000</td>
<td>14,916,000</td>
</tr>
<tr>
<td>Payroll (25 per cent)</td>
<td></td>
<td>7,782,000</td>
</tr>
<tr>
<td>Packaging materials (30 per cent)</td>
<td></td>
<td>9,340,000</td>
</tr>
<tr>
<td>Other (45 per cent)</td>
<td></td>
<td>14,010,000</td>
</tr>
<tr>
<td><strong>Total value added by processing</strong></td>
<td></td>
<td>31,132,000</td>
</tr>
<tr>
<td>F.O.B. value of pack</td>
<td></td>
<td>$46,048,000</td>
</tr>
</tbody>
</table>

**Green Peas**

<p>| | | |</p>
<table>
<thead>
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<th></th>
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</thead>
<tbody>
<tr>
<td>Amount paid to growers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tons sold ($89/ton)</td>
<td>64,000</td>
<td>5,729,000</td>
</tr>
<tr>
<td>Payroll (30 per cent)</td>
<td></td>
<td>4,468,000</td>
</tr>
<tr>
<td>Packaging materials (32 per cent)</td>
<td></td>
<td>4,767,000</td>
</tr>
<tr>
<td>Other (38 per cent)</td>
<td></td>
<td>5,660,000</td>
</tr>
<tr>
<td><strong>Total value added by processing</strong></td>
<td></td>
<td>14,895,000</td>
</tr>
<tr>
<td>F.O.B. value of pack</td>
<td></td>
<td>$20,624,000</td>
</tr>
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Other vegetable and fruit crops which could be similarly examined that have potential impact on the New Zealand economy include sweet corn, broccoli, beets and carrots. Fruits include strawberries, pears, cherries and probably certain nuts like filberts ($3 million crop in Oregon) and walnuts.

Another crop in a rather different category is mint (processed for oil used in flavouring) which grosses in excess of $5 million to Oregon growers.

In summary, Oregon’s vegetables and fruits grown in an environment remarkably similar to New Zealand’s is worth more than $226,000,000 when processed and ready for sale to wholesalers and retailers. This industry has created an equivalent of 2,000 new off-farm jobs in the last five years. That food processing also provides direct payroll for average annual employment of about 18,000 persons demonstrates its impact on Oregon’s economy. Much other employment results in the manufacture of packaging materials and in general plant and equipment maintenance and operations.

Oregon has chosen to concentrate on industries best suited to its total environment, namely those concerned with processing and marketing of agricultural and forestry products. New Zealand’s ecological and sociological environment is remarkably similar to Oregon’s. It surely follows that for New Zealand to develop secondary industries such as electronics, machinery, toys and the like instead of concentrating as Oregon has done on a variety of agricultural and forestry...
products and processed commodities is at best foolish and could result in economic suicide. The feasibility of processed vegetables in New Zealand for export deserves considerable attention.

Potential Markets for New Zealand Processed Vegetables

Australia and Japan would seem to be likely customers for the quality processed product economically produced in the market gardens of New Zealand. Thousands of dollars of processed products are already being exported from Oregon to these areas. It is a well known fact for instance that mint oil is exported from Oregon to New Zealand, Australia and S.E. Asia. It is used to flavour gums, toothpaste and candies. Mint oil could just as easily be produced and processed in the South Island netting farmers $400/acre as it does the Oregon producer.

Beans, peas, table beets and sweet corn and other processed vegetables surely have a market in Australia and in Asia. We cannot expect these markets to develop overnight. Oregon's processed vegetable industry has taken almost two decades to become what it is today. Continuous imaginative, courageous research and development both here and abroad offers the prospect and potential for what seems to me as healthy processed vegetable export. Processed vegetables sold abroad could indeed provide a considerable source of foreign exchange, a sensible development of a meaningful secondary industry engaging sizeable labour forces. It could provide a complementary system of farming of our capable arable farmers of New Zealand who will continue to produce their meat, wool, bread and butter.
THE MONETARY AND ECONOMIC COUNCIL'S VIEW OF THE ECONOMY

Dr G. B. Battersby, Chairman, Monetary and Economic Council.

The present economic situation can best be described by saying "You can't get a quart of beer out of a pint pot." Whatever we do we have got to stay with our overseas income. Moreover our future prosperity depends on our overseas trade. This is true whatever government is in power and cannot be avoided as far ahead as we can see. Maybe there will be some change in the pattern of trade, new products are essential, diversification of markets, but nevertheless trade is the life-blood of this country. It is far more important to it than many large countries such as the United States.

Overseas trade is important to us because we have a small home market and the developments which have taken place overseas in technology are particularly designed for large markets. Computers, automated industries, the petro-chemical industry are industries which are going to affect our economy and our prosperity in the future. We can only get access to the products of these industries by overseas trade.

Consequently those New Zealanders who are engaged in overseas trade must have a very important future as the cornerstone of the economy. This is not going to change.

However, in our overseas trading position it is most important to remember that we are a small country and that in the battle for markets we have little political influence. To a certain extent we have to accommodate ourselves to conditions set down by others. I have heard our position described in terms of a football match. "We're not one of the players, we're not even one of the crowd attending, we're only the ball that's being kicked about." It is no use talking about us being the most efficient producers of dairy produce in the world if we let our neighbours take it from us.

Finally, I think we have got to recognise that change is inevitable. In the past we have reacted against change but we must adapt our economy. This means change in the employment of people, change in their training, their occupations, the products they produce, because it is only by this means that we will achieve the highest standard of living.

Change is affecting us already in three major ways.

Firstly, changes in technology:

The technology of the synthetic fibre industry is certainly having a serious impact on our woollen trade.

Secondly, changes in political and trade groupings:

The possible entry of Britain into the E.E.C. is an example of this kind of change.

Thirdly, the changes in the availability of overseas capital will affect us. We need the investment to develop our economy.
used to be our major capital market providing us with funds. It no longer is. We are forced to change over to using the services of international institutions such as the I.M.F. and the World Bank which are probably not as well disposed to us or as accommodating as the London market used to be.

I am going to very briefly go through the history of the economy in the last few years and bring it up to date and then try to project it into the future and see what conclusion we come to.

I am only going to go back to 1964 when there were the first signs of an uneasy balance in the economy.

Our balance of payments on current account was unsatisfactory. That year we had a high rate of increase in exports accompanied by a high rate of increase in national expenditure. Then early in 1965 exports fell but our national expenditure continued to rise by 9.1 per cent in 1965, 11.1 per cent in 1966 and by 4.6 per cent in 1967.

Now we could not sustain the increase in national expenditure from our own production. It was essentially inflationary and was substantially caused by marked increases in Government expenditure. A major part of these were capital expenditures but nevertheless they were costing us money. We were running down our overseas funds and borrowing overseas.

This situation could not continue and towards the middle of 1966 a very substantial sum of money was drawn from the I.M.F. in order to assist the balance of our overseas reserves.

The Government started at about the same time to slow the economy down but with limited success. You will remember 1966 was an election year and inadequate steps were taken to slow the economy down. By November 1966, just before the fall in wool prices took place, we had the economy running at full lick. At the same time our reserves were down to bedrock and it was under these conditions that wool prices dropped and made necessary a very severe adjustment to the economy.

The Government eventually took steps in February 1967. In general they were the right steps, they were necessary, they had the effect of restraining the economy, not markedly at first, but during the course of last year progressively more so.

Then in July 1967 the Government introduced its 1967 budget in which, for the first time in many years, a serious attempt was made to restrain Government expenditure.

In fact Government expenditure has, in the last year, been kept down to a 2 per cent increase which is something quite remarkable for governments of any kind and this Government has done well to keep expenditure down to this level.

The combination of restraints on credit and the fiscal measures—the removal of food subsidies for instance—had a marked effect on the economy as you are aware. It brought some unemployment, a downturn in industrial production, and it has had a very severe effect on the building industry.

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Now this was the situation at the time of devaluation which took place in November 1967. Devaluation was not a positive part of Government policy. It came about when Britain devalued but I believe it was absolutely essential for a policy of continued economic growth.

