Lincoln College
Farmers' Conference 1975

LINCOLN COLLEGE FARMERS' CONFERENCE 1975

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UNIVERSITY COLLEGE OF AGRICULTURE
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PRE-CONFERENCE ADDRESS

PROFESSOR I.E. COOP

The pre-Conference address by Professor I.E. Coop was delivered from notes and not as a paper. The Conference Committee thought that the material would be of general interest and should, if possible, be published. His address was based on his observations on a recent visit to U.S.A. and U.K., and these observations are available in his report to the College Council. Accordingly, the relevant parts of that report are published here.

Editor

PROGRESS IN SHEEP PRODUCTION OVERSEAS

PROFESSOR I.E. COOP

PROFESSOR AND HEAD OF ANIMAL SCIENCE DEPARTMENT
LINCOLN COLLEGE

In view of the importation and impending release of Finn, East Friesland, Oldenburg and Oxford Down sheep from quarantine, I made a special survey of the results being obtained from exotic sheep and their crosses.

Most of the data is from U.K. and Ireland and must be seen against a background which is quite different from that in New Zealand. Briefly, this is that hill sheep weigh about 45 kg (100 lb), have a lambing percentage of 80-100% and a higher litter size (see footnote), is not particularly wanted in this environment. Crossing of hill ewes such as Blackface, Cheviot and Welsh Mountain with a high fertility sire such as the Border Leicester to produce F_1 crossbred ewes is well established. These crossbred ewes and F_2 ewes produced by the Suffolk ram over these F_1 ewes form the dams for fat lamb production in the lowlands. These crossbred ewes weigh about 70-80 kg (150-180 lb) and have litter sizes of 1.8-2.1, and lambing percentages

Footnote: The term litter size is widely used in U.K., is synonomous with prolificacy or lambs born per ewe lambing.

of 150-180%. The long wool breeds are of low fertility and relatively unimportant. They include the Romney, Devon and Galway, and weigh about 65 kg (140 lb) and have litter sizes of about 1.3-1.4.

Exotic sheep and their crosses have, therefore, to compete with breeds and crosses which already have very high productivity by New Zealand standards.

FINN

The Finn was first imported into U.K. in 1962 by the Animal Breeding Research Organisation (A.B.R.O.) which has the most extensive source of data. Table 1 is a summary of the performance of the pure Finns at A.B.R.O. over the years 1963-73.

TABLE 1

Performance of Pure Finns

Class	No. Recorded	% Dry	Litter Size	Lambs Weaned/ Ewes Lambing
Ewe lambs	65	6	2.0	1.1
Two tooths	116	8	2.8	2.2
Ewes (4t and over)	164	3	3.1	2.6

The liveweight of the pure Finns was 50-55 kg (110-120 lb) with some up to 150 lb.

Most interest, however, lies in the crossbreds. A.B.R.O. organised a series of field trials under commercial conditions in which F_1 Finn cross ewes were compared with F_1 Border Leicester crosses in a number of upland and lowland flocks.

A.B.R.O. - Animal Breeding Research Organisation

The results from these trials are presented in Table 2.

TABLE 2

Comparison of Finn and Border Leicester Cross Ewes

		Finn Cross Ewes	B.L. Cross Ewes
Lambing %	Ewe lambs	116	71
	Two tooths	172	146
	Ewes	203	166
Liveweight of lamb weaned	Ewe lambs	138	100 Control
	Two tooths	108	100 Control
	Ewes	94	100 Control
LW lamb weaned corrected for ewe LW .73	Ewe lambs	147	100 Control
	Two tooths	122	100 Control
	Ewes	106	100 Control

The Finn cross ewes were 20% lighter than the B.L. cross ewes and this difference is taken into account in the last section of Table 2. These trials show that the Finn cross ewes produce substantially more lambs but their lower growth rate offsets this so that in terms of liveweight of lamb weaned per ewe, there are only marginal differences except as ewe lambs. Even allowing for the lower body size of the Finn cross ewes and thus making an estimate of lamb weaned per hectare, the advantage to the Finn is only apparent in young ewes. In a mixed age flock the advantage to the Finn would be relatively small.

A.B.R.O. has since turned its attention to comparing Finn x B.L. rams with B.L. rams in the production of first cross ewes.

Here again differences have not been large. Ewes by the Finn x B.L. ram have produced more lambs but these have been of lower weaning weight (2 kg lower).

In Ireland, breed comparison trials over the years 1966-72 included the Finn crosses. The purebred ewes were Cheviots and Scottish Blackfaces, and the crossbreds were the Border Leicester and Finn over these. A condensed summary is given in Table 3.

TABLE 3

Comparison of Border Cross, Finn Cross and Purebred Ewes

	Pure Bred	Border Cross	Finn Cross
Liveweight kg (lb)	49 (109)	58 (128)	48 (107)
Barren (%)	13	11	10
Litter size	1.57	1.67	1.92
Lambs weaned/ewes lambing	1.23	1.31	1.42
LW lambs weaned/ ewe lambing (kg)	33	37	35
LW lambs weaned/ 45 kg ewe LW mated	27	28	32
Ewe fleece weight (kg)	2.3	3.2	2.5

This summary shows the considerable increase in litter size of the Finn cross offset, however, by higher lamb losses and lower lamb growth rates (3 kg lower than Border cross) so that on a per ewe basis the Finn was no better than the Border ewes and only when adjustment is made for the small size of the Finn cross ewe does its superiority emerge.

In another comparison, this time over the local Galway ewes, it again showed the very large increase in litter size of the Finn cross sheep, especially when the Finn is crossed over a relatively low fertility breed such as the Galway.

The Finn was later in reaching the U.S.A. so that results to date there do not include mature ewes data. Results from several sources confirm the precocity of Finn cross sheep. Conception rates in F_1 Finn cross ewe lambs are of the order of 80-90% with litter size 1.4-1.5. Litter size for two tooth ewes is reported as around 1.9-2.0 and weaning percentage (lambs weaned/ewes mated) 1.3-1.6. This is greatly in excess of that of purebred ewes since the latter are of the order of 1.5 per litter size and 1.1 for weaning percentage even in mixed age sheep.

The present feeling about Finn crosses amongst U.S. scientists is one of optimism, but it has to be said that the impact on the U.S. sheepbreeder is yet to be felt. In the U.K. and, to a lesser extent in Ireland, this latter impact has already occurred. One estimate of the number of Finn crosses in U.K. is 10,000-15,000 ewes. As a generalisation, it can be said that the Finn has not produced any substantial improvement for the traditional sheep farmer. The advantage of the extra lambs which are produced is offset by higher lamb losses, slower growth rate and poorer carcase quality. Many farmers who have had Finn crosses have gone out of them. All this is rather unfair to the Finn. The U.K. sheep farmer is already producing at a very high level of individual performance with traditional crossbred ewes and it will take a very good sheep to improve on it. Finn cross sheep are smaller and the consequence of being able to carry more per acre is not considered. Very high fertility sheep require a more sophisticated level of nutrition and management, and the Finn crosses have been asked to fit into an existing system. Nevertheless the fact remains that in the eyes of the farming community the Finn has failed. A more sober and cautious approach, however, now seems to be emerging. Some farmers are in fact making a "go of it" with Finn crosses, especially with

¼ Finn crosses and there is a little renewed interest after an initial period of disillusionment.

In several centres (research stations and Universities) very high performances - 200% of lambs weaned and satisfactory lamb growth rates - are being obtained with ½ Finn and ¼ Finn crosses, and at lighter bodyweights and higher stocking rates than conventional crosses. The scientists' view is that it will now be a long haul to re-establish the reputation of the Finn. Present thinking is that a ¼ Finn ewe is the best answer. At A.B.R.O. there is a project to produce a synthetic ram breed as an alternative crossing ram to the Border Leicester from a gene pool of ½ Finn and 1/6 each of East Friesland, Border Leicester and Forset, but with the present thought that they would now like to see a higher proportion of East Friesland. When crossed over hill ewes, this would give a ¼ Finn. In Ireland, the proposal is to look at a ¼ Finn, ¼ Texel, ½ Galway (local ewe) and if this looks promising, then to interbreed it to produce a new breed to replace the Galway.

The lessons for New Zealand are fairly obvious. In brief, this is that the Finns should not be oversold and should not be released into commercial practice until thoroughly tested and all the considerations weighed up to give a sober, down-to-earth assessment of the part which they should play. Premature release to farmers could lead to the somewhat unfortunate situation that has arisen in the U.K. Having said that, it is my opinion that because of the lower base level of fertility from which we will be working in New Zealand and the lessons to be learned from U.K. experience, the chances of making use of the Finn are better in New Zealand than in the U.K.

EAST FRIESLAND

Much less attention has been devoted to this breed in the U.K. and it has not been used in Ireland at all.

Comparison of the F_1 Finn x Blackface and East Friesland x Blackface ewes is taking place at Leeds University (under grant from the A.R.C.) with 100 ewes of each cross. The flocks bred contained no ewe lambs but did contain 60% of two tooths in 1973 and only mature ewes in 1974. A summary of results is given in Table 4.

TABLE 4

Comparison of F x BF and EF x BF Ewes

	1973		1974	
	F x BF	EF x BF	F x BF	EF x BF
Mean liveweight, kg	54	62		
Litter size	2.8	2.2	2.4	2.2
Lambs sold/ewe lambing	2.3	2.0	2.0	1.9
Av. daily gain, kg	0.26	0.34	0.27	0.36
Fleece weight, kg	1.9	2.5		

The East Friesland cross is a bigger and more presentable looking sheep. On a per ewe basis the slightly lower number of lambs weaned is more than offset by the better growth rates and fleece weight. Under the conditions of these trials, the traditional Border Leicester x Blackface would be expected to give 1.70 lambs weaned per ewe.

Trials in Scotland comparing the East Friesland Finn x Blackface with the Border Leicester x Blackface gives the former 0.2-0.3 superiority in litter size.

The East Friesland, with its greater size, outstanding milk production and high fertility, shows promise as a means of complimenting the Finn or any other breeed needing higher milk production. Apparently the East Friesland crossbred sheep show no signs of the problems which are recognised in the pure East Friesland. Opinion in the U.K. seems to be moving in favour of this breed.

TEXEL

This breed was imported first into Ireland. An extensive fat lamb sire trial has recently been completed with the following results (Table 5).

TABLE 5

The Texel as a Fat Lamb Sire

	Texel	Suffolk	Other Downs
Number of rams used	32	48	28
Average daily gain, kg	0.18	0.19	0.18
Carcase weight, kg	18.9	19.4	18.9
% fat	23	27	28
% lean	60	56	56
Eye muscle area in ^{2}	12.0	11.2	11.6

This shows the Texel up in very favourable light in terms of lean meat production and is the reason for the keen interest in this breed as an ingredient in any Meat Sire lines. Preliminary and limited results of their use in U.K. shows it to have a lower growth rate than the Suffolk and a leaner carcase. There is definitive interest in this breed.

FINN x DORSET

As a crossing ram for producing F_1 ewes it was first introduced by Cadzow as his Improver ram. Current belief is that it is marginally better than the Border Leicester in this role. The other role is as a ewe of high fertility, both parents of long breeding season and the conformation of the Dorset offsetting that of the Finn. In accelerated lambing where high fertility is essential and out of season breeding very desirable, this cross has much to commend it. A small scale trial of twice a year breeding under grazing has started in Scotland.

INTENSIVE LAMB PRODUCTION (ACCELERATED LAMBING)

This has been the goal of the research worker for many years. As the techniques of light treatment, exogenous hormone therapy and the introduction of the Finn came, so the possibility of going really intensive loomed up. The enormous advances made in chicken and pig production offered a blueprint for successful intensification. Intensification involves "accelerated lambing" as it is now called, early weaning, together with housing, hormones and perhaps light. It is one of the technical achievements of the last 20 years that seasonal breeding breeds can be made to breed out of season and so produce two lamb crops per year or at least 3 crops in 2 years. To breed twice a year lambs must be weaned at a few days of age, usually 1 day of age, and weaned artificially on milk replacers and concentrates. Average gains of 0.3 kg/day can be achieved and lamb mortalities are quite low, i.e., 5%. The technique has been solved but the process is uneconomic at today's values. Under complete housing, light control and using hormonal induction of oestrus and wide breeding season ewes (Finn x Dorset), research workers at the Rowett Research Institute have, for the last three years, operated a system of lambing every 7 months, allowing one month of suckling and weaning on to concentrates at 4 weeks of age. This system is producing 3.1 lambs per 12 months. Here again the recent rise in concentrates has made the system uneconomic and the Institute is now looking towards lambing 3 times in 2 years as an alternative system. The first attempt to carry the system to a more practical stage, under grazing, started in Ireland a year ago. Here the ewes will be sponged and

PMS'ed (see Footnote) and lambed three times in two years with the ewes at grazing all year but the lambs weaned at 4-10 weeks of age, according to season of lambing, and the lambs fed concentrates. The target performance is 3 lambs/year. There are certain to be teething troubles; however, it is only by doing experiments of this sort that progress is made!

One cannot help but admire the technical achievement. It is being operated commercially by several producers in France with wide breeding season ewes, lambs weaned 5-6 weeks, housed, and lambing 3 times in 2 years. The French are well up in this field but the major reason for French success is that the price of lamb is almost double that in U.K. ($2.80/kg out of season, $2.20/kg in season - compared with $1.10 kg in season in U.K.). In the U.K. the premium for out-of-season lamb could make the system rather more attractive. However, the hard-headed agribusiness academics have always maintained that one could have calculated beforehand that the systems would be uneconomic and certainly the recent increases in feed costs and fall in lamb prices have highlighted the sensitivity of the systems.

The American scientists see on the horizon accelerated lambing and intensive systems operating in large units sufficient to justify the high technical skills required as one of the few opportunities available for saving the U.S. sheep industry in the East and mid-West. They have the necessary technology and the breeds of wide breeding season but are not quite as advanced as the Europeans. What looked reasonable economically in 1973 now looks uneconomic with current grain prices.

The lessons for New Zealand are that we should follow the technical developments with interest and use the spin-off

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Footnote: "Sponged" is the term for use of the progestagen vaginal sponge. Sponging is normally followed by a PMS injection.

techniques for whatever purposes we can devise but the real point is that there is no evidence to suggest that we should be diverted from trying to maximise the once-a-year lambing grassland system by increasing litter size through selection and crossbreeding.

A related aspect of the system is the production of early season lamb. It consists of using sponges and PMS to bring ewes into season 6-8 weeks before the normal breeding season, the early-born lambs so produced being put into the very high-prices Easter market. In Ireland some 20,000 ewes have been treated each year during the last few years. It is a limited market but in New Zealand it means that we could produce June-born lambs if we wished to without recourse to Merino crosses. The Irish team is now providing a controlled breeding plus AI service operating by the dairy cattle AI units for sheep farmers - a package deal, especially suitable for small flocks of which there are many.

The cost of the treatments is as follows:

1.	Sponge plus PMS	35p	(65c)
2.	Technician time and travel	35p	(does not require a veterinarian in Ireland)
3.	AI materials, technician and travel	30p	

For a New Zealand farmer using sponge and PMS only and supplying his own labour and skill, it would cost 65c, though, by the time the material is imported into New Zealand, it could well cost much more than this.

OUT OF SEASON LAMBING

There is interest in New Zealand (Lincoln and Ministry of Agriculture and Fisheries) in the Polled Dorset as an out-of-season breeder but more especially as a breed which could conceivably be used for accelerated lambing procedures but there is little data on the breeding season in New Zealand. Such information as I have been able to obtain in U.K. suggests that we may be crediting the Dorset with more than it deserves.

Pure Dorsets are used in U.K. for early lamb production. They are lambed in December/January but in practice they are lambed only once a year and costings show that they do not make much more money than those farms using normal lambing time because of high housing and feeding costs. While some ewes will come in season again while lactating, the number which do and which conceive is not great. A flock where this is done showed that 89% of ewes lambed in December but only 56% in June, thus giving 133% or 1.1/3 lambings per year. These gave 188 lambs which is no better than is given by a good crossbred ewe. What the Dorset does do is to give a reasonably reliable out-of-season early lamb and its crosses will also give early lambs. There is evidence that out-of-season breeding does respond fairly well to selection. Dorset crosses (as in the Finn Dorset) certainly facilitate an accelerated lambing programme. M.L.C.* figures show mean litter size of Dorsets to be 1.60 and mature ewe LW 160-164 lb.

SHEEP RECORDING

The M.L.C. is responsible for sheep and beef cattle recording and development. The recording is both pedigree and commercial. The development consists of research work, technical information and publication and development of livestock improvement generally.

The M.L.C. is now producing a considerable amount of factual data about U.K. sheep production and especially about the performance of breeds and of systems of sheep farming. This results from the fact that much of the recording is done in commercial flocks (785 commercial flocks v 350 pedigree in

(*) Meat and Livestock Commission.

1972/73) and these flocks have been selected as representative of major types. Moreover, in many of both commercial and pedigree flocks, ewes are weighed at mating. The significance of this is that the performance of the ewes and the breeds can be related to liveweight, and already much very useful information is available.

The important point I would emphasize again is that the simultaneous knowledge of liveweight and litter size enables one, from a breeding point of view, to sort out those breeds and crosses which have a high litter size in relation to their liveweight, and from a management point of view to see whether a poor litter size or lambing percentage is due to low liveweight and poor nutrition. Much technical information on breeding programmes and flock management can be and is put out by the M.L.C. based on the liveweight, litter size, barrenness and lamb losses, especially in commercial flocks.

Comparable information does not exist in New Zealand. The National Flock Recording Scheme does not include ewe liveweights and is more or less restricted to pedigree flocks. The Meat and Wool Board's Economic Service has mountains of farm performance data but little flock (or herd) performance data amenable to interpretation. In my opinion this is a serious deficiency in the New Zealand farm, flock and herd recording systems and one which should be rectified. The best solution would be for facilities to be created for the data to be collected initially over a 3-5 year period from samples of the ewes in a number of the flocks recorded by the Economic Service.

The M.L.C. and also some M.A.F. farms have also been doing a considerable amount of Condition Scoring. This also is worthy of investigation in New Zealand as an alternative to weighing as it is easier though less accurate for the farmer to do himself. It could be that this is the eventual solution on the farm but in the initial investigatory stages weighing is essential and in any case the relationship between ewe performance and condition score in any breed requires a knowledge of liveweight.

CROSSBREEDING

A factor in animal production which has now really sunk home is the potential of crossbreeding, especially in the female. In sheep the Scotch and Welsh Halfbreds and the Greyface, all first-cross ewes by the Border Leicester rams on hill breeds, have been a feature of U.K. farming for decades. The use of Down sires as terminal fat lamb sires has also been universally accepted. What then is new?

Firstly, in beef cattle, results of large-scale crossbreeding trials in the U.S.A. have recently been coming out and have produced incontrovertible evidence in favour of crossbreeding. Cattle have virtually no breed differences in litter size but do have differences in growth rate. The former makes it easier to establish that differences in reproductive performance, if they occur, are due to heterosis. In one sentence, the U.S. results demonstrate that in a two-breed cross, the F_1 calf out of the pure-bred cow will have 3% greater viability and 4% higher growth rate than a pure-bred calf and in a three-breed cross where an F_1 cow is used instead of a pure-bred cow, there is an additional gain of 6% in calving percentage and 4% in growth rate. The total gain in weight of calf weaned in a three-breed cross as compared with pure breeding is of the order of 15-20%, especially in young cattle, though in older cattle the gains are rather less than this. This inevitably leads to the development of workable systems of beef production, using three or more breed crosses - with an ultimate system of rotational crossing.

Experience with the high fertility sheep breeds in the U.K. and Europe, together with other data from the U.S.A., merely adds more weight to the cause for crossbreeding. In both sheep and cattle the evidence in favour of crossbreeding is overwhelming. The problem is to develop systems which:

(a) Are realistic in the light of the current prejudices and vested interests in pure breeding, and which are acceptable to commercial producers, and,

(b) Combine the breeds in the best possible combinations,

for there are obvious exclusions, especially in sheep, where wool, hardiness, disease susceptibility, etc., preclude some combinations.

New Zealand has largely failed to adopt the crossbred ewe on any substantial scale - either through the lack of foresight and persuasiveness of the scientists or through the prejudices of the sheep breeders. It will certainly be one of the challenges of the future. We will have available high fertility crossing rams such as Border Leicesters, Finn x Dorsets, Finn Borders, East Friesland Borders and so on, and the challenge is to ensure that there are large increases in the numbers of F_1 ewes produced by these rams out of Romney, Corriedale, Perendale and Coopworth ewes, far more than the present number of Border Romneys.

Crossbreeding is, however, not a valid reason why we should not continue to select for fertility and other productive characters in our base breeds (Romney, Corriedale, Perendale and Coopworth). Improvement of these breeds is essential. Despite the arguments for crossbreeding, I cannot envisage at present an acceptable system of crossbreeding on our hill country and for this large and important area purebreeding must remain the dominant system for many years yet.

IMPROVEMENT OF BREEDS BY SELECTION

I found in U.S.A., U.K. and Ireland a curious indifference or reluctance to acknowledge much merit in trying to improve existing breeds of sheep other than Downs and by implication a curiosity as to why we, in New Zealand, are devoting so much effort in this direction. The reasons are, I think, as follows:

1. The U.K. research worker is more removed from the sheep farmer, he lives in a more academic world and does not actively converse with pedigree breeders and farmers' representatives.

2. The main animal breeding research station, A.B.R.O., does not have direct breed improvement as one of its mandates. Instead, this role is given to the M.L.C. which is of more recent origin and has not had time to organise this aspect, though it intends to do so.

3. There is no dominant breed (except a Down breed - the Suffolk) such as the Romney in New Zealand or Merino in Australia where a small relative improvement makes a large absolute increase, or where up and coming breeds such as the Perendale and Coopworth are striving to compete.

4. Sheep flocks are relatively small and, except in hill country, they are often not the main source of income.

At the scientific level there are additional factors:

5. Two attempts which have been made to breed for higher litter size - one at Newcastle and one in Ireland have failed to show improvement and some scientists seriously question the results emanating from New Zealand and Australia.

6. It is agreed that breed improvement, through selection, is slow. They see the answer in crossbreeding. The wide differences in performance of breeds in litter size, growth rate, conformation, wool and so on and the multitude of breeds available suggest that crossbreeding

offers a faster and more effective means of achieving increased production.

THE GRAIN CRISIS

While I was overseas the impact of the oil or energy crisis increased, the grain crisis started and the beef crisis occurred. The effect of these at the agricultural scientist level has been pretty profound. The increased cost of energy and of fertiliser has brought home to scientists and others a realisation that land resources and science cannot maintain an abundance of human food. This, in turn, means that where animals and man compete for the same food resources, animals must go. Grains, which can be fed direct to humans, are now used in the Northern Hemisphere in large quantities for feeding to pigs, poultry, beef cattle and dairy cattle. This may mean that pig and poultry production, which rely so heavily on grain, will be the first to feel the pinch. Equally, however, in the present context, one cannot justify the feeding of grain to ruminants. There is already evidence of a shift in research activity back towards using ruminants for what they were designed - to eat grass, roughage and arable by-products. It is as easy to over-react to crises as it is difficult to predict the outcome, but current thinking in U.S.A. and U.K. is that there will in fact be a considerable reduction in use of grains for ruminants and that these will mean that costs of production will increase (due to the absence of previously cheap grain), that grading standards for beef and lamb will have to change towards acceptability of leaner carcases and that putting fat on animals is a costly and wasteful process. In other words, the trends away from fat and towards lean will be hastened.

BEEF CATTLE

During the period of this leave, the beef crisis was in full flow. It was brought about by a reduction in per capita consumption due to earlier very high prices and by over-production, the latter spurred on by false predictions of unsatisfied demand and by very rapid increases in cattle numbers. The crises was exaggerated by the grain crisis and, particularly, by the very great increase in feed grain prices. The effect of this on research thinking and research direction is to regard as ended for all time the era of cheap feed grains which had been brought about 10-20 years ago by improvements in grain production technology.

This will mean a movement back towards less reliance of grain finishing and a greater reliance on grass, forages and arable crop by-products or the natural ruminant foodstuffs. In the U.S.A. it is not seen as the deathknell of the feedlot but rather that high grain rations will be fed for a shorter time. The end result is that the farmers are going to produce leaner cattle. In the nutritional field, the emphasis will continue to be placed on factors producing high liveweight gains at high efficiency and with a good lean/fat ratio, and also in the utilisation of roughages such as silage and cereal grain straws and even forestry wastes such as sawdust.

In the cattle breeding world the European cattle, especially Charolais, Simmental, Limonsin, are having a big impact though there are signs that some have reached a plateau. The high cost of grain and decreasing importance of grain finishing is likely to react against the late maturing European cattle unless the U.S.D.A. relaxes its beef grading and this relaxation is already being pushed by the Charolais and Simmental interests. The colour of cattle in the U.S. feedlots is indicative of the increasing acceptance of crossbreeding by the U.S. cattlemen, including the use of crossbred females, especially the Angus-Hereford (but not Friesian crosses), and this is widely encouraged by the scientists as described elsewhere. In the U.K. there are extensive breed comparison trials run by the M.L.C. which will continue to be of interest to us in New Zealand. Here the crossbred cow from the dairy industry, that is, the Hereford Friesian, is widely accepted - it is the crossbred cow from the single suckler herds that is now also wanted. In the last 10 years the single suckler beef numbers have doubled.

Recording and selection within breeds is well established in both the U.S.A. and U.K. One interesting comment made by several authorities in the U.S.A. was that there could be dangers in having a national herd recording scheme with the one objective. It was felt that it was by no means absolutely certain what the objectives should be and they should vary in different parts of the U.S.A. There was actually encouragement for some diversity in the selection objectives in the different Recording Schemes. In particular, the importance of reproduction and of adaptation must not be forgotten.

There is a considerable amount of research on twinning in cattle, several people assembling herds of cows with a twinning record and hoping to make genetic progress through selection. Stimulation of multiple ovulation with hormonal therapy has run into difficulty because of highly variable responses and because, unlike sheep, ova do not migrate from one horn of the uterus to the other and each horn can hold only one foetus. More work is in fact being done in the area of egg transference, transferring eggs from superovulated cows into the vacant horn of a bred cow or into the two horns of an unbred cow. Two groups in Ireland, as well as the Cambridge unit, are active in this field. Egg transference, whether for single or twin pregnancies, is at present uneconomic except for very valuable animals, though it could become so if and when non-surgical transference is shown to be a practical proposition.

MISCELLANEOUS OBSERVATIONS

Testes Size as Index of Fertility

Whether or not the Finn makes a contribution to the sheep industry, it has certainly made a contribution in research, for it is an extraordinary sheep, an extreme in the sheep world in all those parameters affecting reproduction - precocity, length of oestrus, ovulation rate and now size of testes. It has been shown by comparing the Finn with other breeds at A.B.R.O. that breeds of high fertility have a high testes diameter and those of low fertility low testes diameter in the young male at 6-16 weeks. Preliminary results are showing within breeds that the progeny of young males selected for high testes diameter in relation to liveweight have above average litter size. These are very interesting observations. The question is whether testes diameter is a sufficiently sensitive and reliable measure of the genetic value of a ram lamb to be of value in selection. If it is, it will be of tremendous value for we have no direct measure of a ram's potential. A great deal of work is needed before this question can be answered.

Maize

There has been a very marked success in the use of maize on the Continent and it is increasing also in U.K., doubling each year, where it is used for making silage for winter feed for cattle. Crude protein levels are around 8% and to increase this, urea is added to the barley supplement which is fed with the silage though there is interest in adding anhydrous ammonia to the silage.

Heavy-Weight Lambs

For many years scientists in New Zealand have pointed out the advantages, in the terms of efficiency of conversion of grass to meat, of taking our lambs to heavier weights. It is appreciated that early slaughtering suits many environments, that taking our existing lambs to heavier weight would only lead to over-fatness and the lamb schedule does not encourage heavy lamb production.

It is my opinion that we should indeed be aiming to produce a proportion of our total kill (an initial target of 10%) in the heavy-weight range of around 18-20 kg (40 lb) CW. For one thing, the trend in both U.K. and U.S.A. is towards heavier lamb and, for another, the arguments in favour of producing processing and marketing a larger lean lamb are growing. For these reasons, it is my opinion that some real emphasis should be given to the breeding, nutrition and management aspects of this problem. One thing which is impressive in the U.K. (and U.S.A) is the size of their ewes and the M.L.C. liveweight data (see under "Sheep Recording") verifies this - the ewes have a larger frame than have our Romneys and Corriedales. This size, plus the use of the Suffolk sire, enables a 18-22 kg (40-50 lb) lamb which is not over-fat to be produced. One thing which is absolutely clear is that heavy-weight lambs must be <u>lean</u> and they should have a reasonable conformation.

The constant comment that one hears of meat in general, and especially of lamb, is the fat content. The two most important factors operating against meat are price and fat content. It is my opinion that carcase assessment in breed comparison trials, in selection programmes within breeds and in studies of production systems must become a greater part of the overall assessment than has hitherto been the case in New Zealand.

Mating Ewe Lambs

All over the world intensification is seen as one and in many cases the most important movement towards increased production and profitability. In sheep, the greatest research effort in U.S.A. and U.K. in this direction is in accelerated lambing programmes already discussed. Another contribution is in earlier breeding, that is, at the ewe lamb stage. The U.K. is well ahead of us in New Zealand in this area.

At present some 30% of ewe lambs in the U.K. are put to the ram, ranging from about 10% in hill flocks to 55-60% of crossbred lambs in lowland flocks. The possibility of increasing production through mating ewe lambs seems to be more acceptable to U.K. sheep breeders than does breed change and some other methods recommended. The limitation to getting ewe lambs into oestrus and then in lamb is accepted as due to two thresholds - those of liveweight and of age. Investigations aimed at circumventing these thresholds and so getting a higher proportion of ewe lambs pregnant are going on in several centres in U.K. and Ireland.

It has been shown that synchronisation and advancement of oestrus by the ram induction method can be achieved but greatest hopes are pinned on sponging. With short-season breeds which constitute the majority in U.K. and New Zealand, sponging brings 100% of lambs into oestrus with 60-70% conception rate if liveweight and nutrition are satisfactory but if the latter are not there is increased embryonic absorption so the number remaining pregnant does not greatly increase. Certainly sponging will advance and increase oestrus and remove the thresholds to oestrus but not necessarily to pregnancy. With the long-season breeds such as Finn and Dorset crosses the onset of oestrus is not a problem.

AGRICULTURE IN THE "COST-PLUS" ECONOMY

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INTRODUCTION

My assigned task in this paper is to introduce today's Farmers' Conference session on the general question of farm income stabilisation. This I have done by, first of all, making some brief general observations about the economic environment in which I believe the agricultural industry will be operating over the next few years and against which the ideas on stabilisation, in succeeding papers today, should be judged.

However, that done, I want then, myself, to look at one special aspect of this stabilisation question which was introduced in the Zanetti Report on the matter but which, I believe, should be taken many stages further. This is the question, not of stabilising or evening-out fluctuating farm incomes, but of maintaining them at an adequate level in remembering that, for the most part, such incomes are determined by a process of "prices less costs", whereas, in the rest of the economy, prices and incomes tend to be determined by a process of "cost-plus".

I want to ask what policies can be developed to cope with this situation. My answers to this question will not please everyone, indeed they will please very few, but, if only for that reason, they will, I hope, stimulate some useful discussion.

TRENDS IN THE ECONOMIC ENVIRONMENT AND ECONOMIC POLICY

As a background against which to judge my arguments on agricultural policy, let me first, briefly, indicate what I believe are the important and significant developments occurring in national economic policy.

1. Need for Increased Agricultural Production

There is now, I believe, general recognition (or, should I say, re-recognition) of the need for increased agricultural production which, over the last five years, was, under the N.D.C. targets, supposed to grow at 3% per annum but has, in fact, shown a growth rate of precisely zero.

The effects of this on the economy were, of course, disguised by the very high terms of trade and balance of payments surpluses we enjoyed a few years ago and also by a certain amount of euphoria in the export achievements of other sectors - manufacturing, forestry and tourism. Had agricultural production and exports been on target this year, our present and prospective balance of payments' problems would be much less severe and worrying than they in fact are.

It is, of course, not self-evident that increased exports should come from agriculture; indeed, in some quarters the view is held that a massive increase in manufacturing exports could equally solve our problems. The validity of this view depends on the resources required to mount such an expansion and on what is thought to be the likely future agricultural terms of trade.

In both of these respects the argument is largely nonsense as we have shown in some recent work in the Project on Economic Planning.[1] The direct and indirect resources required are such as to make such a programme unfeasible unless there were a whole lost of desirable, but unlikely, structural changes in the manufacturing sector and, even with terms of trade as low as 1970 (at which low level they stand approximately at the present times), increased agricultural production is still the critical requirement for overall long-term economic growth and balance of payments equilibrium.

Indeed, even from a purely short or medium-term viewpoint, increased production is urgently needed since many commentators now foresee the present downturn in the world trade cycle followed by a short but massive boom[2] in 1977 or 1978 with a marked rise in export prices from which we would want to extract the maximum benefit from high export volumes.

2. <u>New Moves in Economic Planning</u>

As foreshadowed in last year's Budget Speech and adumbrated in a recent policy document, Government has now outlined a new economic strategy aimed at improving the efficiency in use of resources at the level of individual industries. Taken at its face value, this implies a review of all forms of protection and assistance to all industries, including agriculture; the introduction of a lower, though adequate, level of protection (probably still by import control in the case of the manufacturing industry) and some restructuring of the manufacturing industry.

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1. B.P. Philpot, "Medium-Term Perspectives for the N.Z. Economy", P.E.P. Discussion Paper No. 1.
2. Ibid.
3. B.P. Philpott, "Incomes Policies and Industrial Relations", P.E.P. Discussion Paper No. 3, V.U.W., April 975.

As it stands, this is a very welcome development as it means that the hard, tough decisions on restructuring which were urged by the N.D.C. but were not implemented are now going to take place, but, of course, we will want to see some action to back-up the words.

3. Inflation, Incomes and Prices Policies

Experience in attempting to control inflation in the last year or so has, I believe, now convinced Government that, whatever other approaches are adopted, the critical thing for success is the maintenance of a permanent and thorough-going incomes policy.

The details of this I have discussed elsewhere[3] but, broadly speaking, the approach must be one in which money incomes are not allowed to rise faster than the increase in actual or prospective national effective productivity. By effective productivity I mean national increase in physical production adjusted, however, by the effect of changes in the terms of trade.

However, even with such firm approaches, and particularly bearing in mind all the lags of the system and the effect of wage drift, the rate of inflation will still continue for the next few years or even longer at rates which, while certainly lower than the 12% we have had recently, will only slowly, if ever, approach the 3 to 4% we had become accustomed to up to 1970.

These, then, are three major aspects of the economic environment over the rest of this decade. The fourth aspect is of such major importance to my theme to justify a section in its own right.

THE COST-PLUS ECONOMY

The Non-Agricultural Economy is basically a "cost-plus" economy - changes in prices reflecting not the forces of supply and demand but changes in costs, particularly wages and other incomes, which have occurred. This is the case and will continue to be the case because no one really has any strong vested interest in it being otherwise for a number of reasons which I can only allude to briefly:

(a) Protection and shelter from import competition.

(b) Monopoly and imperfect competition in the internal market.

(c) The mode of operation of the price tribunal.

(d) The attempts to shift the distribution of income from profits to wages.

(e) The ease with which costs can be passed on in internal inflationary market conditions.

With regard to the last two points, it should be noted that the interests of internal traders (though they would stoutly deny it) are in rising money incomes to stimulate high demand, not the other way round. In such conditions of high demand, profits, far from falling due to wage increases, actually rise, as recent statistics show. The battle between wages and profits is really a sham and the only losers are those on fixed incomes or whose costs cannot be passed on.

The Agricultural Economy

Agricultural export prices are determined by the forces of supply and demand (even though there are, in my view, strong reasons for questioning the necessity for this to be the case). The agricultural industry is, therefore, the residual legatee of cost increases which it cannot pass on. In the past, i.e., up to about 1970, the industry was able to absorb the cost increases from its very superior and continuous increase in physical productivity[4] and still prosper, but under the projected, even if moderate, inflation rates I have talked about, the industry has no show of absorbing out of prices the cost increases which are going to occur.

Agriculture, alone, is not on a "cost-plus" basis but on a "price-less" basis and the deductions from its prices are getting bigger and bigger every year.

AGRICULTURE ON A COST-PLUS BASIS?

If the rest of the economy is virtually on a cost-plus basis, why can't agricultural pricing be organised likewise? There are a number of very sensible arguments on this question in the Zanetti Report on Farm Income Stabilisation, most of which arguments replate to the problem of paying subsidies which are, of course, implicit in any cost-plus system for export industries.

Before I list these arguments, let me counter one argument which I believe is fallacious, that is, that it is impossible for an agricultural economy like New Zealand to subsidise its major industry, i.e., agriculture. It is said this is feasible for an industrial country like Britain because agriculture is only a small proportion of that economy.

I can see no justification whatsoever in this argument. If we, as taxpayers and consumers, etc., choose to subsidise agriculture, then, provided we are prepared to pay the cost, it is perfectly feasible. Indeed, devaluation of the exchange rate is nothing other than a means of providing a subsidy from importers and consumers of imports to exporters, including agriculture, and on some of the occasions when we have devalued it has been a substantial subsidy.

4. See: B.P. Philpott, "Costs, Prices and Productivity in New Zealand Agriculture", Canterbury Chamber of Commerce Economic Bulletin, No. 464, August 1963.

However, the main arguments against cost-plus pricing and the subsidies involved relate to the possibility that we could be accused of dumping - that it is too arbitrary in its effects and would benefit, universally, all farmers regardless of need and regardless of efficiency or willingness to increase production.

But, without doubt, the most important argument against cost-plus subsidies is that they would almost immediately be capitalised into land values which are, in all conscience, high enough in relation to the almost negligible earning power of agriculture.

The Zanetti Report, as you know, deals predominantly with the question of <u>stabilisation</u> of fluctuating farm incomes and in this regard it is quite outstanding in thoroughness, imagination and intellectual power, especially bearing in mind the speed with which it was researched and produced.

But, after examining and recommending moves on stabiliation, the Report then rightly goes on to look at the question of supplementary payments which, of course, is a euphemism for subsidies. In this area of subsidies, the discussion is good but the recommendations are inconclusive. Supplementary payments, it urges, should be paid as additions to farm product prices in the light of certain indicators, mainly trends in farm income, livestock numbers, etc.

The level of subsidy is not specified and no attempt is made to deal with the problem of equity - of ensuring that subsidies go to the right farmers.

For this reason, I believe it unlikely that any Government will be able to persuade the largely urban New Zealand electorate to accept the idea of subsidies at any level that will do any good, and, therefore, no Government will try.

We are likely, therefore, to finish up with the income stabilisation part of the Zanetti proposals without, in the long run, having very much income left to stabilise.

AGRICULTURE ON A PROPER "PRICE-LESS" BASIS

If agriculture can't be put on a cost-plus basis, can we organise better the present system which we can call "price-less", i.e., the farmer gets what is left after all the deductions are made from overseas-determined product prices.

Ideally, of course, it is not the farmer's earnings which should take the knock when the cost price squeeze tightens. The reduction should be taken in the earnings of land or, in the economist's terminology, the "rent" of land.

In a completely leasehold tenure system with frequent adjustment of rentals then a cost price squeeze would lead to a fall in such flexible rents until they reached a level of zero - a level which indicates that a devaluation should occur or the land should go out of production.

But we don't have a leasehold tenure system with flexible rents. We have, largely speaking, freehold farms, many high levels of fixed mortgage debt, and we have land prices which, far from falling, are, due to inflation, rapidly rising. It is not flexible rents or land values which take the brunt of the cost price squeeze, it is the farmer's management reward or salary and this is wrong.

Is there not, we might ask, any way in the actual world, rather than in the ideal world, that we could develop policies which, as it were, simulated the ideal which I have outlined? That is to say, can we conceive of a "price-less" policy which gives the same results as cost-plus but meets the problems outlined before?