Over the last few years the country has suffered from an economic structural imbalance. By the structure of the economy we mean the relative importance of components which go into consumption, into production, into employment and into investment.

With the level of prices in the economy there was a tendency to overspend on imports. The classic answer to this problem is devaluation. Government, by taking this step, presented to the country the opportunity of taking positive long term steps to correct the structural imbalance.

The fiscal measures taken last year and the devaluation have had an effect on the balance of payments. In February this year the Monetary and Economic Council’s 14th Report predicted that in the year ended June 1968 there would be a $69 million deficit on current account. You have already heard Mr Muldoon earlier this morning tell you that this has been converted to a $70 million surplus. Well, what I do not accept is that the position is really as good as this.

The Smithfield meat price has been inflated by the London dock strike and the foot and mouth disease outbreak. This advantage may not continue but in any event it has produced a $23 million gain. There has been a $10 million improvement in wool receipts. There has been a dramatic fall in imports to the extent of $19 million and there has been a visible improvement, $8 million, in invisibles which includes shipping, freights, insurance, tourists and so on.

The Monetary and Economic Council’s projection for next year are still predicting for June 1969 a deficit of about $20 million.

The Government’s plan to have a balance of payments equilibrium by December 1969, as expressed in their letter to the I.M.F., will be achieved without further restraints but the situation will not permit very much relaxation during this year and next year even though next year is an election year.

We, on the Monetary and Economic Council, think that imports are bound to rise. We think that stocks of imported goods have fallen markedly and we have talked to a large number of manufacturers on this point. They have been running down their stocks. This situation cannot continue for very long. There is certain to be a rise in imports in July-August this year. So the situation is not quite as good as it might appear at first.

Now I want to deal very briefly with the question of the structure of the economy and close on full employment.

What we are striving to achieve is a structure of the economy which will give us economic growth, meet our balance of payments problems and, at the same time, give us full employment.
And this does mean almost for certain that the economy must be redirected towards more exports because export income is the limiting factor as far as employment is concerned. Our factories are dependent on imported raw material and imported plant to maintain an increased output. Devaluation, which had the effect of assisting our exports, must be seized up to help develop our export trade, build up economic growth and restore full employment.

Now if we look at our exports we find at the present time some 90 per cent are derived from farming. Meat, butter and wool are the main products and when you look at the rest after taking out the products of the cow and sheep there is very little left.

We have got to change this situation to some extent. We are like a three-legged stool at the present time and the fall in wool prices showed us the effect this can have. We must diversify, we must expand our export markets away from the United Kingdom or, at least, reduce our dependence on the United Kingdom and away from our three-products economy.

To this end we must shake up the direction of the economy. If you look at the other products we find that the potential exports, say, of forestry may be of great significance. The same can be said of tourism, arable farming, horticulture—flowers perhaps—and these kinds of labour intensive products. But perhaps the best hope of all lies in our manufactured products. Up to the present time manufactured products have been only a small component in our exports. It is the view of the Council that this must be changed, slowly at first as the economy is adjusted, but in the long run, the late 1970s and early 1980s to a very great extent so that we can spread the risk involved in our economy.

This brings me to the basic question dealt with by our 14th Report. How do we ginger up our manufacturing industries, how do we persuade them to export?

At the present time exports of manufactured goods have increased rapidly by something like 15 to 20 per cent over the last six months. The Manufacturers' Association is planning something like a 15 per cent per annum growth rate in manufactured exports. At the present time these exports have only been undertaken by manufacturers because of the slack local market.

What would be much better to do in the long run is to have manufacturing capacity directed to export and not just have a margin which is exported. This is going to take a lot of doing and will present a challenge to our manufacturers.

During the last few years the Monetary and Economic Council has made many visits to factories throughout New Zealand. I, personally, have never ceased to be amazed at the range of products, the technology involved and the quality of the goods being produced. New Zealand manufacturers have really come on the scene in a big way. However, they are not exporting to a sufficient extent.

Now the Monetary and Economic Council has argued that import licensing is a deterrent to the development of sustained export trade in manufactured goods. This is why the 14th Report, which I recom-
mend that you read, makes out a case for the gradual removal of
import licensing over the major part of industry.

We think it should start by removal of import licensing on raw
materials in order to enable manufacturers to compete with each
other so the present industrial structure can be rationalised to some
extent, bigger units developed and advantage taken of the economies
of scale. By this means we will get resources concentrated in the
hands of efficient producers.

Then we think the licences should be taken off plant because
manufacturers have in recent years been very severely handicapped
by the lack of availability of plant.

Finally as a last stage import licensing should come off all con-
sumer goods.

Now we have been misreported and misinterpreted by some
writers and speakers by suggesting that manufacturers cannot com-
pete without protection. We believe that tariffs should be used
instead of import licensing. Of course they will be in operation before
import licensing is removed. The tariff must be adequate and in
many cases existing tariffs will need to be increased.

The question of tariffs is extremely topical. There are over
4,000 tariff items and something like 2,000 items at the present time
in trade agreements with other countries. This means that if we
remove import licensing and substitute tariffs there is something over
2,000 items to be considered by the Tariff Board.

Now as far as the internal economy is concerned I think we must
set out to make much better use of the existing resources we have in
New Zealand at the present time.

We have got to have more shift work so our plant is occupied
better. We have got to take much better care in the selection of new
projects, we have got to concentrate our investment in the growth
industries.

Then you have got to adopt a flexible approach and I want to
make it quite clear that the decisions about the economy will not be
made with any certainty.

There is doubt, there must be, about our future in farming and
our future in manufacturing.

Consequently, we must keep a flexible approach and this I think
is best accomplished by concentration on education, on training, on
research, on the development of technology so that we have resources
which to some extent, at least, can be shifted. By this means we can
meet changing circumstances overseas.

Then we must have greater competition in the country, concen-
tration of business units where this will make for greater efficiency
particularly in manufacturing but also in farming.

As to farming we have got to proceed with the farm investment
plan, these I think can be proceeded with in confidence.

In the future the relative importance of manufacturing is likely
to continue, but farming will continue to be the cornerstone of our
economy for just as far as anyone can see.
THE MEAL-BASED PIG PRODUCER AND THE FUTURE

Mr Alan Shepherd, Farm Advisory Officer (Economics), Department of Agriculture, Palmerston North.

I start with the simplifying assumption that the motive for being in the game of pig meat production, is to make a profit.

This immediately implies that the pig producer is concerned with inputs, pig meat output and their respective prices.

Much of today's discussion has been related to the technologies of pig management, particularly in relation to meal feeding.

Taking that input requirements, costs and technologies have been adequately covered, I shall confine myself to comment on the future demand/supply situation. The balance of demand/supply determines the market prices for pigmeats.

Some appreciation of the movements of demand and supply would seem essential to sound future planning of an enterprise.

Demand:

The major determinants of changes in consumer demand are:

1. Changes in population.
2. Changes in income.
3. Changes in price.

Population increases depend on the net immigration rates and birth rate. The birth rate has recently declined slightly from 26 births to 23 births per thousand of the mean population in 1965. There is not much a pig producer can do here unless the Council were to sponsor an anti-"pill" campaign.

Increases in real disposable income depend on national productivity and the terms of trade. Again the individual pig producer is in a position of having to accept what comes.

Population growth rate is slowing and per capita income growth prospects are not rosy.

As price increases, other things remaining equal, quantity demanded declines, and there is a certain amount of substitution of other commodities for the one with a relatively higher price.

This is rather unfortunate for producers of the higher-priced products—because though making a high profit in the short term, there will be a tendency for reduced consumer demand as other commodities are more permanently substituted for it.

Changes in consumer preferences, or tastes can occur in this way. Recent high retail prices of pigmeats would seem to have induced such a tendency for taste change. Bacon and eggs have been a staple New Zealand breakfast food.

If the large increase in egg surplus this season and my own little consumer survey among friends and relatives mean anything—I would think that bacon and eggs have given way to ready-to-eat cereal preparations, coffee and toast.