It would need to be a policy which:

(i) Assured the farmer of a management reward which, like other incomes in the economy, rose each year in line with other incomes as a reflection of increases in cost of living and growth in national effective productivity.

(ii) Involved the use of subsidies which did not get capitalised into higher land values.

(iii) Provided incentives to efficient farmers anxious to maintain high levels of production or to increase production, but penalties to those who didn't.

(iv) Is, therefore, saleable politically.

I suggest the only way to achieve this is by the introduction of a system of productivity subsidies and taxes.

A PRODUCTIVITY SUBSIDY/TAX

The general ideas of this proposal are as follows:

Basic Outline:

1. Abolish all input subsidies (such as fertiliser subsidies, etc.) and abolish income tax in agriculture and in its place substitute a fixed-tax.

2. The fixed tax to be calculated as:

(i) The value of gross output (valued at the Zanetti stabilised prices) of an average efficient farmer for that type of farm.

(ii) Less cost of inputs at current prices for that type of farm.

Less interest paid on fixed debt.

Less normal management reward for that type and and size of farm.

3. Value of all production in excess of the assessed level as in (i) would be free of tax.

4. For some types of farms or for all types of farms in some periods (of adverse terms of trade) the fixed tax may become negative, i.e., become a fixed subsidy.

5. The effect of this is that an average efficient farmer would be guaranteed a management reward comparable with his managerial responsibilities and with that earned in other industries.

Adjustments in the Fixed Tax/Subsidy:

These would occur as follows:

1. The tax would rise when stabilised output prices rose and fall when prices of farm inputs rose (and vice versa).

2. The tax would fall as a result of rises in the cost of living index and, therefore, in the money level of the assessed management reward or as a result of a general rise in all incomes as prescribed in the incomes policy which I mentioned earlier.

3. The tax could be reduced in specific regions in years of drought, flood or other disaster in lieu of ad hoc drought and flood relief and similar measures.

4. In those cases where farm development out of income is desired or proposed, the tax would be lent back to the farmer as a development loan under the administration of the Rural Finance Corporation.

IMPLICATIONS AND ADVANTAGES

These are as follows:

1. Provides Cost-Plus Pricing by the price-less route without any of the disadvantages outlined before and satisfying all the conditions I set for a satisfactory system.

2. Averts Subsidy Stigma

   The subsidy element in these arrangements depends, essentially, on its effect over time on Government net tax revenue from agriculture. To the extent this is reduced, as it may well be, then, effectively, the rest of the taxpaying community will be subsidising agriculture but in a way which can hardly carry the same stigma of dumping as is even the case at present with the $43 million of input subsidies which are being paid out; and, of course, it could be that, when account is taken of the reduced Government expenditure on these input subsidies and the very low yield of income tax from agriculture at present, that the whole net effect on Government finance is zero - the scheme, in other words, is self-financing within the agricultural industry.

3. Reduces Land Values

   The subsidy element in the scheme would not be capitalised into land values - indeed, the effect of the fixed tax would be to reduce land values since, as I explained before, the whole aim of the exercise is to raise the return to management and reduce the return to land. Certainly there would be no future in holding land unused or underutilised while waiting for capital gain in various forms.

4. Efficiency in Resource Use

To the extent that there is a net subsidy element then its provision would be, and would be seen by the urban electorate to be, equitable and, therefore, more politically saleable.

Any farmer unable or unwilling to farm at, at least, average efficiency would either take a cut in management reward or would be wise to sell his farm to someone who is able or willing to do so. Not only does this conform to the new ideas on efficiency in resource use I discussed at the beginning of the paper, but it may have the desirable effect of increasing the supply of farms for land settlement.

5. Incomes Policies

It would bring agriculture sensibly and flexibly within the scope of the incomes policies which I suggested earlier were going to be an integral part of New Zealand policy in the future.

6. Combats Rural Depopulation

One of the reasons for rural depopulation is the aggregation of farms into larger units to reap lower costs or adequate incomes. If rural depopulation is thought to be a bad thing, and I personally think it is, then there is no reason why the fixed productivity tax/subsidy should not be assessed on the basis of the viable 1 or 2 man unit - viable that is, as far as a decent management reward is concerned so that the pressure to amalgamate would be thereby reduced.

Against these advantages there are, of course, inevitably, problems.

PROBLEMS

I have only time to mention the two most important problems:

1. There would be a temptation for farmers to jack-up notional fixed debt to secure the exemption of mortgage interest implicit in the scheme. Frankly, I don't know how that could be prevented but I would be perfectly happy to rely on the shrewdness and the wits of the Inland Revenue Department who have, in the past, plugged more subtle forms of evasion than this.

2. Assessing Farm Type Average Efficient Productivity
   This is, of course, the critical problem but I do not believe that if we really accept the benefits of the scheme that it is beyond the professional and administrative abilities of institutions associated with New Zealand agriculture to develop farm-type production assessments which, in the beginning stages at any rate, are not too cramping and inflexible.

   An enormous amount of data is now available on average farm performance in various districts, much of it unused, and in some cases ideally suited to assisting in this problem.

   Furthermore, we should not forget that in a previous period in New Zealand's agricultural history we had a system of productive valuation which involved the valuers in the types of assessment I am at present discussing and which, for my part, is infinitely preferable to the present current market value nonsense which stands in for land valuation.

   Admittedly, the productive valuation approach was introduced as part of the Land Sales Act which eventually failed but for reasons connected with the unrealism of trying to tie everything to static 1942 values. I see no reason why the Valuation Department, with suitable additions to its staff, shouldn't again move in to making the same production assessments as it did then and subject, of course, to the same appeals as it is at present with current land valuations.

CONCLUSION

Many of you will not find favour with the ideas expounded in this paper and for this reason many of you will, subconsciously, find all sorts of administrative difficulties in its possible implementation. I have no sympathy at all with that point of view. In its place, I urge you to consider seriously this or some similar system of guaranteed real income which is acceptable to the nation as a whole, otherwise the industry is doomed to enjoying the pleasantries of stabilisation without anything much left to stabilise.

FLUCTUATING FARMING INCOMES AND THE NEW ZEALAND ECONOMY

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I suspect that for some time it will be impossible to discuss the subject of fluctuating farm incomes in New Zealand without reference to the Zanetti Report.[1] I, therefore, propose to begin by addressing my remarks to the relevant sections of the Zanetti Report before turning to some issues which are not fully covered by the Report.

If, as we so often proclaim, we are a dependent economy, this is not because of the relative size and importance of our export sector. Our exports of goods and services are only 25% of G.N.P. which is rather low by comparison with many other countries, particularly the smaller developed countries.

If anything, our dependence arises from the nature of the goods in which we trade rather than the extent to which we trade. The bulk of our imports are raw materials and components. Our exports are still dominated by a narrow range of primary commodities which, like most primary commodities, are subject to price fluctuations, at times quite violent price fluctuations.

This leads to fluctuations in export revenue which have a destabilizing effect on the economy as a whole. The result is a continual stop-go cycle coupled with recurrent Balance of Payments crises. Our dependence on external markets is perhaps best seen in this light. One of the consequences of this cycle has been a preoccupation with short-term problems at the cost of any serious attention being given to more fundamental problems of a longer term nature.

Few economists would question the potential destabilizing effects of fluctuating export revenue. Where there is disagreement is is centred on the question of the relative importance of the various ways in which fluctuations in export earnings can influence the rest of the economy. This is nevertheless a question of fundamental importance if we are to have any success in overcoming the worst effects of these fluctuations.

The Zanetti Committee have tended to play down the importance of the destabilizing effects of fluctuations in export prices on both incomes and the cost and availability of credit.[3] They have instead given greater credence to an alternative view of the way in which the New Zealand economy responds to fluctuating export prices. This thesis (baldly stated) is that what the economy reacts to, both at a policy level and at the level of many individual decision-makers, is the additional foreign exchange that increased export prices generate.

This view deserves close examination. For most of the post-war era a continuing shortage of foreign exchange has been regarded as the major constraint on expansion. Even in the brief period from about 1969 to mid-1973 when the New

1 = The Report of the Farm Incomes Advisory Committee, March 1975.

Zealand dollar no longer appeared to be over-valued, policy makers and their advisers often continued to react as though it were. As a result, the balance of payments has usually been the most important factor determining short and long term economic policy.

Against this background, the Zanetti Committee arguments have a decided ring of truth. Business confidence can be expected to reflect what is happening in export markets and expansionary phases might easily be seen as a direct result of the effect on improvements in the balance of payments on both Government policy and business confidence. In addition, some of the instruments used to conserve foreign exchange, particularly import licensing, have undoubtedly played their own part in this process.

If these linkages were the only way in which fluctuating export prices affect the New Zealand economy, then the policy prescription would seem to be quite clear. The explanation implies quite forcibly (as does the report) that what we have witnessed in the past has been a failure of foreign exchange policy not the effects of fluctuating prices <u>per se</u>.

Management of our external sector is undoubtedly made much more difficult by fluctuating export revenue. However, this is something we will have to deal with regardless of what machinery we devise to stabilize farm prices. Either we are prepared to build up our external reserves in times of high prices (including our capacity to borrow) so as to sustain activity in times of low prices or we are not. Simply changing the way our reserves are held will do little to protect us from external fluctuations. If "frozen" accounts were to exist, both policymakers and the community at large

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3 = Section 8, Report of the Farm Incomes Advisory Committee, March 1975.

could not help but be aware of them and, therefore, could not help but take them into account to much the same extent as is the case now.

The clear implication of the Zanetti Report then is that stabilization of farm prices will not contribute very much towards ironing out the peaks and troughs in activity elsewhere in the economy except insofar as it encourages a more rational foreign exchange policy. Whether or not stabilization of farm prices will lead to a more rational foreign exchange policy is a moot point.

It is at this point that I would take issue with the Committee. My argument is not that the foreign exchange linkages on which the Zanetti Committee has laid so much emphasis have been unimportant in the past nor that they are likely to be unimportant in the future; I would accept, prima facie, the case that the effects of additional foreign exchange on business confidence and on Government policy are indeed important.

My argument is instead with the Zanetti Committee's implication that these are the only linkages of any consequence. Three other linkages were also examined by the Committee:

1. The Export Income Multiplier: Whereby changes in the earnings of exporters (including the earnings of all those engaged in the export chain from farm gate to ship's hold) result in the first instance in changes in spending within New Zealand by exporters which in turn has a multiplier effect on aggregate demand.

2. Liquidity Effects: Changes in export earnings constitute one of the causes of changes in the money supply.

3. Direct Price Effects: Increases in prices of exports which are also consumed locally have a direct effect on the Consumer's Price Index.

At the cost of over-simplifying, allow me to paraphrase what the Report seems to be saying on these issues:

On the question of the export income multiplier, the Report contends that the farm sector is now too small in relation to the rest of the economy to have much of an impact on the aggregate demand. Furthermore, any fluctuations in spending out of export receipts must be viewed alongside other changes in spending such as Government expenditure.

On the question of the possible liquidity effect, the Report is silent on the possible magnitude of these effects but states again that fluctuations in the inflow of foreign exchange may also be offset by other factors.

On the question of direct price effects, the Committee properly asserts that these have not been important in the recent past as the old C.P.I. would have led us to believe.

This boils down to two things: first, an assertion on what is essentially an empirical question regarding the relative magnitude of these possible effects; secondly, the analytical point that there are other possible destabilizing influences that must be considered.

It is the assertion about relative magnitude that concerns me most. This is an empirical question and yet only in the rather trivial case of direct price effects has any attempt been made to provide a meaningful quantification. As regards the possible importance of the export income multiplier, the Committee has clearly got hold of the wrong dimension. What matters here is not how large or small the farming industry is in relation to the rest of the economy, but how large or small are the fluctuations in pastoral incomes.

The year by year changes in pastoral export earnings over the last decade (adjusted for both changes in purchasing power and the effects of the Dairy Board operations) are shown in Table I (attached). To provide a frame of reference, changes in real G.D.P. are also given. It can be seen that although pastoral export earnings have declined in relative importance (the Zanetti Committee's main argument in this context), changes in pastoral export earnings are still sufficiently large to constitute a potentially powerful destabilizing influence.

The Committee is, of course, correct in suggesting that we must also look at other possibly exogenous changes in spending such as Government expenditure. This is done in Table II and indeed the changes in real Government expenditure have been as large and as variable as changes in pastoral export earnings. Whether all of these changes in real Government expenditure can be regarded as truly exogenous is a more difficult question.

One of the major difficulties confronting the economic analyst is to separate cause and effect, i.e., those factors which are responsible for any change from those factors which are changing simply as a result of the initial stimulus. In this context, export earnings are clearly an initial stimulus from outside the system. Whether all changes in real Government expenditure can be regarded in the same way is a more difficult question.

In the past we have often seen a sharp, if belated, response in Government expenditure to changes in our Balance of Payments position. This does lend support to the Zanetti Committee's idea of a foreign exchange response mechanism, although the process may be much more complicated than that.

The only conclusion that one could draw at this stage is that if Government responses to changes in the availability of foreign exchange have been important, then so too have changes in exporters' incomes.

On the question of liquidity effects, Table III provides the data referred to in the Zanetti Report on the influence of the inflow of foreign exchange on trading banks' cash. Despite large swings in the inflow of foreign exchange, these have, in the main, tended to be offset by other factors. The notable exception was towards the end of the period when the system had to cope with a very large influx of foreign exchange.

This brings me to the major point I wish to make. In the past and no doubt again the future fluctuations in exporters' incomes, as distinct from fluctuations in the availability of foreign exchange, may not have been <u>the</u> most important factor determining economic activity year in year out, but there have been times - in 1950/51 and again in 1972/73 - when the sheer size of the fluctuations in export incomes has been sufficient to dominate all other factors. If, as was the case in 1972, when we had a very expansionary budget, those other factors are also working in the same direction, then we are in for a very rough time indeed. We can once again expect an uncontrollable expansion in the economy. This will generate a very large increase in imports so that when the boom in export prices inevitably collapses we are left with a very large balance of payments deficit. This will in turn engender a sharp contraction in the economy. While it is currently fashionable to argue the point, we will be lucky to escape an increase in the rate of inflation during the upswing which will not immediately abate during the contraction despite significant unemployment.

This then brings me to the question of farm income stabilization. The potential benefits to the economy as a whole are clear enough. While I would not like to prejudge what Professor Dent has to say on the subject, there would also seem to be potential benefits to farmers. This still leaves a number of important issues to be resolved. Perhaps the most important of these is the question of alternative ways of dealing with this problem.

One commonly held view is that this problem can and should be tackled by counter-cyclical monetary and fiscal policy. Regardless of the political consequences, there are very real impediments to effective counter-cyclical action. Too often the effect of counter-cyclical action, both here and elsewhere, has been the opposite of what has been intended, i,e., the net effect has been destabilizing rather than stabilizing.

The problem is simply this - by the time a new situation has been recognized, a plan of action formulated, approved and implemented, and, most important of all, sufficient time has elapsed for that action to have taken effect, it will be far too late. Making short-term economic policy has been likened to a blind man walking down a ridge in a fog with only a mate travelling twenty yards behind to tell him what it is like back there. By the time he can properly assess what is happening, it is too late.

The lesson is clear. Given the speed with which the major commodity booms have developed in the past (and the equal rapidity with which they have subsequently collapsed), to be effective any action must be capable of automatically neutralizing the destabilizing forces as close to the source as possible.

In conclusion, let me attempt to summarize my argument. Because our export trade is still narrowly based on primary commodities we suffer from what are at times quite violent fluctuations in export revenue. As well as producing recurrent Balance of Payments crises, these fluctuations have a destabilizing effect on the entire economy. Conventional weapons of monetary and fiscal policy cannot respond quickly enough to smooth out the peaks and troughs. The result is a stop-go cycle which both exacerbates inflation and diverts attention from the more fundamental issues.

If we are to resolve these fundamental issues - inflation, resource allocation, the environmental issue and, closer to home, the threatened viability of pastoral farming - then we must ensure that in the future "the current situation" does not dominate our thinking as it has in the past. To this end it is essential that we do two things:

We must adopt a more rational foreign exchange policy.

We must also find ways to neutralize the destabilizing effect of fluctuating export prices.

TABLE I

FLUCTUATIONS IN PASTORAL EXPORT RECEIPTS

	(1) Pastoral Export Receipts O.E.T. June ys* Deflated by the G.D.P. Deflator	(2) Year to Year Changes in (1)	(3) Real Gross Domestic Product March Years	(4) Year to Year Changes in (3)
	$m 1954/55 Prices			
1960/61	511		2,367	
1961/62	503	-8	2,446	79
1962/63	529	26	2,521	75
1963/64	587	58	2,675	154
1964/65	563	-24	2,838	163
1965/66	600	37	3,011	173
1966/67	542	-58	3,135	124
1967/68	557	15	3,112	-23
1968/69	619	62	3,176	64
1969/70	669	50	3,350	174
1970/71	602	-67	3,486	136
1971/72	644	42	3,591	96
1972/73	773	129	3,777	186

* - Adjustment for net advances to Marketing Boards

SOURCES: (1) Reserve Bank Bulletins and the N.Z. Official Yearbook.

(2) The N.Z. Official Yearbook.

TABLE II

CHANGES IN REAL GOVERNMENT EXPENDITURE

WITHIN NEW ZEALAND

March Years	(1) Government Expenditure Within New Zealand Deflated by the Implicit G.D.P. Deflation	(2) Year to Year Changes in (1)
	$ million 1954/55 Prices	
1960/61	596	
1961/62	674	78
1962/63	654	-20
1963/64	669	15
1964/65	704	35
1965/66	756	52
1966/67	820	64
1967/68	812	-8
1968/69	808	-4
1969/70	840	32
1970/71	940	100
1971/72	977	37
1972/73	1,066	89

TABLE III

FACTORS AFFECTING TRADING BANKS' CASH

	(1)* Trading Bank Sales (-) Purchases (-) and MB Advances	(2)* Government Internal Cash Surplus (+) Deficit (-) Before Internal Borrowing	(3)* Internal Borrowing	(4)* RB Advances to TBs -Δ Current and Time Deposits of RB	(5)* Trading Bank Cash
1960/61	40.0	-7.3	88.4	0.9	-40.2
1961/62	33.5	-9.1	32.9	11.8	21.5
1962/63	78.4	-48.0	107.3	-12.8	6.3
1963/64	60.6	-29.0	127.4	3.7	-34.1
1964/65	107.7	5.7	144.3	5.3	-37.0
1965/66	46.4	-9.7	77.5	52.8	31.4
1966/67	-1.2	-19.4	82.2	20.3	-43.7
1967/68	106.8	-18.2	89.8	-40.0	-4.8
1968/69	115.8	-29.1	146.4	15.1	13.6
1969/70	148.0	9.6	110.0	-26.2	2.2
1970/71	72.5	8.9	9.7	51.9	15.8
1971/72	291.2	25.6	128.1	-87.2	50.3
1972/73	606.5	-109.4	435.9	-237.2 (a)	42.8

SOURCE: M.J. Pope, New Quarterly Data for Stabilization Purposes. N.Z. Reserve Bank Research Paper No. 15, Dec. 1974.

(a) Special deposits $240m.

(1)* Net sales of foreign exchange to the Reserve Bank by the Trading Banks, plus total internal payments from Marketing Board accounts held at the Reserve Bank.

(2)* Government current revenue, minus net Government expenditure as per Table II of the Budget, adjusted for external receipts and payments.

(3)* Reserve Bank advances to the Trading Banks and the money market arising from the RB's role as lender of last resort, plus changes in both private sector time deposits at the RB and private sector (other than Trading Bank), time and other deposits at the RB.

This includes a circa $240 million increase in trading bank time deposits when the banks were compelled (?) to sell Government stock and deposit the proceeds with the RB on the same terms and conditions as the stock surrendered.

(5)* Pope's estimates of the overall cash injection into the private sector.