To summarize, price and taste changes will have been acting to reduce per capita consumption of pigmeats from around 33 lb per person over the period 1960 to 1965. Income growth rates can be
expected to do little to compensate for this effect in the next few years.

Using the Government Statistician's estimates of population growth—that allow for the 1965 birth rate, a possible high per capita consumption of 33lb and a possible low level of 27lb, I estimate that pigmeat consumption may lie between 40 and 50 thousand metric tons in 1970, between 45 and 55 thousand metric tons in 1975, and between 50 and 60 thousand metric tons by 1980.

This compares to a production of about 46,000 metric tons in 1966, and of about 52,000 metric tons in 1964.

Supply

In the past New Zealand’s pigmeat production has been largely based on skim milk available on dairy farms. We all know of the trend towards whole milk supply and the associated decline in pigmeat production from this sector. The rate of decline in the last three or four years has, however, exceeded the rate of expansion at the whey and meal feeding margins of the industry.

Mr Davenport's survey in 1966 provided extremely useful data on the structure of the pig industry. At that time about 60 per cent of the sow herd were primarily dependent on skim milk as a feed source, and about 30 per cent of the sow herd were primarily dependent on whey as a feed source.

Because of the still major importance of dairy by-products in pigmeat production, an investigation of likely future trends in dairy by-products' availability was made.

This indicated that skim milk supplies on farms would decline very rapidly during the period 1965 to 1970, and continue to decline at a somewhat slower rate over 1970 to 1975 and 1975 to 1980.

Consideration of the whey supplies that may be available over the same period shows that increases in these may tend to offset the decline in skim milk supplies.

Based on assumptions of productivity increase in the dairy industry, certain proportions of powder, casein and cheese manufacture, and making allowances for possible innovations in whey utilisation, the feed units available from dairy by-products appear to be of the order of 400 million by 1970, 390 million by 1975, and 335 million by 1980.

These figures compare to an estimated 500 million feed units available in 1965-66 from dairy by-products of which it is estimated 400 million feed units were utilised.

Thus depending on the utilisation of dairy by-products, this source of feed supply could continue to be the dominant base of production over the next decade. Utilisation will primarily depend on the reaction of the industry to increased supplies of whey becoming available.

In summary I expect increasing supplies of pigmeats to be coming from whey-based piggeries in the next decade. Just how much room is left for the meal-based producer depends on:

1. The average level of productivity in the dairy by-product based sector.
2. The actual utilisation of dairy by-products available.
If about 75 per cent of the available dairy by-products were utilised and converted into pig meat at the rate of six feed units per pound of carcass meat then dairy by-products could supply in

1970  26,000 metric tons of pig meat.
1975  25,000 metric tons of pig meat.
1980  20,000 metric tons of pig meat.

Of course, the dairy by-products will be putting out more production than this, dependent on the extent to which they make use of meals as a supplementary feed. Assuming meals form about a quarter of the dairy by-products based pig producers feed unit input—then total meat output from this section would be:—

1970  35,000 metric tons.
1975  33,000 metric tons.
1980  27,000 metric tons.

When related to the expected consumer demand of 40 to 50 thousand metric tons there is seen to be not a great deal of room left for production from the garbage and meal based sectors.

This would indicate that any expansion of meal based piggeries should be undertaken with consideration of the need for high efficiency of production and of the need to accept very small margins of profit.

Attention to low capital costs per animal, large litters, two plus litters per annum and high efficiency in feed conversion are essential if the meal based producer is to compete with the whey producer who enjoys the advantages of lower feed and transport costs.
DISEASE PREVENTION IN THE PIGGERY

Mr. P. G. Davenport, Veterinary Advisory Officer (Pig Diseases), Department of Agriculture, Auckland.

Until comparatively recent times a high level of efficiency of production was of little apparent importance to the majority of pig farmers. The ready availability of cheap food such as whey, skim milk or garbage, meant that the number of sows required to produce a fixed number of pigs for market in any one year, was of minor significance. As costs were low 60 sows could be kept to produce 600 pigs and empty sows or high losses in individual litters were accepted as despite them, an overall profit on the enterprise was made.

However the position has now changed drastically in many areas due either to the disappearance of cheap food or the reduction in the returns for pig meat. The counter to this must obviously be an increase in efficiency and farmers must think in terms of producing 600 pigs from 40 sows. The only way in which this can be done is to reduce losses among the pigs born. Obviously the prevention of diseases provides a necessary first step in reducing the losses.

In practice pigs can be produced completely free of all diseases. They are called gnotobiotic animals and I was associated with their production during my recent stay in Canada. Unfortunately outside the world of research these pigs have very limited use as they are extremely expensive to rear despite the extreme rapidity with which they grow. A modification of this system is the Specific disease-free programme. Here the piglets are removed from the sow by Caesarian section. Initially they are reared on artificial diets until 6-8 weeks and then treated as normal pigs. As they mature they are allowed to breed naturally and their progeny reared as with orthodox pigs.

The only difference in this system of pig production is the absolute quarantine that is imposed on the farm to prevent contamination of the pigs with diseases carried by orthodox pigs. Despite some controversy many farmers in North America use the system to get rid of enzootic or virus pneumonia and have maintained their herds for about 10 years under these conditions. Some farmers have expressed interest in the development of a similar pattern in New Zealand but although it has undoubted value on individual farms, the time probably is not opportune for its extensive use.

Diseases are also prevented by regulation in New Zealand. This may sound rather far-fetched but I am referring to such things as swine fever and foot and mouth disease. Regulations have been drawn up and are vigorously policed by officers of the Department of Agriculture to prevent agents causing these diseases from getting into New Zealand. Obviously no regulation is infallible and can be either intentionally or accidentally broken. A lot of responsibility therefore remains with farms to ensure that the defence barriers set up by the regulations have not been breached. They can do this only by reporting immediately to a veterinarian if any untoward losses or symptoms occur in their livestock. The recent experience in North Auckland is an example of this type of disease prevention.

Some diseases can be prevented by the use of vaccines which increase the resistance of susceptible animals to a specific disease. In New Zealand leptospirosis is about the only pig disease where
this method of control is used extensively. Luckily swine erysipelas is sufficiently uncommon and responds so well to antibiotics that vaccination against this disease is unwarranted in New Zealand at this stage. This is in marked contrast to most of the major pig producing countries where erysipelas is of prime importance and vaccination is both essential and costly.

All the methods of disease prevention I have mentioned so far have limited practical application and none are infallible. I now want to discuss the most important and despite contrary opinion from some, the easiest method of disease control. The agent used is not 007 but 00 Farmer.

A survey carried out in South Auckland proved than an average of 38 per cent of pigs born in a group of poorly managed farms died before weaning. In comparison only 16.5 per cent of pigs born died in a comparable group of well managed farms. Putting the results another way, it showed that over 20 per cent more pigs or two more pigs per litter were successfully reared as a consequence of an improvement in management. Extending this survey to the national figure it would seem that at least two more pigs per sow could be marketed each year just by improving management. As our present production is 10.4 pigs per sow, the improvement by management alone would be nearly 20 per cent. What is more important is that this improvement could be achieved by the application of knowledge that is already available.

In case you think management is too vague a term to define, I intend to spend a little time on talking about the factors that make up management.

In my opinion the most important idea for a pig farmer to appreciate is that his is a production industry. The sow is the machine and the piglets the product. An inferior machine will produce either an inferior product or it will cease production. A herd sow must therefore be of known genetic merit and capable of regularly turning out an even high-quality piglet. Obviously she must be fed adequate quantities of properly balanced food at all stages of pregnancy and lactation. Similarly attention must be paid to the nutrition of younger pigs if diseases are to be kept at bay since any individual must have adequate nutrition to be well. Food excesses or deficiencies also have a profound influence on the course of diseases. We know that no matter how she is fed a sow’s milk will always be deficient in iron and her litter will quickly become anaemic unless supplied directly with supplementary iron. What is not so well known is that an anaemic pig is very susceptible to bacterial infections and many losses directly blamed on infectious scour are in reality primarily due to the iron shortage. Hence the recommendation to inject iron into the litter before they are three days old.