STABILISATION SCHEMES FROM THE FARMERS' POINT OF VIEW

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We are likely to face uncertain and unpredictable world trading circumstances for an indefinite period ahead. Perhaps the only two foreseeable certainties are that the nations presently taking the major part of our export commodities are likely to labour under a relatively high inflation rate and that in these countries protectionist policies for agriculture are liable to lead to continuing instability in world prices for red meat and for wool. The first issue means that external costs on our export commodities for handling, processing and transport are likely to continually rise, as will imported inputs to our farming systems, whittling away at our share of any improved prices, while the second means that we shall have to fight for our markets for beef and wool in particular. These conditions also mean in general that producers' margins will be under pressure and that we can expect little income stability in the farming community other than that which we create ourselves.

Faced with this likely continuing situation, it is the aim of this paper to underline again the on-farm problems which fluctuating commodity prices create and to examine the effect on farmers' incomes of possible measures which could be taken to iron out some of the variations in world market prices. The major fluctuations in price for export commodities are summarised for convenience in Appendix Table 1. The resultant fluctuating net farm incomes (see Appendix Table 2 for example) have had important repercussions on short and long-term management decisions, some of which will now briefly be discussed:

1. Typically, investment in the development of a property is financed mainly from profits in the previous years. Fluctuating incomes lead to inefficiencies in development which were well expressed by farmer members of the Farm Management Association at Lincoln in August 1974. Investment is encouraged, not only by good surpluses in the immediate past, but by good prospects and confidence in the future. Professor Stewart[1], at this Farmers' Conference some years ago, pointed out that unstable prices prevented development plans from being carried through to their planned stage. Figure 1 illustrates varied investment patterns on New Zealand farms over recent years expressed as expenditure per stock unit. It will be noticed the big jumps in investment are from 1963-65 and 1972-73 when average net incomes were high. Some of this represents ad hoc investment, particularly on the part of established farmers, in plant and equipment and fertiliser in an effort to minimize tax payments rather than as part of a planned investment programme. The impact on rural industries must also be considered - their rundown in times of low farm incomes has an important influence on the ability of farmers to respond to better prices when they come along.

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1. Stewart, J.D., Financial Problems of Development in Fluctuating Prices, Proceedings of the 17th Lincoln College Farmers' Conference, 1967.

2. One of the most important impediments to steady growth in farming is the understandable lack of enthusiasm of farmers to increase their level of debt under conditions of fluctuating annual net farm income. With a steady annual commitment, following the acceptance of loan finance, falls in income have caused extreme hardship. Again it often is the younger farmers developing their business who are hardest hit. Steadier incomes would alleviate some of the problems and permit the farmer to plan better for his debt servicing.

3. As well as long-term planning of financial commitments, planning in general should be eased by more stable commodity prices. The Report of the Farm Incomes Advisory Committee (Zanetti Report) has suggested that an average be taken of the actual market price over the previous three years as a basis for the pay-out price in any one year. This device has the potential advantage that short-term changes in price are reduced and the market trend for a commodity thereby becomes clearer. The result is that forward planning of the farm organisation should be more straightforward.

4. The Zanetti Report also suggests price stabilisation should imply that the payout price should be fixed for the year ahead. With prices fixed, short run planning and financial management should also be easier. At a time when costs are spiralling under inflationary pressures, financial management becomes of greater importance. Continuing cost increases can be expected, some of which will be imported as inputs vital to our farming. The high farming costs we are now experiencing are not a bad dream that will fade in the light of the morning. We have entered into an entirely new ball

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1. We wish to thank J. Gillespie for his assistance in extracting and handling data for this paper.

game with high costs and consequent higher indebtedness. Both these lead to the need for a more business-like approach to our farming - attendance on the financial organisation of the farm, proper forward planning of financial commitment, business control by working closely to detailed budgets and cost control.

To survive in the kind of economic conditions ahead, we must expect the farmer to spend more time on his business. In our opinion this business approach to farming is aided by effective sector stabilisation schemes.

The remainder of this paper is devoted to illustrating how possible price stabilisation methods might affect the after-tax net farm income which is the key financial factor as far as the farmer is concerned. Surprisingly, little precise documented attention seems to have been focused on this factor following the tabling of the Zanetti Report. In this illustration, data have been used from our Ashley Dene farm over the 20 years up to 1973, largely because the reports are well documented and the figures easily available. Two methods of price stabilisation have been examined - the first is essentially that proposed by the Zanetti Report, the second involves the exploitation of an already available tax regulation.

1. <u>The Three Year Average Pay-Out Price (Zanetti)</u>

This system would work in the way mentioned earlier and would involve the creation of a buffer fund from which a supplement would be paid in years of low actual market prices and into which contributions would be made in years of high actual market prices. This method is illustrated in Appendix Table 3.[1]

In this paper the Ashley Dene after-tax net farm income has been compared for three conditions:

(a) Under present legislation with no smoothed pay-out.

(b) Stabilisation for wool prices (Zanetti for wool), and

(c) Stabilisation for both wool and lamb prices (Zanetti for wool and lamb).

Stabilisation of prices does not mean that the same price will hold from year to year nor does it give any guarantee of minimum income levels. In the same way as farmers today trim their spending to the present income (and so have an informal, though inefficient, type of income stabilisation scheme), the same will happen, though to a lesser degree, after stabilisation. Ashley Dene has been no exception to this rule and so in working out the pre-tax net income under a system of smoothed payout prices we have ensured that farm expenditure would be higher in years of high gross income than in years of low gross income. One way to measure the effect of price stabilisation on after-tax net farm income is to measure the fluctuations by a statistic called the Standard Deviation. The greater the fluctuation in after-tax net farm income, the higher will be the Standard Deviation and the less effective will be the stabilisation method. Bearing this in mind, Table 1 sets out the Standard Deviation of after-tax net farm income for Ashley Dene.

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1. The considerable fluctuations in the buffer account have been explored in research at both Massey and Lincoln. See, for example, Candler, W.E., and McArthur, A.T.G., Efficient Equalization Funds for Farm Prices, Amer. J. Agr. Econ., <u>50</u>, 91-96, 1968.

TABLE 1

Fluctuations of After-Tax Net Farm Income ($) (Measured in Standard Deviations) With and Without Price Stabilisation Measures

No Zanetti	Zanetti for Wool	Zanetti for Wool and Lamb
4,870	3,970	3,370

It is clear that the fluctuation as measured by the Standard Deviation is greatly reduced by price stabilisation and that stabilising wool has more effect than stabilising lamb prices.

A simple statistic like this can be misleading and, therefore, Figure 2 shows the levels of after-tax net income for each of the years up to 1973. Evidence of a smoothing of after-tax net income is obvious from Figure 2 but, except in the wildest of swings, the total effect is disappointing. The statistic of Standard Deviation is unduly influenced by the most extreme years and particularly by the 1973 year.

2. Using Tax Legislation

Under the present legislation for provisional and terminal taxation, most farmers pay provisional tax on last year's income. This means they pay less than they should in boom years and have a heavy terminal tax in the following year. In bad years following good years farmers pay more provisional tax than they should, thereby loosing liquidity until the terminal tax refund the following year. The overall effect is to accentuate in after-tax net income any fluctuations in pre-tax net income.

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1. Charlton, P.J., A Practical Guide to Tax Planning Using Procedures for Income Equalisation, A.E.R.U, Res. Rep. 70, Lincoln College, 1975.

Farmers can, however, pay tax on an estimate of the present year's income. For farmers with an end-year in June this means making an estimate in February/March of the year's income. In this way tax is paid in the year the income is earned. The advantages from the farmer's point of view have been set out in a recent A.E.R.U. publication.[1] In this publication the clear advantage of making an estimate when income is falling is underlined. We have called this procedure "Partial Estimation". "Full Estimation" is when farmers make an estimate every year - good or bad - and pay tax on their current income. The effect of "Partial" and "Full" estimation on the Standard Deviation of after-tax net income for Ashley Dene is shown in Table 2.

TABLE 2

Fluctuations of After-Tax Net Farm Income ($) (Measured in Standard Deviations) Under "Partial" and "Full" Estimation for Tax

Provisional Tax an Last Year's Income	"Partial" Estimation	"Full" Estimation
4,870	4,414	3,198

It can be seen that the stabilising effect of Full Estimation on after-tax income is greater than the procedures suggested by Zanetti. For those who prefer the diagrammatic representation, Figure 3 shows the extent of the smoothing of after-tax income resultant on making an estimate.

There will be farmers and accountants who believe that making an estimate of present year's income is a chancey operation. However, the penalty for incorrect estimation is relatively small and the contribution to stable after-tax incomes is more significant than the Zanetti proposals operating under the provisional and terminal tax system.

If the Zanetti recommendations were combined with "Partial" and "Full" estimation for tax, then further gains are possible. In the situation where prices are known for the season ahead, more accurate forward budgeting is possible and making a good estimate of the year's income becomes a much more feasible proposition. The stabilising effect of the combination of measures is shown in Table 3.

TABLE 3

Fluctuations of After-Tax Net Farm Income ($) (Measured in Standard Deviations) With Price Smoothing and Tax Management

	No Zanetti	Zanetti for Wool	Zanetti for Wool and Lamb
Provisional Tax on Last Year's Income	4,870	3,970	3,370
Partial Estimation	4,414	3,447	2,859
Full Estimation	3,198	2,598	2,367

It will be seen from Table 3 that fluctuations in after-tax income as measured by the Standard Deviation is more than halved from using "Full" estimation and Zanetti on both wool and lamb. Figure 4 shows the stabilising effect of the combined procedures.

CONCLUSIONS AND GENERAL COMMENTS

On the basis of the present study which, admittedly, is limited to one farm only but a farm which, over the years reviewed, is fairly representative, a number of conclusions can be made:

1. The stabilising effect of the Zanetti proposals on after-tax farm incomes seems very disappointing with tax being calculated on a provisional-terminal basis except in years of severe swings in product prices. More studies for different farm types should be made on after-tax net farm income. It is tempting to suggest that the major impact of the Zanetti recommendations may be at the national level in combatting inflation and in general economic stabilisation. This national effect, however, could be achieved under normal Reserve Bank operations without the Zanetti proposals if the political will was there. There is no doubt that a buffer account could have a major impact on national stability and this would indirectly aid the rural community.

2. There is no reason why separate buffer accounts should not be run for each major commodity and that different smoothing methods could be used for each. In fact this would almost certainly improve the effect on after-tax income for the farmer. The "tunnel effect" recently suggested by the Minister of Agriculture, while permitting more market flexibility, is only likely to reduce the effect of the Zanetti proposals on after-tax income - an effect which, in any case, is unlikely to do much directly for farmers in most years.

3. Price stabilisation need not be coupled with product acquisition. Smoothing of prices can be achieved without central marketing. This is not to say that central or co-operative marketing would not be an advantage to the industry in overseas trading. Long-term contracts for substantial quantities that almost certainly will be asked for by our newer trading partners can be more easily established by some form of acquisition.

4. The spin-off from some Zanetti recommendations for better financial management is important, particularly improved stability of after-tax income by making income estimates for taxation purposes would be encouraged. This procedure appears more effective as an after-tax income stabiliser than the Zanetti proposals. However, in some conditions, where good years follow not-so-good years, a certain loss of liquidity will arise if tax payments were based on an estimate, but these will be balanced in the reverse situation and there will be an addition to national stability as well as on farm stability. Farmers could, therefore, insist on a quid pro quo of, say, a Government-financed farm recording and management scheme, which would aid the farmer and his accountant in making the estimate of income. Paying tax based on an estimate in every year makes the Zanetti proposals much more effective in stabilising after-tax net farm income.

5. A final point about the Zanetti proposals and their influence at farm level should be noted. If the system for fixing the payout price is known, farmers may adjust the supply of their products on to the market with unfortunate effects on supply. In a good year following two or three poor years a farmer about to sell his wool in February will be able to calculate that if he keeps his wool in the shed until the new price is announced in October, he will get more for it. This will mean that shrewd farmers with liquid assets will be able to contribute less to the buffer fund and get more out of it. Moreover, those that handle the product will have seasonal feasts and famines. The administrative arrangements necessary to deal with this problem have not been formulated by the Farm Incomes Advisory Committee and could constitute a major unforeseen problem.

APPENDIX TABLE 1

Real prices for wool (New Zealand Auction - greasy - cents/kilo) for manufacturing grade cow beef (Schedule for 141 kg and over - cents/kilo) and for lamb (Schedule for Prime 13.0-16.0 kg - cents/kilo).

	Wool	Beef	Lamb
1960/61	74.12	23.59	30.75
1961/62	70.78	19.95	23.43
1962/63	76.26	20.13	29.05
1963/64	97.19	21.44	30.39
1964/65	72.40	21.44	30.36
1965/66	69.38	27.11	23.71
1966/67	57.22	24.73	22.75
1967/68	42.66	30.19	24.49
1968/69	50.50	30.28	26.20
1969/70	44.51	37.68	30.84
1970/71	39.99	35.09	25.71
1971/72	46.05	31.57	19.72
1972/73	91.64	39.75	29.32
1973/74	80.92	26.60	33.95
1974/75	48.80	12.67	19.77

Source: N.Z. Meat and Wool Boards' Economic Service and N.Z. Wool Marketing Corporation.

APPENDIX TABLE 2

Actual Net Farm Income for Sheep Farmers

Year	Average Actual Net Farm Income $
1960/61	5,800
1961/62	4,600
1962/63	5,700
1963/64	7,600
1964/65	5,800
1965/66	6,000
1966/67	4,200
1967/68	4,800
1968/69	6,000
1969/70	6,300
1970/71	5,800
1971/72	7,100
1972/73	18,800
1973/74	13,800
1974/75	5,300

Source: N.Z. Meat and Wool Boards' Economic Service.

APPENDIX TABLE 3

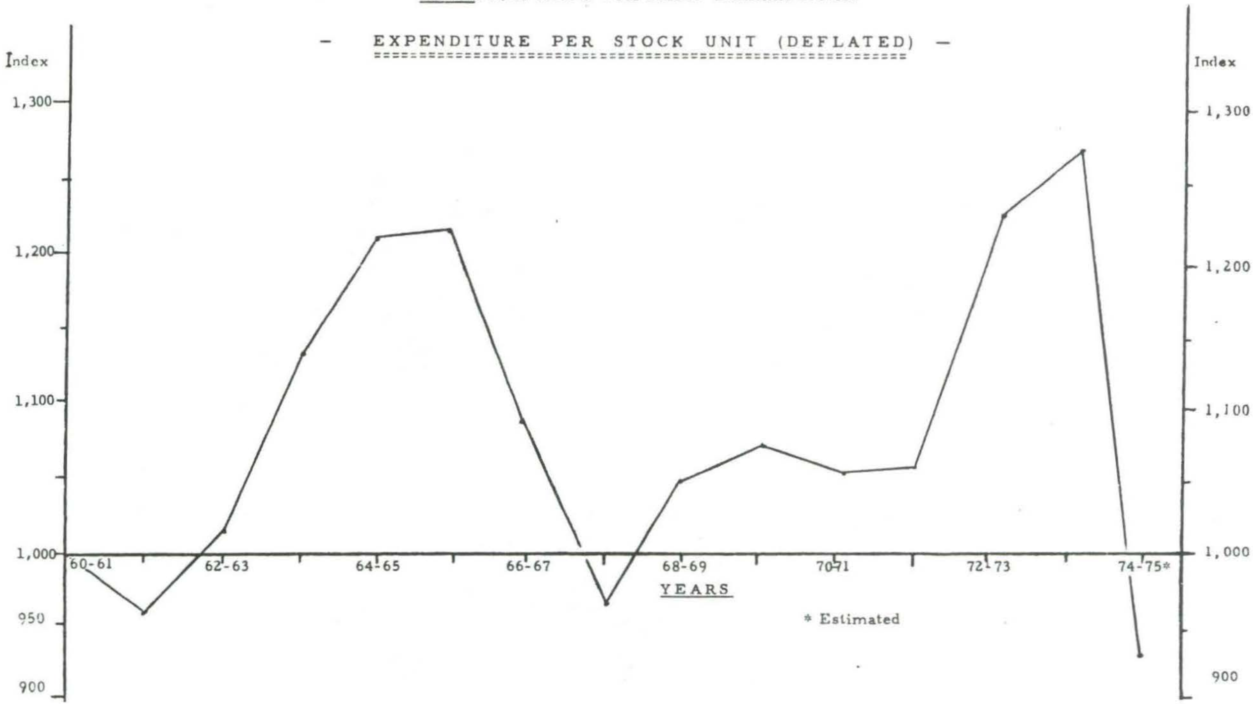
An Example of the Method of Smoothing Payout Prices for Wool (cents/kg)

	3 Years Ago	2 Years Ago	Last Year	This Year	Next Year
Actual average price for the year	100	180	150	90	160
Smoothed payout price				100 180 150 3) 430 143	180 150 90 3) 420 140
Supplement from buffer fund				53	
Contribution to buffer fund					20

FIGURE 1

PRODUCTION TRENDS 1960-61 TO 1974-75 (1960-61 = 1000)

Source: N. Z. Meat & Wool Boards' Economic Service



ASHLEY DENE FARM - LINCOLN COLLEGE 1955-73

FIGURE 2

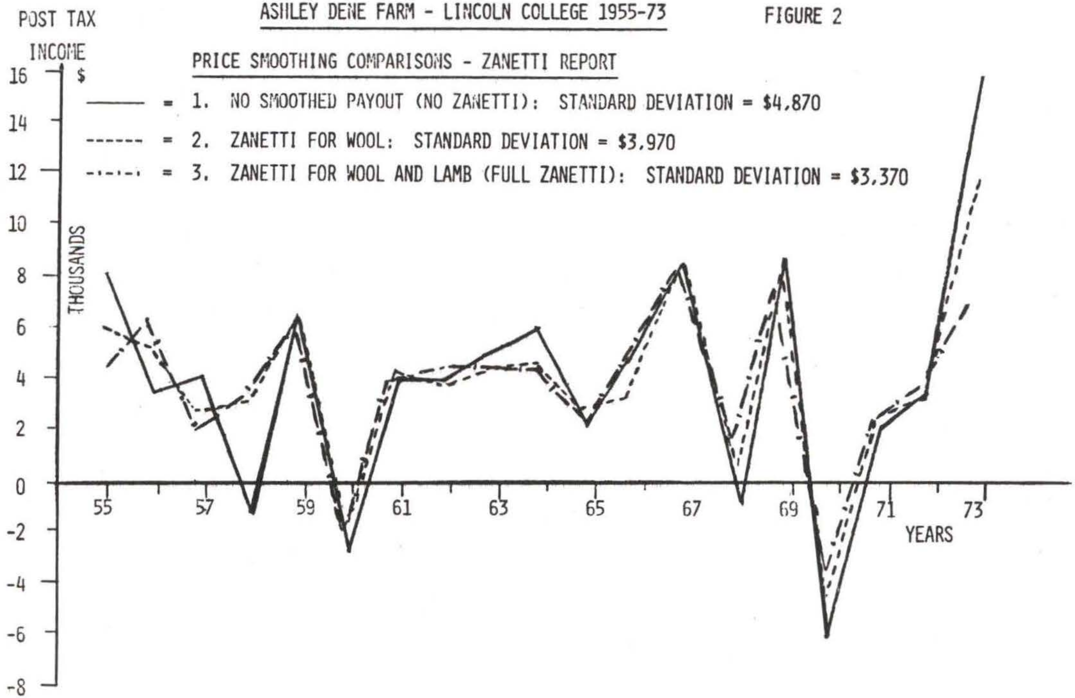
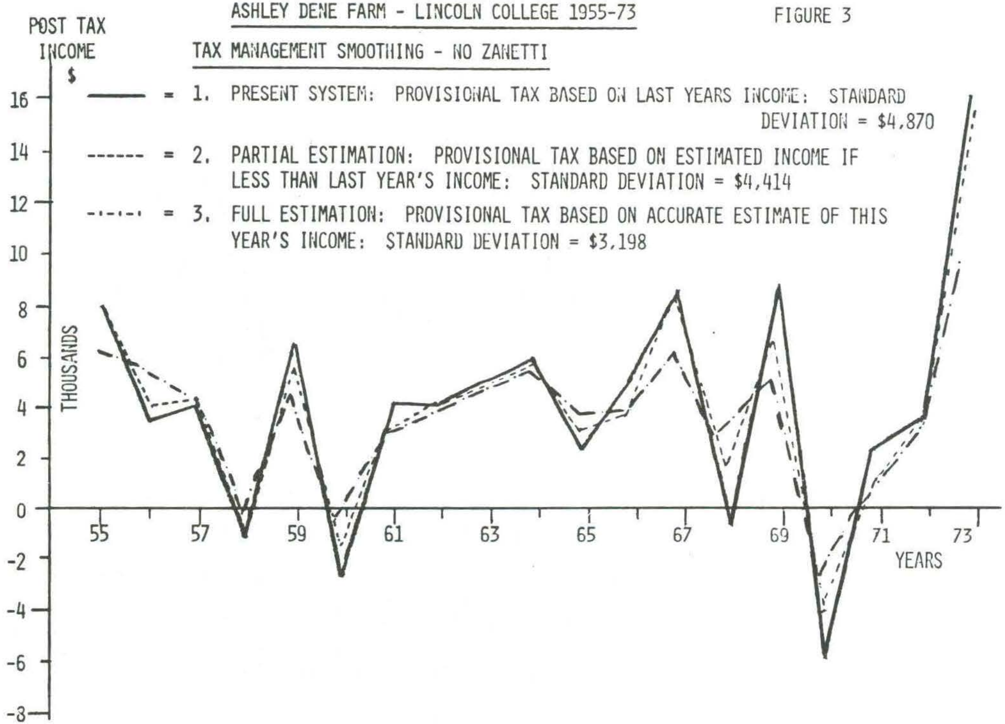