A new-born piglet is also very vulnerable to its environment and every endeavour must be made to keep this as near as possible to that which is ideal for example, the temperature in the creep must be of the order of 85 degrees Fahrenheit, but draughts which are more apt to occur at this high temperature must be eliminated by careful design of the creep. Dampness and poor sanitation go hand in glove with infections in the new-born.

Thorough cleaning, disinfection and spelling of farrowing crates, between sows will result in fewer losses.
As the pig gets older different stresses are likely to precipitate disease. For example when pigs are between three and four weeks old the resistance to disease which they acquired from their dams' colostrum begins to drop. They are not yet old enough to develop their own resistance which usually occurs when they are five or six weeks old. Consequently there is a two-week period when they are particularly vulnerable to disease. Weaning, too, is often associated with disease outbreaks. It needs little imagination to think of some of the stresses that occur at this time. Things such as changes of environment, or of diet, mixing with other pigs, crowded pens and so on can all occur. If they happen singly little damage is done but collectively they frequently lead to outbreaks of salmonellosis.

I have said little about treatment of disease as there are few instances where treatment actually helps to prevent disease. One exception is however in the prevention of serious effects of internal parasites. As every dog probably has to have its flea so too does every pig have its worm. Pasture management goes a long way to preventing heavy burdens being acquired and so too does strategic dosing of susceptible or exposed animals with appropriate drenches. Stomach worm control is a good example of this. Treatment of the sow before farrowing will prevent the transference of large numbers of the worm to her litter thereby preventing considerable reductions in growth rate.

There is another main thought on treatment of diseases. People with a fire insurance occasionally have to call in the fire brigade. Think of using drugs along the same lines. Use them to put out the fire and then seek out what caused the fire to start. If necessary get assistance in your investigations—it is not a case of money being spent unwisely. In most cases it will save you both time and money.
THE EFFECT OF PRICE ON THE PIG ENTERPRISE

Mr O. Kingma, Research Officer, Lincoln College.

Although present pig marketing questions and their adverse effect on financial positions of farmers involved in pig farming, are not conducive to expansion of the pig enterprise, it is nevertheless important to examine price levels at which it is profitable to produce pigs.

The effect of price fluctuations is undoubtedly the most serious uncertainty facing the specialist pig producer, and will, in the limited time available be handled by examination of a budgeted farm situation.

A 20-acre property carrying a 50-sow herd and associated fattening stock was used in the budgets, this representing the specialist type of pig unit which evolves in the absence of dairy by-products.

Land utilisation in the programme is with emphasis on quick rotation of green feed and fodder crops to provide maximum home grown sow feed. This integration of different crops to form a continuous feed supply without conservation of feed is extremely important and together with efficient return of pig manure to the soil, is the secret to success in the enterprise. Some lucerne has been established, greenfeed crops are grown for both winter and summer production and fodder beet is grown for winter feed.

1. Livestock Policy

The budgets have been established over a one-year period with initial stock numbers as in Table 1.1. This facilitated consideration of the pig enterprise as a “going concern” with fattening accommodation initially occupied by 245 fattening pigs. An efficiency level of 8.5 pigs reared per litter was incorporated while number of litters per sow was 2.02 during the budgeting period. The breeding herd should be maintained solely for the production of weaners and should be regarded as supplying these to the fattening unit. Criterion for production within the breeding herd should therefore be the weaning of the maximum number of high grade pigs per sow. Further, because the fattening pig requires a certain minimum amount of food per unit of liveweight gain, and has thus a virtually fixed profit margin, the management of the sow herd becomes critically important as a means of generating profit.

TABLE 1.1.

Stock Numbers at 31st March

<table>
<thead>
<tr>
<th>Stock Type</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sows</td>
<td>50</td>
</tr>
<tr>
<td>Gilts</td>
<td>4</td>
</tr>
<tr>
<td>Boars</td>
<td>3</td>
</tr>
<tr>
<td>Weaners</td>
<td>102</td>
</tr>
<tr>
<td>Suckers</td>
<td>76</td>
</tr>
<tr>
<td>Fattening</td>
<td>169</td>
</tr>
<tr>
<td>Total</td>
<td>404</td>
</tr>
</tbody>
</table>
While grazing of sows and growing of greenfeed for this purpose is essential to minimize the quantity of bought-in meal, the fattening herd must be grown under intensive, controlled or semi-controlled environmental conditions. Sales (Table 1.1) have been governed by the availability of fattening accommodation during different periods of the year, this resulting in a 50 per cent bacon policy, the balance being sold as pork with some surplus stock sold as weaners.

At weaning pigs are transferred to a weaner pool system on deep litter, the aim being to provide low cost, temporary housing from which pigs at store weight (9-10 weeks) are transferred to an enclosed fattening house.

2. Capital Involved

Herd establishment requires heavy initial capital outlay in both stock purchases and buildings plus subdivision with additional large amounts of initial working capital outlay in feeding the increased stock inventory. Capital involved is $15,442 (see Table 2.1) which includes a 4 per cent allowance for Working Capital.

TABLE 2.1.

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land—20 acres at $200/acre</td>
<td>$4,000</td>
</tr>
<tr>
<td>Buildings (plus fencing valuation)</td>
<td>4,440</td>
</tr>
<tr>
<td>Stock</td>
<td>4,922</td>
</tr>
<tr>
<td>Plant</td>
<td>1,486</td>
</tr>
<tr>
<td>Working Capital (4 per cent)</td>
<td>1,594</td>
</tr>
<tr>
<td><strong>Total Farm Capital Involved</strong></td>
<td><strong>$16,442</strong></td>
</tr>
</tbody>
</table>

Total capital involved per sow is therefore $329 while building capital outlay per sow is $89. Both these figures reflect a very good level of efficiency and can be regarded as the minimum outlay required for the budgeting assumptions used. Irrespective of whether it be appropriate to have fixed farrowing quarters or “Ark” farrowing outdoors (depending on climatic conditions), capital involved in running the breeding herd must be kept to a minimum, for production of cheap weaners.

3. The Financial Results

The initial farm budget, established as an equilibrium producing position, has in Table 3.1 been subjected to the effects of product price change. Five price regimes have been listed and meal prices incorporated were as follows:—

- Compounded Finisher Meal ... $58.33/s. ton
- Sow meal ... $54.00/s. ton
- Weaner Grower meal ... $66.00/s. ton

Results have been compared using “Owner’s Surplus,”* the resulting figures thus making allowance for all expenses (excluding taxation) and interest on capital at 6.75 per cent.

*Owner’s surplus can be defined as income less working expenses, allowance for depreciation and interest on total Farm Capital (6.75 per cent in this case), and is the sum available to the farmer as a reward for his labour and management.
Feed costs as a percentage of total costs (including interest on capital but excluding labour costs) represent 72 per cent of expenditure. However, if an allowance of $2,000 is included as payment for total labour required, this figure is reduced to 63.6 per cent of total expenditure.

Results show the marked effect which a small drop in product price has on the profitability of the unit. Owner’s surplus is reduced from plus $1,805 to minus $913 (a net drop of $2,718) with a 3.5 cent/lb drop in bacon and pork prices. Budgets included a grading of 70 per cent Prime 1 bacon, this giving under the assumptions used a level of 20 cents/lb (average) for bacon and 21.5 cents/lb for pork above which owner’s surplus becomes positive. If the enterprise was run as a specialist pig unit involving no supplementary enterprises however, then a price greater than 21 cents for bacon and 22 cents for pork would be required for a profit margin. Similar results are obtained using gross margins analysis.