FIGURE 3

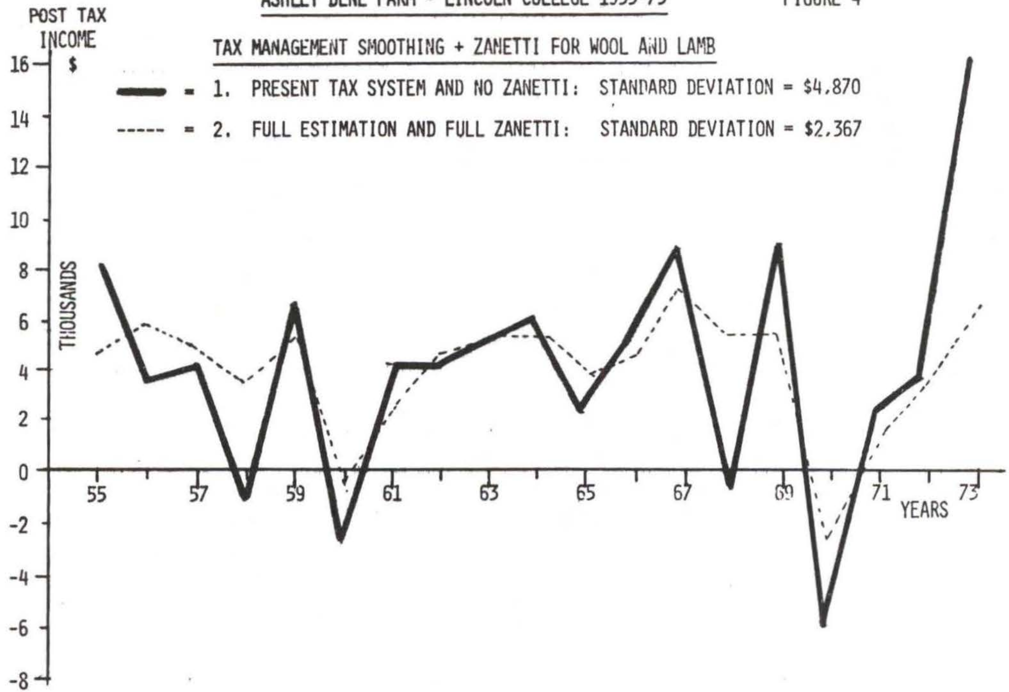
ASHLEY DENE FARM - LINCOLN COLLEGE 1955-73

TAX MANAGEMENT SMOOTHING - NO ZANETTI



ASHLEY DENE FARM - LINCOLN COLLEGE 1955-73 FIGURE 4

TAX MANAGEMENT SMOOTHING + ZANETTI FOR WOOL AND LAMB



THE POLITICS OF STABILISATION

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The title of this paper is the "Politics of Stabilisation". I have borrowed the subtitle from one William Shakespeare - "Confusion has now made his Masterpiece". When I have finished speaking you can make your individual decision as to whether in McBeth he was referring to the New Zealand Economy, 1975, understanding of stability of politicians or this paper. It is necessary to define stability before the politics of stabilisation can be discussed. The best description I have seen was that given by Prof. Belshaw back in 1953 and I quote:

> "So let's pretend we are living in a society which is economically stable. What does this heaven of stability look like? There is a stream of production going forward which is constant from year to year. It is a money economy and the costs return as income, so both are equal. In order not to impose an undue problem for the Deity, we shall permit of seasonal changes in the weather and in crops, but He must be careful that these are the same from year to year.

When the grain is harvested it will be stored, but exactly used up on the day a year hence when the next harvest comes in. There will be fluctuating stocks of other things too, but they need cause us no trouble. We must successfully negotiate an agreement with God to gather the same number of people to their ancestors each year and fill the cradles with the same number. This means an unchanging size and age composition of population and must be so or the structure of demand and production will alter. This is asking a lot of the Deity and you will already suspect trouble ahead, especially on the procreation side.

Production is entirely devoted to consumption and depreciation because saving and net investment will induce change. The pattern of income distribution will be unchanging but as long as all income is spent, we need assume no particular pattern. The Government will impose taxes which may even be graduated and spend money, but it must not alter the pattern of these. On the basis of past experience, producers will correctly anticipate demand and produce and allocate resources accordingly. Money and banking will be convenient for accounting purposes and to facilitate exchange and provide a reserve of purchasing power because receipts and disbursements do not exactly coincide. Deposits will come from revenue received before expenses for production and consumption are incurred (for example, from wheat farmers) and lent to others to meet expenses in anticipation of sales, but we must not have credit creation. There is no need to have a reserve of money or deposits to satisfy the speculation motive or the investment motive because without change there is no speculation and there is no investment.

We can have contact with the outside world provided that the quantities and prices of exports and imports are the same each but, but this is greatly daring for, if other economies go in for a spot of change, it will not be sufficient that God is doing his bit about the weather and that the demographic contracts are honoured. We shall find exchange reserves necessary because receipts and disbursements do not coincide in time, but not for any other reason. The average amount from year to year will be unchanging.

The business man need not worry about his liquid assets, the farmer will not make a nuisance of himself over guaranteed prices, there is no need for dreary debates in Parliament or meetings of the Economic Society or Chamber of Commerce, this Convention is not being held and there are no Professors of Economics. (Professors of Economics, you will note, are one of the costs of instability.) Instead we can pursue culture, provided it does not stimulate our minds so that we want to change things. There is clearly a lot on the credit side and we feel awfully safe, but we are also frightfully bored."

So complete stability is neither desirable nor practical but we can and do have areas where we can and do have stability.

Stabilisation is a political exercise within an economic and social framework, and we must accept that a desire for greater economic stability has become an influence on Government policies of all countries.

Complete stabilisation means that all factors will forever maintain their present relativity. This is impossible so we are really discussing the degree of stability we want and in what fields we believe it is politically acceptable, and in what degree it will be applied in the individual sectors of the economy.

The catch is that stability in one area creates instability in others. It is here that we get into political strife. Let us examine just some spheres of possible stability and our decisions already made and some of our motives:

Stability of Employment: Accepted by all political parties who ever hope to become the Government. This destroys the chances of certain other forms as you will see.

Stability of Prices: Accepted as desired by all electors but impossible to reconcile with almost all others. Therefore, all Governments are under pressure to perform the impossible.

Stability of Balance of Payments: In conflict with almost all other forms of stability.

Stability of Cost of Production: Only in part controlled by internal decisions. Highlighted by the effect of decisions of other Governments and their rate of inflation. Decisions of groups such as oil producers, etc. Of paramount importance to farmers.

Stability of Wages: Has been an area of confusion since the virtual destruction of the Arbitration Court in 1968. Demands on base of cost of living. Free bargaining between parties. Claims of relativity. All destabilising and conflicting attitudes.

Stability of Money Values: Unrealistic but more of this later.

Stability of Taxes: By rate or in total. I leave this to the Minister of Finance tonight to walk the annual tightrope.

Stability of Living Standards: This the whole electorate wants if the alternative is to go backwards. This nobody wants if there is an opportunity to go forward.

Stability of returns to primary producers. Problem of a dual economy. Payments based on overseas prices. Costs based on internal values. The list is almost endless, stabilisation of population, stabilisation of the environment, stabilisation of profit, and so on ad infinitum. The politician must attempt to gauge the political climate at the time, although, in general, the attitudes of the involved sectors are predictable.

Those on fixed incomes living on capital or its interest want complete stabilisation. The militant Left can not improve its position or make any comparative progress under stabilisation, nor can the Right, the entrepreneur, the adherent of laissez faire. These two sectors - the Left and the Right - are, in principle, generally opposed to stabilisation of their position.

The balance of the electors, depending on their personal circumstances, their place in society, occupy the shifting centre. Their position depends to a very large degree on the amount of stabilisation as it has affected them personally in the immediate past and leans in the opposite direction. At any given point in time their political decision is how much of their personal freedom they are prepared to surrender in return for stronger stabilisation measures. Government decision is taken in the light of how much stabilisation is politically acceptable, how much is economically possible and what effects it will have on those not immediately involved in the decision. The political decision is between progress and security, growth and stability, importation or curtailment of consumption. The issue is what degree of economic stability is a practical and politically desirable objective at any given moment.

Bearing all these views in mind in any stabilisation discussions, there are always four parties to the decision:

1. The general electorate who wants security and increased living standards.

2. The politician who wants to be elected and further his own particular philosophy.

3. The Public Service whose interest is to preserve continuity and to simplify administration.

4. The sector involved whose interest is to defend and to strengthen its relative position.

You will note that each of the parties to the negotiation has goals which conflict, not only with some of the others but also contain conflict within their own viewpoint.

All nations use the same phrases to describe their national objectives - social justice, full employment and freedom of the individual.

These are destabilising factors and are not compatible. A balance between these aims is the politics of stabilisation.

It is important to have a clearer public realisation that some measure of instability is a necessary price to pay for growth. On the other hand some people value stability as a feeling of security.

In any democracy political policy must always be a compromise - sacrificing some growth for a lesser degree of instability and sacrificing some stability for growth.

To speak on stabilisation one must also briefly discuss inflation as a concept because of their inevitable antagonistic influence. During an inflationary period there is a great desire for stabilisation in general but also a knowledge that stabilisation of personal income must be disadvantageous if applied in isolation.

Inflation is, therefore, a major destabiliser. From time immemorial the main source of inflation has been the Sovereign's and later the Government's desire to acquire resources, whether to wage war, construct palaces, public works, in lieu of taxes or national deficit financing.

The classic method was to debase metal used in coinage, then paper currency - more recently book entry in central banks. This allows Government to push the individual and the company into higher tax brackets without legislation and at the same time reduces real debt, both national and individual. Somewhere between 1½ and 3 per cent has been acceptable and overtime expected. I know that this is an over-simplification and that there are many new factors in the almost universal escalation of inflation.

In speaking on the Politics of Stabilisation in relation to farmers, one must accept the domination of the community's influence as the farmer's attitude as stabilisation of farming is only a part of a whole and cannot be taken in isolation.

The effect of the degree of stabilisation in the community is the major factor affecting the profitability of farming as a sector.

This effect, particularly on meat, is increasing at a dramatic rate due to the escalation of processing costs and the lessening share of the farmer in the total national income.

Farm Gross Income as a proportion of G.N.P. has dropped from 22.7% to 13.2% in the last 10 years.

Even this figure overestimates the farmer's influence, as he is receiving an ever-decreasing share of his gross income as on-farm costs rise. In the same 10 years the farmer's share of private income has dropped from 10.1% to 3.4% this year with a projection of only 2.8% next year.

What this means is that while the effect of the level of farmers' income on the community has lessened, the effect of the community has increased on the farmer. His on-farm costs at a constant level have increased by 77.5% in the same ten years.

As the farmer receives less and less as a percentage of total returns, as his share decreases, so it becomes less important in the total national accounts. Stabilising of prices to the farmer is attempting to stabilise a diminishing residue. Farmers are very well aware of this.

There has always been an obsession with on-farm costs in New Zealand. Nationally the same attention has not been paid to processing, transport and marketing. I suppose this has been inevitable in a traditionally production-orientated economy. Our research, our public interest, our discussion and debate are almost all centred on on-farm efficiency. Could you imagine at this time the wealth of expertise which can be assembled at meetings such as this and other conferences being centred in the processing, transport or marketing part of the operation. There is not either the depth of research or the interest.

Farmers are only too well aware that prices received on overseas markets do not reflect in nett income on farms. The share taken by the rest of the community to an increasing degree determines just what farm income will be.

I have not spoken of the Zanetti report yet and this was quite deliberate. I believe that the Committee has done a magnificent job in examining the whole field of the economics of farming, its impact on the community and the community impact on it; but remember its title does not include the word "stabilisation", nor does its terms of reference.

The first term of reference asks the Committee to examine ways to reduce fluctuations in prices received by producers of the major agricultural products. The second to examine ways of achieving a more consistant level of farm income, limit the stop-go impact on the New Zealand economy consistent with maintaining the maximum level of returns to the producer. The third how to do this while maintaining a market orientated and responsive industry.

Their duty as the Committee's name implies (Farm Income Advisory Committee) was to produce a Farm Income Policy consistant with a desired rate of growth remaining market responsive, whose fluctuations could be cushioned both from the farmers and community effect point of view. In other words, how to attain maximum growth in agricultural production with the minimum amount of instability. A mammoth task within a strict time limit.

There is another implication related to their terms of reference which is of great significance because of their recommendations which concerned dairy, meat and wool only.

Because they came firmly down against input subsidies, their recommendations, if implemented, would destroy the stability of the cost structure of many other farmers. Just as the withdrawal of weedicides and pesticide subsidy had, as an example, a disastrous effect on fruitgrowers' income, so would the withdrawal of the fertilizer subsidy affect the grain growers' income - in fact, every other farmer's income. It would alter the whole relationship between sections of farmers. I use this as an example just to show the complexity of the problem and to illustrate that no sector of farming, or for that matter, any sector of the community, can be taken in isolation.

To me the main points raised in the Zanetti report are:

1. Nationally farming must receive sufficient encouragement to increase production as there is no prospect at this time of an alternative exchange earner of the desired magnitude.

2. Fluctuations in agricultural price are a reducing factor in total national accounts.

3. That stabilisation of prices to the farmer in isolation of itself is of limited significance or, in the words of the report, "rather limited".

4. High returns for farm products gives New Zealand a favourable exchange position and signals all sectors to expand their expectations and all take action to satisfy them.

5. Stabilisation of prices received does not mean sufficiency of income.

6. Farm profitability is increasingly influenced by actions of sectors outside farming.

7. The difficulty of equating price stability and market orientation.

8. Government should display greater resolution in controlling farmers' costs.

9. Supplementary payments will be necessary to maintain a desired growth rate.

Just what is politically acceptable? I think that the fundamental conditions are quite clear, that is, the base of negotiations. From the meetings which have been held throughout the country and from attitudes expressed at the Meat and Wool and Dairy Councils of Federated Farmers, I feel that the farmers would co-operate in some sort of smoothing out operation provided, and this is the important point, that it is through the existing structures provided by the respective Producer Boards using their machinery in consultation with their industry and Government.

In return they would expect Government action such as:

1. The necessary finance through the Reserve Bank.
2. A resolute attack on specific costs of the sector.
3. Satisfactory level of assistance with farm inputs when returns do not meet the income levels necessary for the desired growth rate.

There is nothing new in these requirements of Government, just the progression and updating and adjusting of present trends and policies.

It is my opinion that neither the farmers nor the Government would accept the proposed new Co-ordinating Authority as proposed by the Zanetti Committee; the Government because it would limit political freedom of action; the producer because the consensus of farmer opinion is firmly that if any individual freedom is surrendered, it will be only to a producer organisation with a clear and visible producer majority.

I also believe that the principal of supplementary payments as proposed by the committee is not really acceptable by Government long term, as a direct payment on an end product is politically embarrassing in access negotiations. I also consider that the withdrawal of input subsidies would have a very disastrous effect on all other forms of agriculture.

Input subsidies do not give absolute equality between sectors but they are the best sort of rough justice yet devised to cause the least imbalance and the smallest distortion with the least interference with market orientation. So I come back to my first position - that stabilisation is a political exercise and the present discussion is not about stabilisation but about what political decisions are possible and desirable so that we may attain maximum growth with the minimum amount of instability.

MY WAY OF ADJUSTING TO THE UPS
AND DOWNS OF FARMING

FOR HILL SHEEP FARMING

MR W.N. MAXWELL

FARMER, CHEVIOT

My personal background as a farmer - my father purchased a hill property at Motunau in the early 1920's, quite unimproved and at a price which soon proved to be much in excess of its productive value. I have very vivid memories of what was entailed in, shall we say, just hanging on during the 20's and particularly the 1930's.

With the outbreak of the 2nd World War and being of the age group involved, I found myself in uniform and served with 2N.Z.E.F. for four years, returning in late 1945.

I found that I qualified for the rehabilitation assistance and with this finance duly purchased in 1947 a property of 1,580 acres in the Ethelton Valley to the West of Cheviot County and known as Mount Sandford. It was, of course, part of the Cheviot Hills subdivision and its classification was as a small grazing run with the production of store sheep.

The country runs from 600 to 1,500 feet above sea level of easy rolling hill country. The rainfall is recorded as averaging 35"; however, it is, of course, very often rather poorly distributed.

The cover in an unimproved state is silver and fescue tussock, with matagouri flourishing, particularly in the more recent soil types. It will be of interest that there is considerable evidence that the area had carried a totara forest in some previous times.

Prior development had consisted of limited subdivision, some over-sowing of cocksfoot grasses and clover; a team was kept for limited cultivation, mostly, I feel, to facilitate the fattening of lambs. Some of the cultivation of the early 1900's was ultimately sown down with chewings fescue.

The property was purchased with the expectancy that it would carry 1,000 Corriedale ewes with some 600 dry sheep, including supporting ewe hoggets, and in defferance to the appreciation that there was a place for cattle on this type of country, 60 breeding cows were included. This proved to be a reasonable assessment of the property's capabilities at that time.

With the upturn for wool and meat in the early fifties, every advantage was taken to utilize the surplus income advantageously; a 30 h.p. Crawler replaced the five horse team to the delight of man and beast. After the rebuilding of existing fences, a programme of subdivision began, the tractor being a great advantage in the programme of pasture renewal.

The advent of the airplane at this time was obviously a terrific break-through and was utilized to the limit of available funds for topdressing and over-sowing.

The results of these practises quickly became evident in stock performance and in increasing numbers.

In 1966, having four sons, the older ones showing an interest in farming, and with an adjoining property coming on the market, advantage was taken of the equity established to purchase this further 1,600 acres. Its condition and stock performance was very similar to the original Mount Sandford. In the succeeding nine years the extended programme of development has led to there now being in excess of 8,000 stock units on the two properties; this has been achieved from income.

After all this I now come to the title of my paper, i.e., "My Way of Adjusting to the Ups and Downs of Farming as a Hill Country Farmer".

What I have said will, of course, cover the ups reasonably well, however, I must say that there is still quite a potential for further production by the methods now existing.

The downs show every prospect of slowing down the tempo of development, although this is regrettable, it would be far from disastrous.

One's main concern would be being able to ensure the maintenance of existing development, that is, adequate maintenance, top dressing, otherwise stock performance and then numbers must decline - so far we have as yet no experience of this and hope that we do not.

The old cliche that one's farm is one's bank still holds good and we trust that this will ensure that the enterprise will be self-sustaining.

One is very conscious of the benefits of fertilizer assistance to the industry and the importance of maintaining the viability of our services by way of transport, aerial aviation and agricultural contractors.

Farmers and the nation have been very well served by the acceptance of the importance of investment allowances.