**TABLE 3.1.**

**Effect of Price Change on Owner’s Surplus for a 50-Sow Herd**

<table>
<thead>
<tr>
<th>(Budgetary Analysis)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Price Regime</strong></td>
</tr>
<tr>
<td>Prime 1 Bacon (c/lb)</td>
</tr>
<tr>
<td>Prime 2 Bacon (c/lb)</td>
</tr>
<tr>
<td>Weaners ($/hd)</td>
</tr>
<tr>
<td>Pork Price (c/lb)</td>
</tr>
<tr>
<td><strong>Gross Profit</strong></td>
</tr>
<tr>
<td><strong>Cash Expenditure</strong></td>
</tr>
<tr>
<td>(a) Feed costs</td>
</tr>
<tr>
<td>(b) Other costs</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
</tr>
<tr>
<td><strong>Depreciation</strong></td>
</tr>
<tr>
<td><strong>Gross Expenditure</strong></td>
</tr>
<tr>
<td><strong>Net Income</strong></td>
</tr>
<tr>
<td><strong>Interest on total Capital involved</strong></td>
</tr>
<tr>
<td><strong>Owner’s Surplus</strong></td>
</tr>
</tbody>
</table>

In summary, these results have been achieved under a set of assumptions with respect to physical performance, meal prices, crop production and capital involved. The position may not altogether be proportionate however as provision of flexibilities in the management system may tend to have a “buffering” effect on profit at lower prices.
THE RELATIVE VALUES OF FISHMEAL AND MEATMEAL FOR GROWING PIGS

Mr A. C. Dunkin, Reader in Pig Husbandry, Massey University, Palmerston North.

Milk proteins are outstanding in their ability to promote rapid weight gains of high lean content in pigs. However these proteins are so valuable for human nutrition that it is inevitable that they be gradually replaced by cheaper substitutes in pig production. Already, for the grain feeder who does not have access to liquid skim milk or whey, the problem of alternative sources of protein to supplement grain to the best advantage is of major concern.

At the present stage, meat meals, meal and bone meals, and more recently, fishmeals, are the principal alternatives. While fish-meals are generally reckoned to be superior to meat meals as protein sources for pigs and poultry, they cost roughly twice as much per ton. It is therefore important to establish how these two protein concentrates compare in terms of their flesh building ability in pigs at different stages of growth. In the case of fishmeal, there is also the question of determining what dietary levels may be used without the risk of fishy taints in the meat.

Unfortunately, one of the major difficulties in making such a comparison is the wide variation in chemical composition and in nutritive value that occur in meatmeals and fishmeals. This fact must be borne in mind when considering the results from two individual feeding trials which were recently undertaken at Massey with the object of obtaining some preliminary information on the comparative nutritive values of meatmeal and fishmeal in all-meal diets for pigs killed at pork weight. In each of these trials only one consignment of fishmeal was compared with one consignment of meat meal. A total of 32 pigs was used in each trial.

Trial 1

In the first trial, a control mixture containing approximately 85 per cent barleymeal and 15 per cent meatmeal (54 per cent crude protein) was compared with three other mixtures in which respectively one-sixth, one-third and one-half of the meatmeal was replaced, on an equal protein basis, by fishmeal (58 per cent crude protein).

From 55 to 85lb liveweight, growth rate and food conversion efficiency improved progressively with the dietary level of fishmeal, those pigs fed the 50/50 fishmeal/meatmeal concentrate growing 18 per cent faster and requiring 10 per cent less food to reach 85lb than the control group. However, from 85 to 120lb liveweight, growth rate and food economy was similar for all treatment groups.

Assuming costs for barleymeal, fishmeal and meatmeal of $50 per short ton, $145 per short ton and $88 per long ton respectively, the total cost of food consumed for the growth period 55-85lb liveweight was 2½ and 5 per cent less for the two diets containing the greatest amounts of fishmeal. Conversely, since the more expensive fishmeal produced no response, relative to meatmeal, in rate or economy of gain from 85 to 120lb liveweight, the cost of the food eaten during this latter period was 8-9 per cent greater for these same two groups than for the controls.
So far as carcass characteristics were concerned, there was little difference between the control group and the two groups fed diets containing the lesser amounts of fishmeal. However, the carcasses from pigs fed the diet containing the 50/50 fishmeal/meatmeal protein supplement had 6-14 per cent less depth of fat over the “eye” muscle in the loin area. Dissection of rib joints (representing approximately 20 per cent by weight of the side) indicated an increase of approximately 4 per cent units of lean and a commensurate decrease in fat for this latter group compared to the control group.

As assessed subjectively by touch, there was a progressive softening of the fat as the level of fishmeal in the diet increased. A tasting trial, carried out by the Department of Food Technology at Massey, and using loin roasts from six pigs from each treatment group except that fed the lowest level of fishmeal, disclosed no significant treatment differences in respect of the flavour or odour of the cooked meat.

**Trial 2**

In view of the fact that in the first trial, growth response to fishmeal was restricted to the earlier stage of growth and was greatest for the highest fishmeal level tested, a second trial was undertaken in which the effects of (a) reducing the level of fishmeal at 85lb liveweight and (b) using a higher dietary level of fishmeal were investigated.

The four experimental treatments were:—

1. Treatment 1. 15 per cent meatmeal throughout (control).
2. 50-50 fishmeal/meatmeal and supplement to 85lb liveweight changing to all meatmeal thereafter.
3. All fishmeal (14 per cent) supplement up to 85lb liveweight, reducing to 50/50 fishmeal/meatmeal thereafter.
4. All fishmeal (14 per cent) supplement throughout.

During the stage of growth 45 to 85lb liveweight, those diets containing fishmeal again produced a progressive response in growth rate and food economy. From 85 to 125lb liveweight, whereas the group fed the 50/50 fishmeal/meatmeal diet had a similar growth performance to the two groups receiving meatmeal, those pigs continuing on the all-fishmeal protein supplement (Treatment 4) grew faster and more efficiently than the controls, although the relative response was less than half of that which occurred prior to the 85lb liveweight.

The cost of food eaten over the liveweight range 45 to 85lb by pigs fed the 14 per cent fishmeal diet was slightly greater than for the control group; whereas the food cost for the 50/50 fishmeal/meatmeal diet was slightly less than for the control diet.

Greater treatment differences were found in the fatness of the carcasses in Trial 2. Compared with the controls, those pigs fed the 50/50 fishmeal/meatmeal supplement to 85lb liveweight and only meatmeal thereafter (Treatment 2) had thinner backfat and 1.3 per cent units more dissectable lean in the rib joint. Those pigs fed 14 per cent fishmeal until slaughter were even leaner, with smaller backfat measurements and rib joints containing 5.1 per cent units more lean and 6.4 per cent less fat than the controls.
As assessed by touch, the fat of the pigs fed 14 per cent fishmeal until slaughter was extremely soft. Sample roasts from all carcasses have yet to the tested by a tasting panel.

**Summary—Conclusions**

The results from these preliminary experiments suggest that replacement by fishmeal of approximately half of the meatmeal in a 85:15 barleymeal:meatmeal diet is likely to have beneficial effects on growth rate and food conversion efficiency up to about 85lb live-weight and some favourable influence on carcass leanness at pork weight.

While the economic advantage of including fishmeal in the diet in the early stages of growth, will obviously depend on the relative prices of meatmeals and fishmeals and also on the relative nutritive values of particular consignments, evidence has been provided that use of the costlier fishmeal may even reduce food costs at this stage, apart from raising rate of throughput of pigs.

Beyond the 85lb liveweight stage, a dietary level of more than 7 per cent fishmeal was required to produce a relatively small improvement in growth performance. Although carcass leanness was influenced favourably by a 14 per cent dietary level of fishmeal until slaughter, fat firmness was adversely affected and the economics of using this relatively large amount of fishmeal—or even any fishmeal at all—from approximately 85lb liveweight would seem doubtful. The question of possible fishy taint associated with high levels of fishmeal, fed until slaughter, has not yet been settled.

Further work is required concerning the effect of variation in the nutritive value of both fishmeals and meatmeals on performance of pigs at different stages of growth and also an assessment of the comparative values of these foods at somewhat lower overall protein levels in meal mixtures than were adopted in the two trials reported here.
ECONOMIC POINTERS TO GRAIN-FEEDING PIGS IN NEW ZEALAND

Mr J. Baker, Department of Agriculture, Hamilton.

With the current cost/price squeeze situation in the agricultural sector and the prospects that the situation will deteriorate, there is a need to use a business management approach to pig farming. This paper will show how and by how much very small changes in farming efficiency will effect profits. In the paper a particular model is chosen to illustrate and examine these changes, and the effects on profitability. For this model certain costs and prices are assumed, there are realistic assumptions based on survey costings that have been made. These cost assumptions will not fit all situations, but by using the methods and tables in the paper each farmer will be able to calculate his own break-even costs using his own production efficiency levels.

This paper will examine the economics of bacon production only, as this is the market at which most farmers aim. The first and most important item to examine is feed and feed costs. In an all-meal feed unit, feed can account for 75 per cent of the costs incurred in the production of a pig.

Table 1 shows revenue received at various meat prices for a 135lb carcass. From the gross revenue the fixed costs are removed (column 3), this leaves the money that is available to cover all the other costs and profit. The fixed costs are those costs that would be incurred on the farm without any production. These costs vary widely from farm to farm and for this particular example they are calculated as follows:

<table>
<thead>
<tr>
<th></th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour</td>
<td>2000</td>
</tr>
<tr>
<td>Accountant</td>
<td>100</td>
</tr>
<tr>
<td>Administration</td>
<td>100</td>
</tr>
<tr>
<td>Interest and Principal on $10,000 for 15 years at 5% per cent</td>
<td>1000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$3200</strong></td>
</tr>
</tbody>
</table>

Assuming that this farm has a 50-sow herd producing 800 pigs per annum, this will put the fixed costs for this particular example at $4.00 per pig. From the Table it is seen that at a meat price of 21c/lb, $24.35 is left over to cover all the other costs. Referring this figure to Table 2, various break-even points can be determined.

Table 2 shows the total variable costs (weaner cost plus feed cost plus variable cost) for various feed costs, weaner costs and feed conversions efficiency. The variable costs include only those costs that change with the intensity of production, i.e.:

<table>
<thead>
<tr>
<th></th>
<th>Cents/pig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veterinary Expenses</td>
<td>0.30</td>
</tr>
<tr>
<td>Repairs and Maintenance 2 per cent</td>
<td>0.40</td>
</tr>
<tr>
<td>Farm Capital at $20/pig place</td>
<td>0.50</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$1.20/pig</strong></td>
</tr>
</tbody>
</table>
From Table 1 it was found that at a price of 21c/lb for pigmeat, $24.35 remained to cover all the other costs, i.e. those shown in Table 2. At all places on the Table 2 where this figure occurs, it will represent a break-even point. For each variation of feed conversion efficiency, the break-even line has been drawn in on the Table, all points to the left of this line will be economic, and to the right a loss. The Table shows that with very efficient cheap weaner production and between the feed conversions, the farmer can only afford to spend up to between $52/$64/ton for meal. At the more expensive weaner cost and most efficient feed conversion the farmer can only afford to spend up to $50/ton for meal. The conclusion is that as production becomes more efficient, the more the farmer can afford to spend on his meal or the greater his profit-margin becomes. As an example, at a feed conversion of 3.9 a reduction of $1.00/ton will increase profit by $69 per 100 pigs to bacon. The problem is how to reduce meal costs to these relatively low levels, the only way is to purchase barley direct from the paddock, store it in silos and use a mill to grind and mix the farm's rations. This will ensure the feed to be economically priced, the farmer will be free from market price fluctuations and shortages over the year, as the annual requirement is stored in the silo.

TABLE 1

Revenue and Revenue Available to Cover Costs in Table 2.
N.B. (135lb Carcass).

<table>
<thead>
<tr>
<th>Price/lb cents</th>
<th>Gross Revenue $</th>
<th>Fixed Costs $</th>
<th>Money Available to Cover All Other Costs $</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>24.30</td>
<td>4.00</td>
<td>20.30</td>
</tr>
<tr>
<td>19</td>
<td>25.65</td>
<td>4.00</td>
<td>21.65</td>
</tr>
<tr>
<td>20</td>
<td>27.00</td>
<td>4.00</td>
<td>23.00</td>
</tr>
<tr>
<td>21</td>
<td>28.35</td>
<td>4.00</td>
<td>24.35</td>
</tr>
<tr>
<td>22</td>
<td>29.70</td>
<td>4.00</td>
<td>25.70</td>
</tr>
<tr>
<td>23</td>
<td>31.05</td>
<td>4.00</td>
<td>27.05</td>
</tr>
<tr>
<td>24</td>
<td>32.40</td>
<td>4.00</td>
<td>28.40</td>
</tr>
</tbody>
</table>

The next pointer follows on from this in that, having acquired this cheaper feed it must be efficiently utilised by the pigs, or their feed conversion efficiency must be improved. The effects of this have already been discussed and shown under Table 2. As an example, if feed costs 2.8 cents/lb, a 0.1 improvement in feed conversion would save 42 cents per pig or $42 per 100 pigs to bacon. To effect this improvement an intensive breeding policy must be followed, for it is a known fact that feed conversion efficiency is a highly heritable trait. Performance tested boars must be used and gilts must be selected by performance not appearance alone. A side effect of poorly selected gilts is that their progeny would be more likely to lay down fat at a lighter weight. At this point it would take two and a half times more energy (or feed) to lay down the fat than the lean, with meal supplying this energy the economics of this situation is clear.

135
TABLE 2

Total Variable Costs with Changes in Feed Conversions, Weaner Cost and Meal Price to Bacon Weight.

(Total Variable Cost = Weaner cost + Feed cost + Variable cost $1.20)

FEED CONVERSION EFFICIENCY (lbs meal/lb Liveweight gain)

<table>
<thead>
<tr>
<th>MEAL PRICE AT TROUGH (cents/lb)</th>
<th>3.5 - 1</th>
<th>3.7 - 1</th>
<th>3.9 - 1</th>
<th>4.1 - 1</th>
<th>4.3 - 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>$</td>
<td>6 8 10</td>
<td>6 8 10</td>
<td>6 8 10</td>
<td>6 8 10</td>
<td>6 8 10</td>
</tr>
<tr>
<td>2.2</td>
<td>18.77 20.77 22.77</td>
<td>19.42 21.42 23.42</td>
<td>20.08 22.08 24.08</td>
<td>20.73 22.73 24.73</td>
<td>21.39 23.39 25.39</td>
</tr>
<tr>
<td>3.2</td>
<td>24.00 26.00 28.00</td>
<td>24.96 26.96 28.96</td>
<td>25.92 27.92 29.92</td>
<td>26.88 28.88 30.88</td>
<td>27.84 29.84 31.84</td>
</tr>
<tr>
<td>3.4</td>
<td>25.05 27.05 29.05</td>
<td>26.07 28.07 30.07</td>
<td>27.09 29.09 31.09</td>
<td>28.11 30.11 32.11</td>
<td>29.13 31.13 33.13</td>
</tr>
<tr>
<td>3.6</td>
<td>26.10 28.10 30.10</td>
<td>27.18 29.18 31.18</td>
<td>28.26 30.26 32.26</td>
<td>29.34 31.34 33.34</td>
<td>30.42 32.42 34.42</td>
</tr>
<tr>
<td>3.8</td>
<td>27.15 29.15 31.15</td>
<td>28.29 30.29 32.29</td>
<td>29.43 31.43 33.43</td>
<td>30.57 32.57 34.57</td>
<td>31.71 33.71 35.71</td>
</tr>
<tr>
<td>4.0</td>
<td>28.20 30.20 32.20</td>
<td>29.40 31.40 33.40</td>
<td>30.60 32.60 34.60</td>
<td>31.80 33.80 35.80</td>
<td>33.00 35.00 37.00</td>
</tr>
</tbody>
</table>
Table 2 also shows the effects of reducing weaner costs, this is directly reflected in profit. A method of achieving this is discussed in a paper given by Dr Adams of Ruakura.

The next economic pointer is shown in Table 3 which shows how the profit per sow per annum is affected by the number of weaners reared per year. Based on the assumptions stated in the notes between a production level of 10-18 weaners/annum profit is increased from a negative figure to $56/sow. The break-even point for this situation is 11 pigs/annum, which is above the national average. Increase in sow output can only be achieved by stock management—farmers must operate on a 3-5 week weaning system depending on capability so ensuring a production of two litters/annum from the sow; the sows must be hand-mated so that misses can be avoided; the farrowing quarters must be well designed to minimise post-natal losses; the post service management of the sows will also play an important role, stress during the first month of pregnancy must be kept to a minimum if the litter rates are to remain high.