A Conference such as this must be above political overtones; however, our awareness that possibly, apart from beef, realizations for our products are by any yardstick of the past quite good, the present down-turn being caused by unprecedented cost escalation as distinct from previous experience. We may only pray that costs are reasonably held and of some measure of stability being achieved by those with whom we are associated commercially.

Since the 1940's farming hill country such as ours has been quite an adventure, the use of tractors, airplanes, dozers, farm vehicles, water supplies and the adoption of contemporary technical developments has brought the most rapid changes in land use - let us trust that this may continue.

I particularly wish to acknowledge with appreciation all those people who made rehabilitation such a success, particularly the staff of S.A.C. who, as you know, acted as agents for the Board, the guidance, philosophy and, above all, friendship of these people is something to be remembered. Also I acknowledge the help of all those many people in the Departments and professions who contributed so much to our progress.

	SHEEP, 1 JULY			EWES	LAMBS	
	Ewes	Hoggets	Total	To Ram	Tailed	%
1959/60	1,399	690	2,169	1,399	1,325	95
1960/61	1,400	665	2,148	1,380	1,535	111
1961/62	1,409	720	2,209	1,409	1,430	101
1962/63	1,435	708	2,233	1,435	1,510	105
1963/64	1,535	643	2,245	1,535	1,720	112
1964/65	1,509	665	2,251	1,509	1,580	105
1965/66	1,580	630	2,293	1,580	1,790	113
1966/67	2,657	1,080	3,905	2,657	2,783	105
1967/68	3,139	1,176	4,562	3,139	3,150	100
1968/69	3,230	1,250	4,638	3,230	3,207	99
1969/70	3,340	1,165	4,633	3,340	3,200	96
1970/71	3,510	1,237	4,900	3,510	3,550	101
1971/72	3,905	1,262	5,342	3,900	4,300	110
1972/73	3,900	1,163	5,230	3,900	3,820	98
1973/74	3,950	1,175	5,297	3,950	3,829	97
1974/75	4,040	1,190	5,415			

SALES

	Prime Lambs	Av. Price	Store Lambs	Av. Price	2T Ewes	Av. Price	Other Sheep (1)	Av. Price
1959/60	410	4.21	2.38	3.00	215	4.85	321	3.57
1960/61	777	4.23	-	-	140	6.58	340	5.41
1961/62	700	3.07	-	-	73	3.58	580	4.62
1962/63	855	4.06	-	-	-	-	533	6.00
1963/64	908	4.76	-	-	215	7.15	324	5.52
1964/65	905	4.98	-	-	-	-	501	8.77
1965/66	1,055	5.68	-	-	-	-	277	9.01
1966/67	1,538	4.60	-	-	-	-	394	5.80
1967/68	1,060	5.26	781	4.22	161	6.60	752	4.93
1968/69	1,539	5.10	443	4.00	432	6.93	561	5.71
1969/70	1,551	5.60	(2) 411	5.77	258	7.37	474	5.86
1970/71	2,248	5.08	-	-	234	6.58	334	5.48
1971/72	2,309	4.52	732	3.53	174	5.14	744	3.90
1972/73	1,814	8.90	(2) 760	7.71	138	12.61	727	13.16
1973/74	1,814	9.10	(2) 742	8.68	278	18.24	689	13.73

(1) Mainly A.D. Ewes

(2) Ewe lambs only

	SALES					WOOL SHORN	
	Total Shorn	Kgs Sold	Kgs P.HD.	Net $	Av. c P.KG	Total Kgs	Kgs Per Acre
1959/60	2,095	10,394	4.96	8,042	77.4	12,282	7.77
1960/61	2,096	10,494	5.00	7,616	72.6	13,605	8.61
1961/62	2,181	10,402	4.76	7,278	70.0	12,631	7.99
1962/63	2,172	11,486	5.29	8,998	78.3	16,454	10.41
1963/64	2,150	10,398	4.83	10,898	104.8	11,613	7.35
1964/65	2,241	10,066	4.49	7,356	73.1	11,951	7.56
1965/66	2,299	11,600	5.04	8,872	76.5	16,197	10.25
1966/67	3,764	16,468	4.37	12,280	74.6	20,371	6.33
1967/68	4,470	18,917	4.23	11,358	60.0	21,252	6.61
1968/69	4,547	18,564	4.08	13,589	73.2	22,514	7.00
1969/70	4,532	14,224	4.24	13,221	68.8	24,286	7.55
1970/71	4,867	22,093	4.53	12,731	57.6	28,141	8.75
1971/72	5,182	22,884	4.38	12,489	54.6	28,955	9.00
1972/73	5,181	21,514	4.15	32,869	152.8	26,720	8.31
1973/74	5,250	20,939	3.48	39,328	187.8	25,857	8.04
1974/75							

CATTLE, 1 JULY

Year	Cows	Heifers	Calves	Steers Bulls	Total	Calves Mated	Calves Marked
1959/60	93	-	80	-	173	90	74
60/61	90	13	74	41	218	88	78
61/62	77	23	78	72	250	77	70
62/63	77	15	70	41	203	90	86
63/64	89	13	86	45	233	98	95
64/65	112	29	95	62	298	109	95
65/66	109	2	95	42	248	107	70
66/67	106	18	70	84	278	124	115
67/68	153	19	115	88	375	150	138
68/69	166	25	138	85	414	166	138
69/70	170	53	138	70	431	170	136
70/71	179	50	136	78	443	179	132
71/72	181	64	132	100	477	181	134
72/73	182	69	134	82	467	182	139
73/74	171	63	139	87	460	171	145
74/75	166	86	145	109	506		

SALES

Year	Prime Cattle	Av. Price	Store Cattle	Av. Price	Total Sold
1959/60	-	-	23	44.86	23
60/61	-	-	44	50.68	44
61/62	78	76.92	35	42.91	113
62/63	20	80.10	17	42.70	37
63/64	22	82.27	-	-	22
64/65	17	88.00	122	52.91	139
65/66	35	101.25	6	86.66	41
66/67	60	107.10	-	-	60
67/68	82	101.89	-	-	82
68/69	110	100.00	-	-	110
69/70	56	123.83	47	87.29	103
70/71	96	124.36	-	-	96
71/72	134	132.07	-	-	134
72/73	118	163.42	-	-	118
73/74	69	173.00	-	-	69

	Meat Production (kgs)					Topdressing		Cultivation
Year	Lamb	Mutton	Beef	Total	Per Acre	Tons Super.	Tons Lime	Acres
1959/60	7,876	12,148	8,300	28,324	17.93	762	-	37
60/61	10,097	12,932	14,910	37,939	24.01	83	-	55
61/62	8,891	13,995	20,857	43,743	28.68	80	95	-
62/63	12,368	12,838	18,892	44,098	27.91	100	-	4
63/64	12,701	11,808	17,543	42,052	26.61	107	-	73
64/65	11,532	12,002	25,878	49,412	31.27	121	400	15
65/66	14,654	16,278	15,298	46,230	29.26	190	-	70
66/67	21,978	25,196	19,992	67,166	20.89	60	-	120
67/68	24,469	20,327	27,132	71,928	22.37	155	-	35
68/69	26,231	22,278	32,750	81,259	25.28	215	-	83
69/70	26,638	22,317	21,932	70,887	22.05	9	-	85
70/71	30,710	24,462	30,456	85,628	26.64	218	-	120
71/72	37,468	19,333	25,708	82,509	25.67	224	500	80
72/73	33,296	21,052	25,545	79,893	24.85	224	152	76
73/74	35,057	23,073	21,864	79,994	24.88	314	840	70

CAPITAL

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Year	Land MV. 30/6	Sheep MV. 30/6	Cattle MV. 30/6	Total Stock	Plant B.S.	Sub-Total	Working Capital	Total Capital
1959/60	56,000	10,700	8,700	19,400	2,100	77,500	5,000	82,000
60/61	60,000	13,200	10,700	23,900	3,300	87,200	6,500	93,700
61/62	64,000	11,100	8,100	19,200	2,800	86,000	5,800	91,000
62/63	68,000	13,400	9,300	22,700	2,400	93,100	6,600	99,700
63/64	72,000	13,500	13,400	26,900	2,100	101,000	7,800	108,800
64/65	77,000	14,900	12,400	27,300	2,400	106,700	7,300	114,000
65/66	82,000	15,000	15,300	30,300	2,700	115,000	9,300	124,300
66/67	170,000	27,300	22,500	49,800	2,300	222,100	132,000	235,300
67/68	173,000	25,500	24,800	50,300	2,300	225,600	15,600	241,200
68/69	176,000	30,100	25,800	55,900	2,600	234,500	18,000	252,500
69/70	186,000	31,800	28,800	60,600	2,800	249,400	15,500	264,900
70/71	199,000	34,700	33,400	68,100	2,700	269,800	21,500	291,300
71/72	215,000	28,800	35,000	63,800	2,300	281,100	24,400	305,500
72/73	244,000	63,500	46,000	109,500	2,400	355,900	29,800	385,700
73/74	290,000	54,000	38,000	92,000	6,900	388,900	30,700	419,600

INCOME AND EXPENDITURE

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Year	Wool	Sheep	Cattle	Other	Total	Total Expend.	Net Income
1959/60	8,106	4,374	3,618	-	16,098	7,944	8,154
60/61	7,676	6,070	3,484	-	17,230	11,184	6,046
61/62	7,348	4,938	7,102	-	19,388	9,648	9,740
62/63	9,066	6,554	4,138	-	19,758	10,592	9,166
63/64	8,670	8,272	3,776	-	20,718	12,844	7,874
64/65	8,186	8,800	5,616	-	22,602	11,914	10,688
65/66	8,936	8,400	4,650	-	21,986	15,680	6,306
66/67	12,288	10,538	6,300	-	29,126	23,036	6,090
67/68	11,378	13,345	9,454	224	34,401	28,442	5,959
68/69	13,683	15,157	10,765	75	39,680	32,571	7,109
69/70	13,259	15,426	11,396	34	40,115	27,524	12,591
70/71	12,846	14,972	12,504	62	40,384	39,482	902
71/72	13,671	15,775	15,863	3,379	48,688	44,860	3,828
72/73	31,977	32,544	18,621	1,638	84,780	55,679	29,101
73/74	39,095	37,566	15,212	-	91,873	57,825	34,048

RETURN ON CAPITAL

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Year	Plus Interest	Less W. of Mgt	Adjusted Net Income	% Return	Farm Cash Expend.
1959/60	354	2,700	5,808	7.04	7,200
60/61	326	3,000	-3,372	3.59	10,000
61/62	298	3,000	+7,038	7.66	8,600
62/63	268	3,300	-6,134	6.15	9,900
63/64	252	3,500	-4,626	4.25	12,200
64/65	242	3,700	+7,230	6.34	10,960
65/66	232	4,000	-2,538	2.04	14,700
66/67	5,232	4,700	+6,622	2.81	21,700
67/68	6,603	5,000	+7,562	3.13	26,200
68/69	6,511	5,000	+8,620	3.41	31,000
69/70	6,435	5,000	+14,026	5.29	26,000
70/71	6,480	5,000	-2,282	0.78	38,000
71/72	7,101	5,200	+5,729	1.87	43,600
72/73	7,002	5,700	+30,403	7.88	54,000
73/74	8,001	7,000	+35,049	8.35	54,400

MY WAY OF ADJUSTING TO THE UPS AND DOWNS OF FARMING

FOR THE MIXED CROPPING FARMER

MR N.Q. WRIGHT

FARMER, SHEFFIELD

I believe the challenge facing farming today and opportunities facing farmers today are greater than they have ever been and they will require men who are prepared to learn their trade thoroughly and be adaptable to the never-ending change and that they should approach their task like business men. Enterprises are becoming larger and amalgamations are increasing. One only has to look at the statistical figures and trends in farming over the last ten years to appreciate that this is in fact happening to much of our farmland throughout New Zealand.

The position facing many farmers today is that they have entered a stage of development after a boom period. The effect of the fallen wool prices in 1967 and the depressed wool market right through to the early 1970's, followed a year of higher prices, coupled with increasing costs for all our commodities used in obtaining our net profits, has meant that the farmer has been forced into the position today of a cost price squeeze of an intensity never anticipated.

Farmers have to face up to the task of working on tighter budget controls, higher cost in labour, essential equipment and, lastly, transport rates.

I wish to describe briefly the farming operation which I run with my brother and which most of the examples and experiences in our operations are drawn from and discussed in this paper today.

The property is situated in the Annat-Sheffield district, some 30 miles West of Christchurch, the area being 920 acres. The altitude is 1100 feet above sea level and with a rainfall of some 37". The property could best be described as intensively farmed mixed cropping, specialising in wheat, small seeds, peas and potatoes, with other crops worked in where suitable, and the whole system combined with a very flexible but intensive stocking policy.

My brother and I took over our father's estate of 570 acres in 1956. This acreage has since been increased by a further 350 acres. In 1972, 900 acres of hill country was leased. The property is all flat, medium to heavy land on the South bank of the Waimakariri River and is suited for intensive cropping.

Livestock management and performance cannot be accurately described because the stock policy is extremely flexible due to the fact that it is always related to the market trends and price and demand for small seeds, and the market price of livestock.

Our study of market returns over the past few seasons has clearly indicated a very substantial increase in both gross and net returns for both stock and cropping.

Gross cropping returns have almost doubled.

Pasture management on the property is tightly interwoven with a flexible stock policy which is briefly this - one and two-year ewes are bought as replacements and lambed and carried through to October. They are then sent into the hill block or grazed off the property, depending on the market prospects for the sheep and small seeds. 1,500 store lambs are bought in January and February, and are sold fat in May and June. Over recent years no set cropping rotation has been followed. INstead the main aim has been specialisation in whatever crops will give maximum yields and return. In the past few years potatoes, wheat, white clover and peas have proved the most successful.

The fertiliser programme has been kept simple, with all crops receiving one hundredweight of super at sowing. White clover for seed production has received four hundredweight of Molibdic Potash Super, potatoes are planted with five hundredweight of superphosphate, and nitrogen in the form of urea is supplied to all grass, cocksfoot and occasionally second year wheat.

Some intermediate fences have been removed so that cropping can be done in blocks rather than in single paddocks and fences replaced temporarily when the land is in pasture. This system makes for cultivation and harvesting with large machinery, quicker and more efficient.

With the introduction of the leasehold hill country block, cattle have played an increasing part in the utilization of crop residues.

That is a brief resume of the farm but certain aspects will need to be mentioned in more detail. While no set rotation is carried out, the rotation is normally as follows - pasture to peas or potatoes, to wheat, to white clover or peas (depending on the quality of the clover stand), followed by wheat, white clover, wheat or barley or peas, or back to resowing in Manawa

FIGURE 1

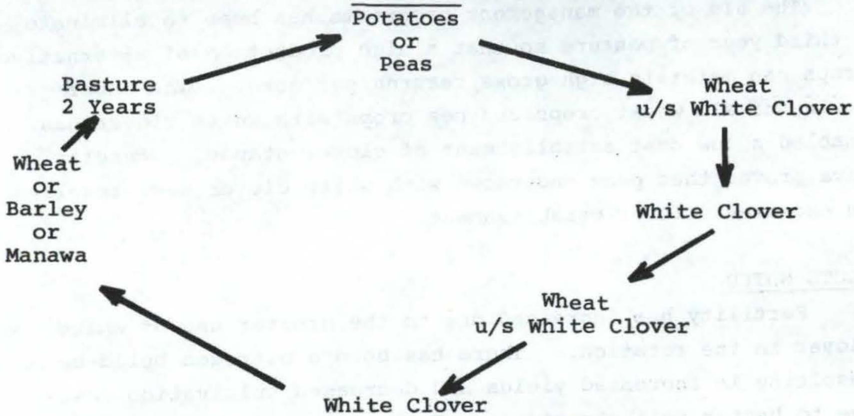

Fig. 1: The above is the likely rotation to be followed on Mr Wright's property.

	1970/71 $	1972/73 $	1974/75 $	1975/76 $
Fixed Costs				
(Cult., cartage, fertiliser, heading, drying and levies)	47.48	56.05	84.10	95.87
Insurance Rates, Wages	10.56	14.10	17.21	19.61
Additional Costs				
(N_2, spraying and regrassing - av. over 10 years)	13.70	14.84	20.88	23.80
Total On-Farm Storage Costs	71.74	84.99	122.19	139.30

Comment: An analysis of the total on-farm storage costs since 1970.

ryegrass.

The aim of the management programme has been to eliminate a third year of pasture so that a high production of alternative crops can maintain high gross returns per acre. The under-sowing of all wheat crops and pea crops with white clover has enabled a low cost establishment of clover stands. Results have proved that peas undersown with white clover have resulted in excellent clover establishment.

FACTS NOTED

Fertility has increased due to the greater use of white clover in the rotation. There has been a nitrogen build-up resulting in increased yields and decreased cultivation costs due to better soil structure. Integration of the stock and cropping policy enabled all stock to be wintered on the cropping farm and fed on supplementary winter feed crops of oats, ryegrass and turnips which are sown in February. From early Spring the stock are sent to the hill unit and enables the home farm to be completely utilised in a cropping programme. Potatoes for seed production are one of the main features of the cropping programme.

The position facing intensive cropping farmers today is that they must face reduced prices for many crops, particularly small seeds. He must hold costs which means reduce fertiliser application, weedicide sprays and all fencing and improvements, and deferring of capital expenditure. He must seek all the advisory help from Ministry specialists on farm planning and from consultants and more detailed budget and cost flow planning. Here we are particularly fortunate to have Lincoln College and the D.S.I.R. stationed at Lincoln, Canterbury.

On our enterprise we will do the following:

1. Retain our present production at the highest possible level.

2. Look at process cropping and explore the possibility of

new horticultural crops which can give a higher return per acre, e.g., onions, process peas and other vegetables.

3. Following crops with supplementary feed using cheap cultivation techniques, e.g., following clover stands with oats, ryegrass and turnips, followed by barley and/ or potatoes in the Spring.

4. Greater use of crop residues. Reducing the handling by using the new one-ton large bale system.

5. Bulk handling of all potatoes and grain. Previously only part of the potato crop was handled in bulk with an X-Ray potato harvester with only three men to do the whole operation.

6. The white clover rotation will be maintained because of all our market prospects; white clover, in the immediate foreseeable future, appears to have the best market prospects due to the increasing high costs of bagged nitrogenous fertiliser throughout the world and farmers are returning to white clover establishment for their pastures to maintain their soil fertility.

7. Last marketing. Future trends will be the combining to sell produce as a group and bulk buying arrangements will also become the pattern. Machinery syndicates for high cost capital equipment will enable farmers to grow larger areas of specialised crops, e.g., potatoes and perhaps sugar beet.

SUMMARISING

In the past year the agriculture farmer has, with farmers in other sections of the industry, been faced with ever-rising costs in all avenues of production. The New Zealand Meat and Wool Boards' Economic Service has stated that the cost of farm inputs has increased 5% in 1972/73, 14% in 1973/74 and 21% in 1974/75. This has meant that arable farmers planning a

FIGURE 3

	1970/71	1972/73	1974/75
FIXED COSTS			
Cultivation, 3 hrs	18.00	21.00	37.50
Seed, 2¼ bus. Aotea	5.54	5.99	6.92
Seed sacks	0.27	0.37	0.48
Seed cartage, 35 mls	0.28	0.32	0.45
Fertiliser, 2 cwt	2.10	2.06	2.27
Fert. cartage, 42 mls	0.14	0.20	0.69
Weedicide	1.56	1.96	4.50
Weedicide spraying	1.25	1.70	2.50
Wheat insurance	0.47	0.54	0.76
Heading	7.70	9.74	13.64
Cartage - On Farm	1.26	1.49	1.66
- To Rail	1.72	2.08	2.45
Drying, 3,898 lbs	6.71	8.09	9.64
Levies	0.48	0.51	0.64
Total:	47.48	56.05	84.10

Figure 3: The above is an analysis of the total fixed costs involved with the growing of a 60 bushel crop of wheat.

programme for 1976 would have to do so on a basis of cumulative increases on the cost of farm inputs of some 35% in the past two years. On projected inflation figures for the coming year, conservatively at 14%, this makes the growing of some crops highly questionable, particularly ryegrass.