As pig-farming becomes more specialised and capitalised, fixed costs will increase and on the smaller units they could become a burden. The only method of overcoming this problem is to spread their charges over more productive units (weaners), this has been shown on a per sow basis in Figure (1) by increasing the sow output from 9-18 pigs reared per sow per annum. If the fixed costs are still a burden after this improvement has been effected, then and only then comes the time to increase the sow numbers.

The final pointer which will affect the economics of the enterprise, is the “Turnover Effect” or the number of pigs marketed per annum. If the sows are producing 16 pigs per annum and only 15 of them are marketed, profits will be reduced and farm management would be affected by the increased pressure on the available building space. But as the efficiency of feed conversion and sow output increases, the annual turnover will automatically increase.

These examples show clearly that with the current cost/price squeeze situation, how a very small change in the management practices on the farm will affect profits. To utilise this type of information to the maximum, it is essential to record intensively both for the physical and the financial information on the farm. Only then can the farmer assess his current situation, plan changes and budget with confidence.

Summarising the pointers to profitability:
(1) Decrease meal costs.
(2) Improve feed conversion efficiency.
(3) Reduce weaner cost.
(4) Increase weaner production from the sow.
(5) Spread fixed costs over more units of production.
(6) Increase turnover.
(7) Record.
### TABLE 3
**Profit/Sow/Annun Related to Weaners Reared/Sow/Annun**

<table>
<thead>
<tr>
<th></th>
<th>No. of Weaners Reared</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Sow meal including boars’ share (Note i)</td>
<td>60.05</td>
</tr>
<tr>
<td>Fattening meal (Note ii)</td>
<td>148.20</td>
</tr>
<tr>
<td>Creep meal (Note iii)</td>
<td>10.00</td>
</tr>
<tr>
<td>TOTAL FOOD</td>
<td>218.25</td>
</tr>
<tr>
<td>Other Costs (Note iv)</td>
<td>54.75</td>
</tr>
<tr>
<td>Stock Depreciation</td>
<td>15.00</td>
</tr>
<tr>
<td>TOTAL COSTS</td>
<td>288.00</td>
</tr>
<tr>
<td>Value of Baconers (Note v)</td>
<td>283.50</td>
</tr>
<tr>
<td>PROFIT/SOW/ANNUM</td>
<td>-5.50</td>
</tr>
</tbody>
</table>

**Notes:**
(i) Sow meal is based on 2080 F.U. for 10 weaners increasing by 28lb/weaner.
(ii) Meal at 2.6c/lb and Feed Efficiency of 3.8 (or $14.82/weaner).
(iii) Based on 4c/lb and 25lb/piglet.
(iv) Labour, etc., based on 25 per cent of feed cost.
(v) Taken as 135lb carcass at 21 cents.

### SUNDARY TABLE
**Meal Cost 40lb-190lb Liveweight for Various Feed Conversion Efficiencies**

<table>
<thead>
<tr>
<th>Efficiency of Feed Conversion</th>
<th>3.5</th>
<th>3.7</th>
<th>3.9</th>
<th>4.1</th>
<th>4.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2</td>
<td>11.57</td>
<td>12.22</td>
<td>12.88</td>
<td>13.53</td>
<td>14.19</td>
</tr>
<tr>
<td>2.4</td>
<td>12.60</td>
<td>13.32</td>
<td>14.04</td>
<td>14.76</td>
<td>15.48</td>
</tr>
<tr>
<td>2.6</td>
<td>13.65</td>
<td>14.43</td>
<td>15.21</td>
<td>15.99</td>
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GRAIN FEEDING OF THE SOW

Dr J. L. Adams and Mr I. J. Shearer, Scientific Officers, Ruakura Agricultural Research Centre, Hamilton.

The production of weaner pigs using meal feeds can be expensive. Under these conditions the cost of the weaner reflects mainly the high cost of meal fed to the sow. The sow, however, costs nearly as much to maintain whether she produces 12, 16 or 18 pigs a year. Because of this, the cost of producing a weaner can be reduced by increasing sow productivity. This involves producing more pigs per litter, and more litters per sow during the year.

In addition to increasing sow productivity as a means of reducing the cost of producing each weaner, there is also the question of how much or how little meal is required by the sow to produce and rear a healthy litter. For the purposes of this discussion let us consider the energy requirement of the sow, which for convenience we can regard as pounds of meal. The meal used for this comparison would be typified by a basal mixture containing 81 per cent barley meal and 18 per cent meat meal.

As the amount of meal eaten by a sow during the reproductive cycle can influence the cost of weaner production, it is of interest to examine briefly energy allowances for the sow. Two such recommended allowances are those published by the National Research Council 1964 (NRC) in America, and the Agricultural Research Council 1967 (ARC) in the U.K. For in-pig gilts weighing 300lb live-weight the energy requirement given by the NRC can be met by an average daily meal allowance of 5.9lb as against 4.0lb cited by the ARC. This difference in the amount of meal would mean a difference of approximately $6.30 in the cost of producing a litter. There is also the point that pasture herbage could well be a cheaper source of feed for sows than meal. If this is the case it might be possible to reduce still further the cost of producing a weaner by replacing part of the meal allowance by grass or lucerne.

With a view to the possibility of reducing the cost of weaner production by varying the level of meal intake and also by substituting pasture herbage for meal, a trial was commenced early last year. The trial was designed to measure the effects of both the level of meal feeding and pasture feeding during pregnancy on sow and litter performance.

The dietary treatments were imposed only during pregnancy with the level of feeding during lactation being dependent on the number of live piglets (Table 1). Pregnancy was divided into three parts, one week post service, the subsequent 10 weeks and the final 5 weeks prior to farrowing. Meal was fed to the sows at two levels—the higher level of feeding was 6lb, 4lb and 6lb of meal daily for the
three stages of pregnancy previously outlined. The lower level represented a daily feed reduction of 1lb of meal so that these animals received daily amounts of 5lb, 3lb and 5lb of meal. The total energy intake in pregnancy by sows fed these amounts of meal represented 123 and 95 per cent of the ARC 1967 recommended allowance for the high and low meal feeding levels respectively. In addition to the two levels of meal feeding, a further two diets were formulated in which grass replaced part of the meal allowance. Earlier trial work at Ruakura indicated that a sow could derive a daily amount of energy from grass equivalent to 3lb of meal. Thus in order to have a meal-grass treatment equivalent to the higher level of meal feeding, it was necessary to give the sows 3lb, 1lb and 3lb of meal respectively, in addition to grazing, during the three stages of pregnancy. The corresponding daily meal allowances at the lower feeding level were 2lb, 0lb and 2lb of meal. During lactation the sows received a daily allowance of 4½lb of meal plus 1lb for each live piglet. In both pregnancy and lactation the same meal mixture was used, comprising approximately four parts barley to one part meat meal with the addition of vitamins and trace minerals.

For the trial a total of 48 large White Berkshire gilts were placed on their respective dietary treatments. During their first pregnancy the grazing sows did not have their meal intake reduced to either 3lb or 2lb daily, but remained on either 5lb or 6lb during the first and last stages of pregnancy. Grazing was carried out only during pregnancy with the aid of an electric fence, and depending on whether the sows were grazed during the day or night, they had access to pasture for either eight or 14 hours daily. Four days prior to farrowing the gilts were moved to round houses where they remained until the litter was four days old. At this time sows and litters were transferred to larger pens, and the litters were injected with an iron compound. Creep feed and water were available to the litter from two weeks of age. First litter sows were weaned at five weeks, while second and third litters were weaned at four weeks of age.

The gilts were all served at an average of 230lb liveweight (Table 2). At the beginning of their second pregnancy the animals on the higher level of feeding were heavier by 24lb than their mates on the lower level of feeding. This weight advantage increased to 50lb at the time of the third service, the net result of this being that the higher plane sows weighed 300lb at second service, while animals on the lower level of feeding did not reach this weight until their third service. During their first litters the grazing groups did not outgrow their meal-fed contemporaries, despite the higher theoretical intake of meal by the former groups.

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During the first two stages of the second pregnancy it was found (Figure 1) that those sows which received 4 lb of meal daily held body weight and soon began to increase in weight. However, when only 3 lb of meal was given daily sows lost weight and only regained their service weight after approximately nine weeks. Against this both grazing groups increased steadily in weight throughout pregnancy. During the last five weeks of pregnancy sows fed the all-meal rations gained more weight than their grass-fed counterparts. This latter finding could have reflected a lack of grass due to unusually dry weather at the beginning of the year. Nevertheless it would appear that grazing of suitable quality pasture for between eight and 14 hours daily, can provide an amount of energy roughly equivalent to that contained in three pounds of meal. In addition it would also seem unwise to reduce the level of feeding below 4 lb of meal daily, or its equivalent, particularly during the first 11 weeks of pregnancy. During the suckling period changes were found in sow body weight. These tended to differ between treatment groups but were generally very small.

For both first and second litters there was a tendency for fewer live pigs at birth in those litters from sows fed the lower all-meal ration (Table 3). Apart from this observation there was little difference between the remaining treatments in the number of live pigs at birth. For the first litters, the litter weight at birth was slightly heavier for those sows fed the higher level of feeding during preg-
nancy. This difference was much less marked for the second litters. In general there were more live pigs born and also heavier litter weights for the second as opposed to first litters.

The most noticeable feature of the litter performances at five weeks was the relatively poor results obtained from sows fed the lower all meal level rations (Table 4). These sows weaned an average of 7.4 and 7.9 pigs which weighed a total of 134 and 154lb at five weeks for their first and second litters respectively. While a similarly poor result was obtained from the corresponding grazing group in their first litter, this was most probably due to a combination of inadequate housing with a particularly heavy frost. In their second litter the low level grazing group produced nine pigs weighing a total of 153lb, a performance similar to that obtained from sows on the higher level of feeding. The poor litter performance of the sows fed the lower all-meal ration level cannot at present be explained, it seems unlikely, however, that their poor performance was in any way related to the level of meal or energy intake, even though this was 5 per cent less than that recommended by the ARC 1967. In view of the satisfactory performance which was found in earlier trials using the low level of meal intake, the possibility, that the present group of sows were generally poorer performers regardless of any treatment cannot be excluded. This particular finding will be investigated further in another trial.

At the outset one aim of this trial was to reduce the cost of weaner production through lowering the meal intake during pregnancy, and by substituting pasture herbage for meal. For this purpose it has been assumed that sow meal costs $60 and creep meal $100, both per short or 2000lb ton. The cost of grazing has been put at $80 per acre. This represents the opportunity cost of dairying. If we were to regard sheep as an alternative instead of dairying this figure would be lower. On the basis of grazing at $80 per acre, and assuming one acre supplies 3lb of meal equivalent daily for eight sows over a year, the cost of grazing per sow per day would be 2.7 cents. This represents a total grazing cost of $2.99 per sow for a complete pregnancy.

When these costings were applied to the trial data it was found that the total feed cost of producing a litter was $34.58 at the higher level of meal feeding (Table 5). This feed cost was reduced to $28.23 when the meal intake during pregnancy was reduced by 1lb per day. By substituting pasture for meal at the higher feeding level, the feed cost of producing a litter dropped to $38.70. The corresponding figure obtained by substituting grass for meal at the lower level of feeding was $24.00. While we were successful in reducing the feed cost per litter by manipulating meal intakes and by substituting pasture for meal, the only meaningful costings were those calculated on the basis of either each pig weaned or per pound of pig liveweight produced at five weeks. When this was done the importance of the number of pigs weaned can be appreciated. Whereas it was found that the feed cost of producing a litter was less as the meal level was reduced, because fewer pigs were weaned from sows on the lower all-meal ration, these pigs cost $3.67 in feed to produce, as opposed to only $3.58 at the higher level of meal feeding. The replacement of meal by pasture was found to reduce the feed cost per weaner by 142
48 cents to $3.10 and by 85 cents to $2.82 for the high and low levels of feeding respectively. As the weight of the litter at five weeks was related to the numbers of piglets at this time, the feed cost per pound of liveweight followed the same pattern as the feed cost per pig.

In conclusion, it appeared that sows which grazed suitable quality pasture derived approximately the same daily amount of energy, as contained in 3lb of meal composed of four parts barley meal to one part meat meal, with added vitamins and minerals. However, the sow growth rate data indicated that 4lb of meal or its equivalent provided the approximate minimum requirement of energy for satisfactory growth during pregnancy, in sows weighing up to 300lb liveweight at mating. As sow and litter performance was unsatisfactory at the lower level of all-meal feeding, where meal intakes were as low as 3lb per day, this particular feeding regime cannot be recommended without further investigation. Finally, while the feed cost of producing a weaner was not reduced by lowering the level of meal feeding during pregnancy, cost savings were achieved by substituting pasture herbage for meal.

**TABLE 1**

Daily Allowances of Meal (lb) with Grazing (G) During Pregnancy and Lactation.

<table>
<thead>
<tr>
<th>Diet</th>
<th>Stage of pregnancy (weeks)</th>
<th>Total Meal (lb)</th>
<th>Lactation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>2-11</td>
<td>12-16</td>
</tr>
<tr>
<td>6 - 4 - 6</td>
<td>6</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>3 - 1 - 3</td>
<td>3+G</td>
<td>1+G</td>
<td>3+G</td>
</tr>
<tr>
<td>5 - 3 - 5</td>
<td>5</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>2 - 0 - 2</td>
<td>2+G</td>
<td>0+G</td>
<td>2+G</td>
</tr>
</tbody>
</table>

**TABLE 2**

<table>
<thead>
<tr>
<th>Diet</th>
<th>Liveweight (lb) at Service (Litter)</th>
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<tbody>
<tr>
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<td>1</td>
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<tr>
<td>6 - 4 - 6</td>
<td>228</td>
</tr>
<tr>
<td>3 - 1 - 3</td>
<td>234</td>
</tr>
<tr>
<td>5 - 3 - 5</td>
<td>228</td>
</tr>
<tr>
<td>2 - 0 - 2</td>
<td>235</td>
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### TABLE 3
The Effect of Dietary Treatment During Pregnancy on the Performance of the Litter at Birth (Pigs born alive).

<table>
<thead>
<tr>
<th>Diet</th>
<th>1st Litter</th>
<th>2nd Litter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nos. Wt (lb)</td>
<td>Nos. Wt (lb)</td>
</tr>
<tr>
<td>6 - 4 - 6</td>
<td>10.1 26</td>
<td>11.4 33</td>
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<tr>
<td>3 - 1 - 3</td>
<td>10.8 26</td>
<td>11.1 32</td>
</tr>
<tr>
<td>5 - 3 - 5</td>
<td>8.4 20</td>
<td>10.1 28</td>
</tr>
<tr>
<td>2 - 0 - 2</td>
<td>9.1 22</td>
<td>12.4 27</td>
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### TABLE 4
The Effect of Dietary Treatment during Pregnancy on the Performance of the Litter up to 5 Weeks of Age.

<table>
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<th>2nd Litter</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Nos. Wt (lb)</td>
<td>Nos. Wt (lb)</td>
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<tr>
<td>6 - 4 - 6</td>
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<tr>
<td>3 - 1 - 3</td>
<td>9.4 171</td>
<td>9.1 160</td>
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<td>5 - 3 - 5</td>
<td>7.4 134</td>
<td>7.9 154</td>
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<tr>
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<td>9.0 153</td>
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### TABLE 5
Feed Costs in the Production of Weaner Pigs.

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<tr>
<th>Diet</th>
<th>Litter ($</th>
<th>Meal Weaner ($</th>
<th>Cost per lb piglet weaned (cents)</th>
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<td>19</td>
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<td>20</td>
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<td>2 - 0 - 2</td>
<td>24 - 00</td>
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