COSTS

The increase on imported machinery over the past three years has been staggering. Tractors have risen 100% in price and combines alone even greater, with one of the larger models costing over $50,000. Increased fuel prices mean that diesel rose by 119% to 43c per gallon.

Increases in the costs of fuel mean increased contracting prices have resulted. General wage orders, additional overtime hours worked because of daylight saving and huge increases in the cost of spare parts. Road cartage rates have risen in the last 18 months by at least 22%.

The cost per acre of growing wheat at 60 bushels per acre, 35 miles from the city and 5 miles from the nearest Railway station, using contract rates and prices as at December 1974, are:

	1970/71 $	1972/73 $	1974/75 $	1975 $
Fixed costs (cultivation, cartage, fertiliser, heading, drying and levies)	47.48	56.05	84.10	95.87
Insurance, rates, wages, etc.	10.56	14.10	17.21	19.61
Additional costs - nitrogen, spraying and regrassing (average over 10 years)	13.70	14.84	20.88	23.80
This has meant total costs of on-farm storage:	$71.74	$84.99	$122.19	$139.28

This is on a 60 bushel crop but the national average is 50 bushels per acre.

You will notice the increase for sprays alone - from $1.56 in 1970 to $4.50 per acre in 1975 - this is just one example.

It is hoped that the Budget this evening will help the intensive cropping farmer with high cost capital replacement equipment by the following:

1. Higher depreciation allowances on all equipment because of the tremendous increased costs in the last few years.
2. Maintain the fertiliser subsidy to enable topdressing to be maintained, even at reduced levels in many cases. This has been one aspect in Government policy which has been of immediate help to all farmers.
3. Reintroduction of a subsidy on all weedicide sprays - you saw the example on the increase in wheat spraying alone.
4. The holding of transport rates which have increased as stated by at least 22% in the last 18 months.

The present Railway price freeze on freight is a good example which has held freight rates for the past year on all Railway haulage goods.

If these four items are done, it will do much to help the mixed cropping farmers and all farmers to combat the inflationary cost price squeeze and maintain production.

MY WAY OF ADJUSTING TO THE UPS
AND DOWNS OF FARMING

FOR THE YOUNGER GENERATION

MR P.J. BARRON

FARMER, TE PIRITA

Mr Chairman, Ladies and Gentlemen:

I have been asked to give a paper this afternoon titled "My Way of Adjusting to the Ups and Downs of Farming". As I have only been farming 13 months I know nothing of the ups but have had very real experience of the downs. Therefore, I have titled my paper - "Adjusting to the Downs and Dreaming of the Ups".

I am 26 years of age, was born, brought up and educated in the City of Christchurch. On leaving school I had attained School Certificate and joined the Farm Trainee Cadetship which was administered by the Vocational Guidance Centre. My first experience in farming was to be on Mr Selwyn Boon's property at Dunsandel.

Why did I choose farming as a career? The outdoor life had always appealed to me. I suppose I could have been described as an animal lover and the rose-coloured picture painted by city people of farming life and, of course, there was no such thing as a poor farmer, were probably some of the things that influenced me. As long as I can remember I was going to be a farmer. I, like most people, had my restless moments but the job variety and satisfaction, the encouragement given to me by my employer and parents, of the dream that I would one day own a few acres of my own helped overcome the times when the greener pastures seemed to be asphalt ones.

After nine years with Mr Boon the dream turned into reality. On 1 April 1974 I took possession of 773 acres of stoney lismore silt loam situated at Te Pirita where I could expect an average rainfall of 30". You will have noticed in the Conference booklet that my address is entered as Dunsandel. After my first interview with the State Advances Corporation, when, on being asked where the piece of land was that I was looking at, my reply with the word Te Pirita ended the interview. Since then I am hesitant in mentioning the word and will first say near Bankside or Mead, but on this occasion it has been a genuine mistake.

The Te Pirita area had experienced seven years of what could only be described as drought conditions. The property itself had had many owners. At possession 75% of the pastures could be termed run-out. By this I mean they had reverted to brown top and hairgrass, although there was a good base of subterranean clover. The total acres of lucerne was 20 - this being the only reasonable producing pasture on the property. Half the fences, with a little repair, were sheep-proof, the remainder were past renovating. The house and buildings were in need of much repair.

By now you are all probably wondering why I would buy a run-down holding in an area known for its droughts, but it appealed to me because it was a similar soil type and rainfall to the property I had had all my training on. The fact that it was run-down put it within my financial means. I knew of no other property offered at Government valuation. Also it was close to my previous employer, whose guidance and help I would be relying on greatly.

In this area the months from November through to March are extremely dry and my farming practice revolves around those five months. I am at present carrying 1500 Border-Cross sheep, 50 aged breeding cows and 250 fattening cattle, this being 2,550 stock units at 3.3 stock units per acre. The cattle are purely an Autumn-Winter-Spring venture. Top stores are purchased as they must all be sold prior to November. They are sold on contract to a local market. All lambs are sold fat off the property and Border-Corriedale Dorset horn cross ewe lambs are purchased for replacements. These are mated as hoggets.

There are many people who have assisted me. Two hundred of the cattle are carried on a grazing arrangement, which I might add is not a G.E.M.C.O. one. I pay all expenses associated with them and receive all profit as a grazing payment. I do not own the cattle, thus saving interest payment on capital required for purchase. The owner of the cattle considers his money is better put to use assisting me than in the Government coffers. My previous employer gave me much assistance with gifts of stock, grass seed and many man hours. My family ask no interest on money invested in me until I am established. Without this support the skies would be very black.

In adjusting to the downs of income, pasture renewal has had to be curbed, fortunately with cattle grazing, and a favourable Autumn some pastures have rejuvenated, thus easing the expense of pasture renewal. Because of the low price paid for cull ewes, I retained all the good-conditioned ones, regardless of teeth. I did not purchase any replacements. There is no money available for fencing, the old ones will have to be stood up again and made do another year. You could say, along with propping up the old fences, I also propped up the old ewes and made both do another year. Repairs to buildings and any thought of expenditure on needed house repairs have long been forgotten. I pray that my 1962 model car doesn't give up as the truck is very draughty. The Government has subsidised super and lime - I would like to have made more use of those subsidies but returns didn't allow.

I have been able to cut on the farm expenditure this year without greatly affecting production, but because of my financial commitments I cannot decrease production, I must produce to survive. Many of you can cut expenditure and production and hope for a return to more favourable times. Some of you will never have farmed with an overdraft, but to myself and many others making their first investment in farming, an overdraft is very real and very large. I consider it very necessary to budget and through revising at various stages through the year, any changes in expenditure can be made before it is too late.

For survival under today's conditions with enormous increases in costs and equally large reductions in prices received for our primary produce, I consider there must be a guaranteed economic minimum price for our products. By economic, I mean a price which will give a reasonable standard of living, a return of at least 6% of the capital valuation of my property after normal maintenance and some development. Likewise, I feel it is equally desirable in years of exceptionally high prices that the top should be skimmed off to help support the minimum price. In between the minimum and the exceptional level, there must be a margin of at least 20%, enabling a farmer to increase production in average years. But any stabilising system must be controlled by the producers concerned and not by the Government of the day because political decisions are not always good business ones and farming is the business of this country.

In these times of extreme economic difficulties when vital decisions for the future of farming are being made, perhaps for the next 30 years, farmers must work together and speak as one voice. As one organisation we have an identity. In a split organisation we have nothing but a bad public image.

Through the help of my family and many other people, I have been fortunate indeed in securing a property of my own. My training and experience best prepared me for that type of farm. To be able to provide my family with a reasonable living and a future in agriculture for my sons, I must have confidence that my efforts for them will be rewarded. A guaranteed economic minimum price must give confidence for the future. Long gone are the days when the farmer was a wealthy aristocrat. Today he is a worker struggling to provide for his family and future. Surely we are entitled to more than 3% of the nation's income.

MY WAY OF ADJUSTING TO THE UPS
AND DOWNS OF FARMING

FOR COMMERCIAL BEEF FARMING

MR D. McDONALD

FARMER, PEEL FOREST

Mr Chairman,

Ladies and Gentlemen,

As the title of this address indicated, I will be talking primarily in connection with the beef industry and in regard to our supply to a commercial beef market.

My remarks are confined to these things which I consider are within the farmer's power to assist himself.

However, first of all, I wish to mention a few details of our property and the manner in which it has been farmed over the previous years.

The property of 251 hectares is situated at Peel Forest in South Canterbury. 183 hectares are of Raupuna type soil and 68 hectares are river silt and shingle fans.

The average yearly rainfall is approximately 915 mm with a dry period in mid-summer of two months. Selling of stock and pasture management is geared to overcome this period. Some cropping of grain and small seeds was carried out but was phased out over the last few years for economic reasons and to reduce the amount of agricultural work. Barley only is grown now for feed purposes, some has been sold this season as it was not economical to feed grain to cattle with the present prices for beef and barley.

The only labour employed is for shearing and harvest.

The sheep are flock Romney and Romney rams are used. Wether lambs are sold fat and all ewe lambs are kept, with the surplus being sold as 2th ewes at the Geraldine annual fair. This season they topped the fair for all breeds at $17.10.

Our first adjustment to an economic situation was to change from a fattening ram to Romney 20 years ago. By culling the ewe flock and selecting good rams we increased our wool clip from 9 lb to 13 lb per head.

Lambing percentages average 132%.

The following chart will give us stock carried and crop grown for the last five years. Also, we have the percentage of gross income distribution for the last five years.

TABLE 1(a)

Stock Carried on 30 June

	1970	1971	1972	1973	1974
Ewes	1,200	1,200	1,050	1,040	1,040
Ewe hoggets	700	700	735	630	600
Cattle	177	223	229	194	239

Crops in Hectares

	1970	1971	1972	1973	1974
Wheat	14.6	7.3	8.1	-	-
Barley	13.8	16.2	8.1	18.3	13.0
Small seeds	21.1	13.8	-	-	-

Sheep percentage has faded during the last two seasons.

Cattle percentage has increased over the last three seasons. This percentage was held this season to the same as last as the result of buying in 80 eighteen month steers instead of all weaners. Through this policy we were able to start selling earlier at a higher price than was available later.

There has been a smaller return from crop as the result of a change in policy.

TABLE 1(b)

% Gross Income Distribution
For Year Ending 30 June

	1971	1972	1973	1974	1975
Sheep	47	51	49	42	40
Cattle	35	25	46	56	56
Crop	18	24	5	2	4

CATTLE DETAILS

The cattle are bought in as weaner steers, though last season we bought in 80 eighteen month steers. It is our policy to buy only the top range of weaners. These suit our programme best as we wish to start selling at the 14 month age and complete at 16 months of age.

It is only possible to attain the desired weight of 450 kgs live weight at this age and give us our profit if we buy the best and feed them well.

We have recorded the weights and weight gains of the top mob of yearlings. Their range of weights on 25 September was from 340-390 kgs.

CATTLE WEIGHT RECORDS

Breed	No.	4 May	Date Sold	Live Weight		Gain Per Day	
		kgs		kgs	lbs	kgs	lbs
Lincoln Red X Shorthorn/ Hereford	1	277	11 Dec.	470	1036	.869	1.9
Simmental X Angus	7	269	5 Dec.	455	1003	.86	1.89
Charolais X Angus	5	272	5 Dec.	451	994.5	.85	1.83
Triple X A/Angus X Her X S/Horn	5	279	24 Nov.	445	981	.8	1.78
Hereford X A/Angus	4	281	24 Nov.	447	986	.768	1.69
Charolais X Friesian	5	311	18 Nov.	465	1025	.735	1.6
A/Angus	3	286	11 Dec.	436	961	.675	1.49
Ayrshire X Hereford	7	290	24 Nov.	454	1001	.65	1.43

This scale will give you their average weights on 4 May and also on the selling date with daily weight gains. As a result of this trial the last three breeds have been eliminated from our purchases this season.

There is only one sound basis on which to calculate the potential of the various breeds.

A recording of weights is essential.

There will be a difference also in lines of the same breed and in this way you will know which line of weaners to buy in the future.

STOCK MANAGEMENT

The weaners are bought at the Autumn fairs or privately.

1. On arrival all weaners are immediately drenched and tagged before going on to clean pasture that has been spelled for six to eight weeks. Drenching is done three times prior to Winter and once in the Spring when going off swedes to pasture.

2. When the total are purchased they are all sprayed.

3. A preventitive vaccine against foot abscess is administered, as is also a triple vaccine for pulpy kidney, black leg and malignant adema.

FEEDING PROGRAMME

In Autumn — The weaners are rotated between three paddocks with ad lib good meadow hay being fed each day.

In Winter — They are grazed on swedes with ad lib hay.

In Spring — They are divided into three mobs according to weight and are set stocked with two or three ewes and their lambs per acre. We have found this practice reduces the occurance of bloat.

It has been the policy to use rolled barley as a supplementary food in Autumn and Spring. This practice was omitted in the last season for economic reasons.

MARKETING ARRANGEMENTS

Our market is a supply to butchers and supermarkets direct from the farm to the abattoirs. The price is arranged between the butcher's agent and ourselves. The agent notifies us of his requirements and we select the cattle.

It has been the custom over a period of years to buy different breeds and cross-breeds to discover which gives us the best return and also the best carcase for the local trade and the best yeild of saleable meat. In doing this we are considering the requirements of the butcher, supermarkets and customer, as well as ourselves. This is a security when markets are difficult to obtain.

A satisfied customer will come back again and for quality be prepared to pay a bit above market value.

There is a follow-up to inspect the beef hanging up in the shops and to see how the different cuts are presented for sale. They must be attractive in appearance with the right proportion and colour of fat. The opinion of the retailer has been of benefit to us in deciding when to market and what type of beef is acceptable. Taste is also of importance.

Roasts and steak from every breed are shared with an agent and results compared.

CATTLE BREEDERS

I wish to mention a few points of interest to breeders.

I am convinced that in the past the conventional beef breeds have made a useful contribution in establishing the beef industry.

The stud breeders are to be commended for the quality of their stock. They have an important function in raising the standard of the breeding herds. Also, the exotic breeds are having an important impact on our beef production and with discreet cross-breeding will continue to do so.

We in New Zealand have various types of country and climates, and you, as individual cattle breeders, will have made your decision to carry the type of cattle most suited to your country and feed conditions. You are responsible for the type that is finding its way to the different markets. The present situation is a challenge to you to consider the requirements of that market. It is of vital importance to satisfy the retailer and consumer.

As one that has followed the cattle market for many years, I am convinced that now is the time to raise the standard of your herds and to eliminate those dams that are not producing good calves.

A most important factor also is the use of a good sire, preformance recorded, or the use of semen from a preformance-tested bull is recommended.

FATTENERS

To those who are fattening cattle for the local or export market, I would impress upon you that if you are going to get the best out of your fattening project, good stock are important, good management and good feed. You cannot fatten cattle efficiently if they are used as a mower to keep down the roughage.

The maintenance of good pastures is necessary for the production of good beef.

When the market and demand come again we want to be in a position to supply cattle of the best quality. Remember we have competitors for the world's beef markets.

A few years ago some farmers left the sheep industry in favour of cattle. They will be regretting that move this season. The same could happen conversely. We do not expect to obtain the high prices of the 1973-74 season but we can be confident of an improvement eventually.

YIELDS TEST

Over the last two years we have been conducting a yeilds test programme.

The object of this programme is to discover what is the difference in the yields of saleable meat from some of the different breeds and crosses of cattle.

We are also looking for cattle that will give a high yield of meat in the hindquarters where the prime cuts come from and the highest priced meat.

This is a benefit to our customer, the retailer. A difference of 4.6% in yield on a 272 kg beast will give an extra 12.5 kg of meat per carcase instead of that amount in bone and fat.

This is one way we expect to satisfy our customer and retain a market that has been satisfactory up till this year.

We intend to concentrate on those breeds or crosses that will give us the greatest weight gain and maintain as high a standard of quality and yield as possible.

RESULT OF YIELDS TEST

AVERAGE PERCENTAGE OF DRESSED WEIGHT

No.	Breed	Bone	Fat	Meat	Hind	Fore
4	Simmental X Angus	16.4	17.4	66.2	24.3	41.9
3	Charolais X Angus	19.13	14.77	66.1	25.33	40.77
1	Lincoln Red X Her X Sh.	16.9	18.8	64.3	24.2	40.1
3	A. Angus	18.1	20.0	61.9	22.3	39.6
4	Hereford X Angus	18.40	20.00	61.6	22.2	39.4
2	Red Devon	18.65	19.45	61.9	20.8	41.1

I wish to acknowledge the assistance of Mr Fairborther of Timaru in conducting this Yields Test.

Each beast is cut on the same pattern. Feeding conditions have been identical. The percentage given is of the dressed carcase weight.

You will notice that the three breeds with the highest yield also had that extra yield in the hindquarters.

These three breeds also had the highest weight gains per day from weaning to killing date.

The percentage of meat in the forequarters varied very little in every breed.

Ladies and Gentlemen,

I make no claim to be able to look into the crystal ball and predict the future of the beef market and your fortunes.

As a summary, I wish to mention three things that would assist breeders to meet the economic situation:

1. Improve the standard of your herds.

2. Give consideration to the types that will meet market requirements.

3. Have the weaners in good condition ready to improve with suitable feed.

There are three things that would assist fatteners to obtain the maximum return from their beef fattening:

1. Breed or buy the right type of cattle that will give you a good weight gain consistant with good quality.

2. See that your stock are fed on pastures of good quality to get the best results in the shortest time.

3. Practice a high standard of management and stockmanship.

Let us, the beef breeders and fatteners of today, accept the challenge of the present economic situation with a resolve to play our part in meeting it with better stock, greater efficiency in feed and management, and a consideration of market requirements.

Mr Chairman,

Ladies and Gentlmen,

I thank you.

ENERGY CONSUMPTION IN THE PRODUCTION CHAIN

MR R.G. PEARSON

ENERGY RESEARCH FELLOW,
LINCOLN COLLEGE

The cost of the energy needed to produce, process and transport meat to Europe rose from 2c to 4c per kilogram after the oil crisis of 1974. This cost will increase by 1c/kg every time the cost of fuel oil rises by 10c/gallon.

I want to show why, by outlining the flows of energy in New Zealand and the part of agriculture in these flows, to make the following points:

New Zealand and its agriculture is heavily dependent on oil.

Agriculture is a large consumer of energy in New Zealand.

The major inputs to food production are beyond the farm gate.

Our food production system uses more energy than it yields.

Much of the energy used is wasted.

Fig. 1 represents the flows of energy in New Zealand. Oil is by far the largest part of these flows, about 60% of our total consumption. Almost all of this is imported. Hydro-electricity and coal provide most of the remainder, with small contributions from geothermal steam and natural gas. Some oil and coal is converted to gas and oil, coal and gas are used for electricity generation.

The "losses" area is rather frightening; it represents the inefficiency of conversion of energy to its end use. For example, coal burnt in the open fireplace gives only 10-20% of its heat content to the room. The rest is lost up the chimney. The most obvious loss on Fig. 1 is in the transport field as petrol and diesel motors run at about 25% inefficiency.

The major change in these flows over the next 20 years will be with natural gas which should outstrip oil imports by 1985. As the gas contains an oil condensate suitable for transport fuels, the imports of oil should remain static or even decrease over the next 15 years. This should help our Balance of Payment problems in the future.

Most of the Maui gas is earmarked for electricity generation in thermal power stations which operate at about 30% efficiency. Thus, the energy losses from gas will grow to the same proportions as those from oil. Much of the electricity produced will be used for heating, hot water and cooking purposes. Natural gas is ideally suited for these purposes, at about three times the efficiency of electricity via natural gas. Not surprisingly, considerable opposition is mounting against this wastage of our natural gas resources. Used for electricity, the Maui field will be exhausted in 30 years.

Well, given these flows, how much of this energy is used in agriculture? This can be seen by looking at the energy use by each sector of the food production chain of farm, transport, processing and shipping. Fig. 2 shows these consumptions.

The figure within each box represents the quantities of the particular energy type (coal in thousand tons, oil in million gallons, electricity in million kilowatt-hours). To put the relative contributions of each form of energy in perspective, they are scaled to magajoules (MJ). Thus, 450,000 tons of coal is approximately equal to 60 million gallons of oil.

The transport figure is an estimate of the fuel used in all agricultural transport operations such as hay carting, lime sowing, stock transport and so on.

Oil is dominant, being about three-quarters of the total use in agriculture. Coal is roughly equal to oil in the processing works sector and is used mainly in the Dairy industry and the South Island Freezing Works.

The totals of coal, oil and electricity used in agriculture, and in the whole economy, are given and also expressed as a percentage. Coal, oil and electricity comprise 15%, 21% and 6% of their respective total consumptions. This amounts to about 17% of the total energy use in New Zealand. This is a high proportion and reflects the heavy emphasis on agriculture in this country. A figure close to 5% would be typical in most industrialised countries.

These are direct energy inputs only. If we included the indirect inputs in fertilizers, chemicals, tractor production, heating at Lincoln College and so on, this percentage could well be doubled.

Looking at the cost of each of these quantities changes this picture somewhat. The price of oil on the farm in the form of diesel is about 37c/ gallon, fuel oil in a Freezing Works is 26c/gal. and the fuel oil used in shipping would be rather less. Taking an average of 30c/gallon, we get a total cost of $72m. Coal, at an average of $12/ton, would cost about

$5½m, and electricity at 1½c/KWhr amounts to $16m. Thus, although electricity is a small energy component, its relative cost is much higher. As an example, 1c worth of electricity will boil about 2 pounds of water, 1c of oil about 6 pounds and coal about 12 pounds.

The final point arising from this figure is that most of the energy inputs come after the farm gate. The farmer's fuel and electricity is only about one-quarter of the total input to get food to its market.

Taking a kilogram of meat through its production chain produces a similar picture. Fig. 3 represents the case where meat is processes in oil-fired Freezing Works. Again, most of this energy is in the form of oil. The Freezing Works offer the only opportunities for alternative fuels (coal or gas). At present, about 50% of New Zealand's meat is processed by oil-fired works, 40% by coal and 10% by gas.

The relative proportion of the shipping sector is higher than in Fig. 2. This is due to the low tonnages carried by refrigerated vessels, with meat in the bulky carcase form.

Adding the quantities from each sector gives about one-tenth of a gallon of oil and three-quarters of a unit of electricity per kilogram of meat. At 30c/gallon and 1½c/KWhr, this gives the 4c/kg mentioned earlier. On a 13½kg lamb, this is about 55c. Thus, although not a major cost to any one sector, in total, energy forms one of the biggest costs in food production and the one that has risen the most rapidly over the past year.

Well, that sums up the production side. To get meat to the kitchen table, we need to add about 40% to our energy total to account for domestic refrigeration and cooking. Applying this to the 22MJ/kg figure on Fig. 3 gives us 31MJ/kg. A rather embarrassing exercise comes when we look at the energy content of the food itself. The nutritional value of meat is about 12.6MJ/kg. In other words, we put two and a half times as much energy into meat production as we get out in the form of food. This is in contrast to the position 100 years ago when the fuel and electricity input was almost zero, with all the work being done by man, animal and nature.

Given all this sobering information, is there anything we can do about it? It is comforting to know that similar problems are facing producers in other countries. We do have an advantage in that our traditional pastoral system of agriculture uses much less energy than feedlot type operations common overseas. Our main disadvantage is the long distances to our markets, with the associated high shipping energy demand. The change to container shipping will lower the fuel requirements for meat as much greater quantities of meat will be able to be shipped per vessel, with the more compact carton packaging. Slower sailing speeds would reduce fuel consumptions considerably, at the cost of poorer use of the capital tied up in shipping.

Changeover to coal or gas firing in the freezing and dairy industries would lower energy costs in the processing industry. However, this would be a slow process as much of the oil-fired equipment is new and cannot be converted to coal-firing. Gas supplies are restricted until after 1980 when the Maui gas field comes on line. Therefore, the oil consumers have little option but to continue to burn oil for at least the life of their boiler equipment.

More rational use of transport facilities would help cut fuel consumption. However, the seasonal fluctuations, the predominance of one-way loading and the rugged geography in New Zealand make major savings difficult.

I feel that the most important area for energy saving lies in the simple answer - cutting down on wastage. In recent work at Lincoln, we have found that some Freezing Works use twice as much energy to produce the same amount of meat as the most efficient Works. Much of this difference lies in bad housekeeping, poor insulation, steam and hot water pipework, wastage of hot and cold water by leaving hoses, taps and sprays running, motors and lights left on, and so on. I suspect similar situations would also apply to farming and transport, with big differences between the efficient and inefficient operation.

Most of the difficulty on making savings in these areas is in convincing people that it is worthwhile. In the freezing industry, energy amounts to only about 5% of total operating costs, management is largely preoccupied with labour and production problems, and the hygiene requirements take priority in the demands for finance. Thus, the seemingly minor fuel savings made by investment in metering, insulation, etc., are often neglected or rejected by management. The potential for savings is great, even in the more efficient Works, and conservation steps usually repay the investment many times over.

What we need to do to save energy is not look at how to save it - the efficient farmer or Freezing Works can show us this - but we need to convince the inefficient user that he is wasting energy and thus profits, and that the savings are well worthwhile. When he accepts this, energy conservation is easy.

In conclusion, it is worth repeating the points made earlier:

New Zealand and its agriculture is heavily dependent on oil. Oil represents three-quarters of our total energy use in agriculture and there is little we can do to change this. We need oil for tractors, trucks and ships.

Agriculture is a large consumer of energy in New Zealand. 17% by my tally, probably nearer 35%, counting indirect inputs.

The major energy inputs are beyond the farm gate. The farmer uses about one-quarter of the total.

Our food production system uses more energy than it yeilds - Two and a half times as much energy.

Much of this energy is wasted.

Each sector of the production chain contributes to this wastage and each sector must take a responsible attitude to energy conservation to achieve worthwhile savings.

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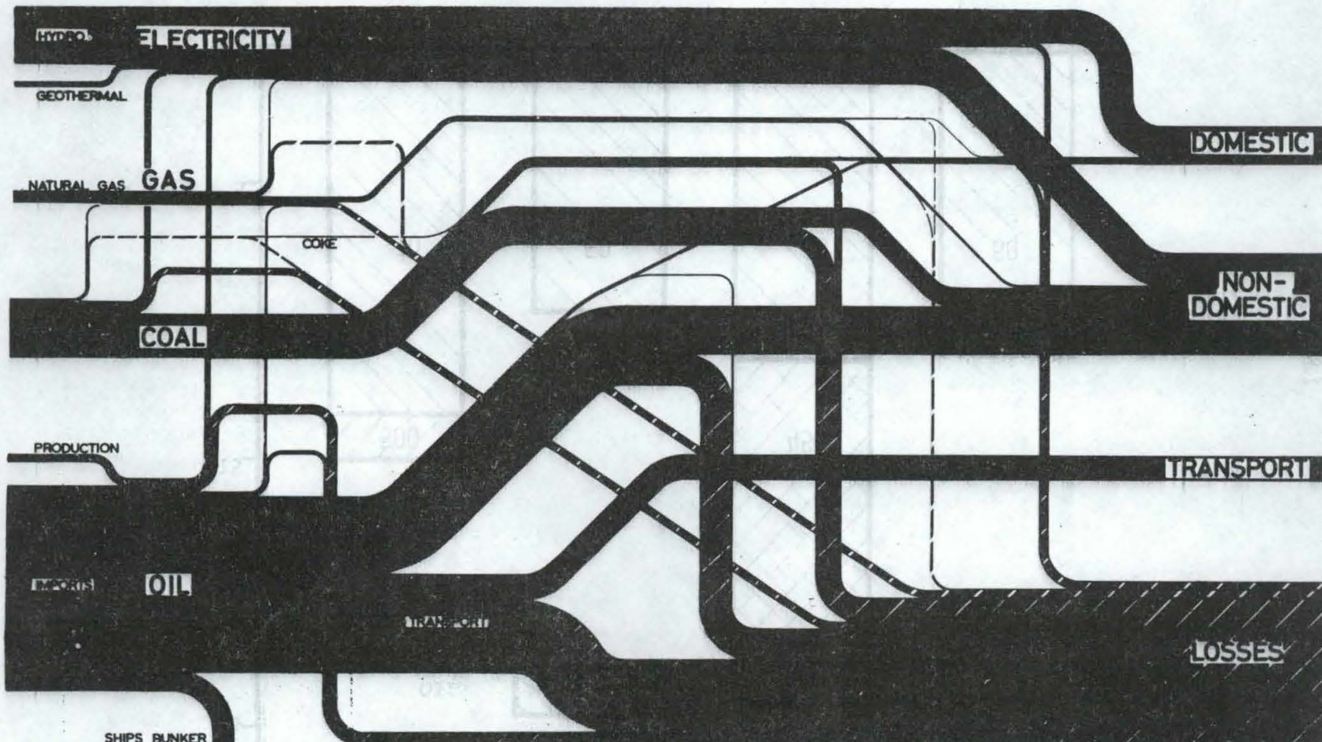
FIG 1: **NEW ZEALAND ENERGY FLOWS - 1973**



(COURTESY : INSTITUTE OF FUEL - N.Z. SECTION (1974-5))

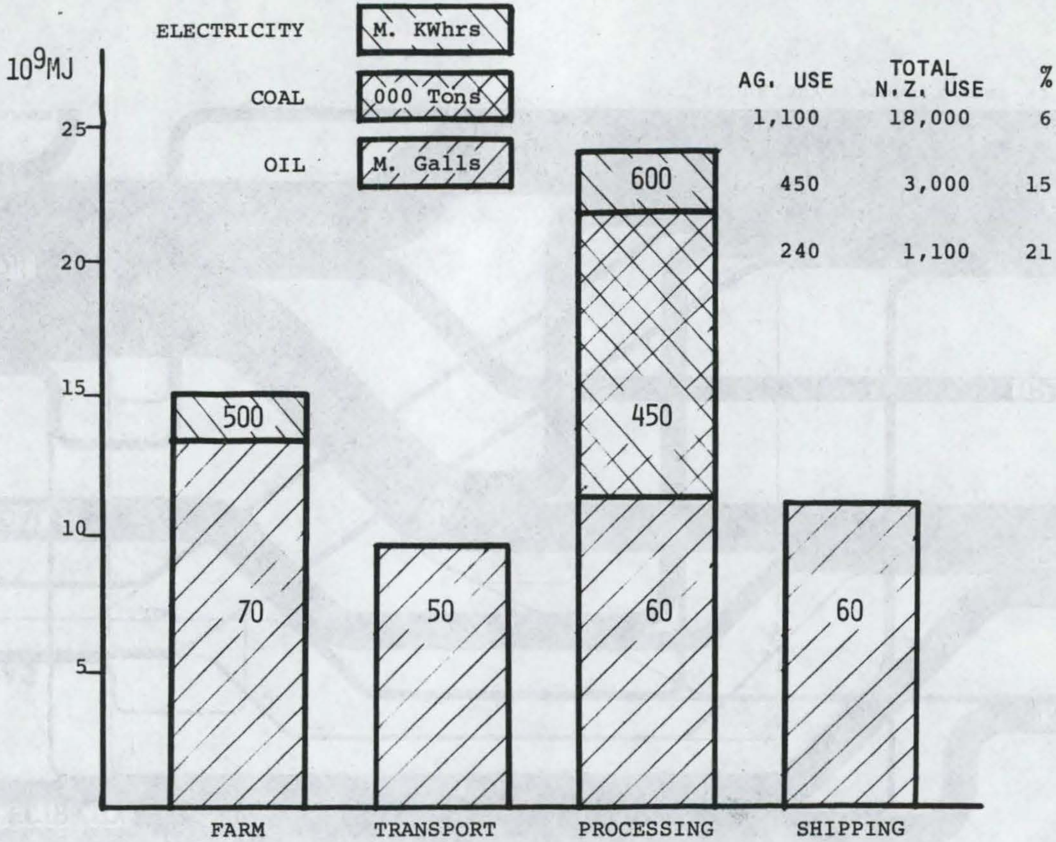


FIG.2: ENERGY USE IN NEW ZEALAND AGRICULTURE

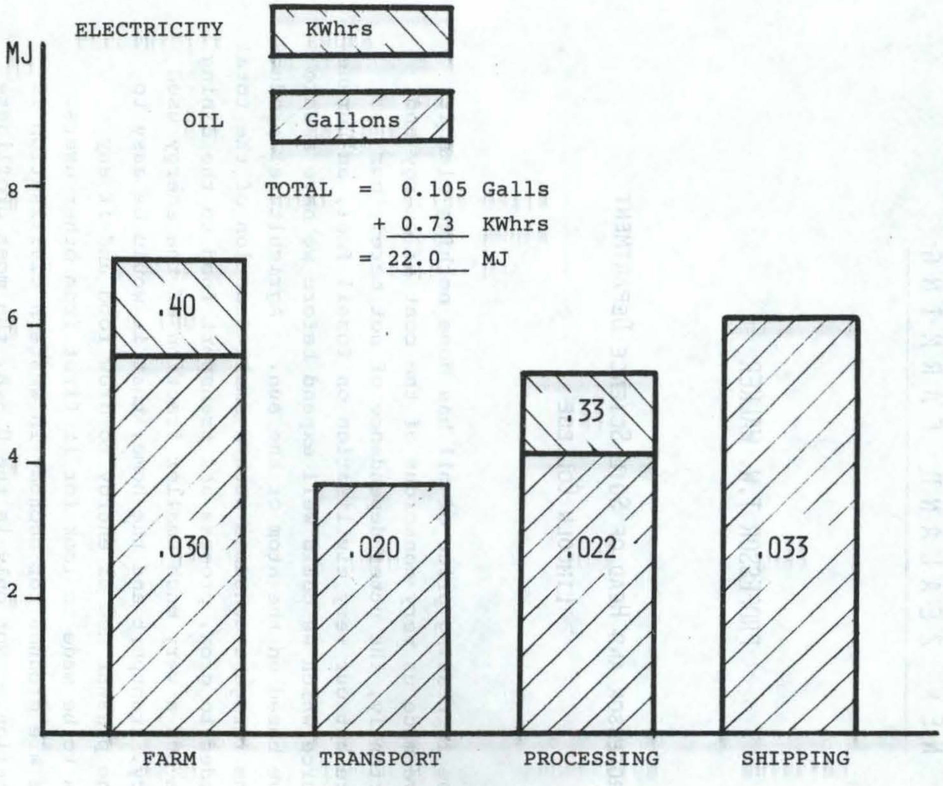


FIG. 3: ENERGY INPUTS TO PRODUCE 1 KG OF MEAT

THE ENERGY CRISIS AND NEW ZEALAND FARMING

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If the increasing price of oil has done nothing else it should have made us very conscious of the cost of energy and, more importantly, the utter dependence of not merely our agriculture but our very civilisation on fossil fuel, an unrenewable resource which we could well expend before we have a safe alternative based on the atom or the sun. Agricultural production to the farmgate consumes such a small fraction of the total energy needed to grow, process and transport food to the dining room table and a very much smaller fraction of the energy used by industry, transport and the home, that it would be easy to justify the present use of energy to grow food and if any saving has to be made to look for it first from other users. That there are grounds for economy in western civilisation is beyond question. Not only is the U.S.A. the most profligate consumer of energy in the world but 96% of this energy is derived from oil, gas and coal, and there are few meals eaten in the States where the energy value of the fossil fuel needed to grow, process, transport and prepare those meals does not greatly exceed the energy values of the food itself. To a lesser degree this is probably true of most other developed societies and it is comparable with a primitive hunter expending more of his own energy to catch his food than the flesh of the animal will provide.

It is clearly an impossible situation and for the last two years scientists throughout the world have been examining the use of energy so that we might see where it is being wasted and where we can economise. My object in this paper will be to look at the use of energy for a few different farm enterprises, draw some comparisons with overseas data and see if economies can be made. It is usually necessary to make many assumptions and few people would care to claim great accuracy for their calculations, because it is not always possible to calculate or even recognise all the energy inputs. Different energy and power units can be very confusing and I shall be expressing all energy units in terms of a mega-joule (MJ) which is a million joules. A 1-kilowatt bar switched on for 1 hour is equivalent to 3.6 MJ. An average man has a daily intake of 3,100 kilo-calories (often wrongly shortened to calories by weight-watchers and Home Scientists) equivalent to 13 MJ. A kilogram of wheat supplies about 17 MJ and 1 litre of diesel fuel about 46 MJ of energy. It should be remembered that food is eaten for more reasons than to supply energy, for example, proteins, vitamins and minerals, and the evaluation of food solely in terms of mega-joules may be quite misleading. It is also irrelevant to evaluate orchids or carnations grown under glass with artificial heat in terms of the energy content of the flowers; we are not growing these flowers to eat.

CULTIVATION

Tables I and II show the average fuel consumption in round figures for various cultivation and seeding practices, based on the use of a medium-powered tractor and medium-textured soil. Although these are British data they are similar to our own. The British have been looking at reducing cultivation, mainly from the viewpoint of minimizing the deleterious effect of machinery on soil structure in intensive cropping. Obviously from Table II, if direct drilling gives yields comparable with traditional or reduced methods of cultivation, even if energy-rich herbicides have to be used as well, it will consume considerably less energy. From what experiments I saw in Britian last year my general impression was that yields of wheat were poorer with direct drilling, probably due to nitrogen deficiency. The application of only 16 kg/ha fertiliser N would bring up the energy cost of direct drilling to traditional cultivation costs. There is scope for more experimental work here as cultivation constitutes the biggest fraction of energy costs in average arable crop production in New Zealand.

WHEAT

The energy expended in wheat growing and harvesting in Canterbury is shown in Table III, assuming no use of nitrogen fertiliser. The direct use of fuel for cultivation and heading makes up 75% of the total energy cost and economies in this field represent the only significant sources of saving. The tremendous significance of the build-up of nitrogen in soil organic matter from clovers in our pastures can be appreciated from the very high energy costs in making nitrogen fertilisers. If we needed to use nitrogen fertilisers on wheat at the rates common in W. Europe or the U.S.A. (100 kg N/ha) our energy input would be trebled and the output/input energy ratio would drop from 14 to 5. The energy cost is 1.2 MJ/kg wheat compared with 6 MJ/kg corn from similar calculations in the U.S.A. by Pimentel et al., (4), although the American value includes costs of irrigation, drying and transport of grain to point of processing. The energy cost of nitrogen for growing corn in the U.S.A. amounts to one-third of the total and is responsible for two of the 6 MJ/kg.

Over the last few years T.E. Ludecke (2) has been looking at the responses of wheat to nitrogen in Canterbury and elsewhere. In 33 trials harvested from 1972 to 1974, the average yield of grain was 4140 kg/ha in the absence of fertiliser N and 4560 kg/ha after the application of 97.5 kg/ha fertiliser N, or an average increase of 4.4 kg wheat/kg fertiliser N. This would not be profitable either financially or for energy as about 5 kg grain would be needed to cover the energy needed to make 1 kg fertiliser N (fertiliser N = 80 MJ/kg; wheat = 17 MJ/kg) and 1 kg N costs about five times as much as 5 kg wheat (1 kg N costs 50c (subsidised) and 1 kg wheat ($95/tonne) = 9.5c). However, the results ranged from a maximum depression on a Wakanui soil at the College (4180 to 3740 kg/ha or a decrease in yield of 4.7 kg grain/kg N) to a maximum response on a Lyndhurst soil at Methven (3019 to 4696 kg/ha or an increase of 17.2 kg grain/kg N). This latter response compares with European values quoted by Schuffelen (5) of 10 to 25 kg wheat/ kg N and would give a return of $1.63 for $0.50 of fertiliser-N or a return of 290 MJ in wheat for the expenditure of 80 MJ of energy in fertiliser-N. In other words, even if fertiliser-N is costly (in both money and energy terms), it may still be used profitably if we can pick the soils and crops that need it and this is the very essence of Ludecke's work on wheat. Extremely large amounts of nitrate-N can be formed from the breakdown of organic matter after ploughing a good pasture and we must do experimental work on ways of minimising the losses of such nitrogen that can take place, particularly by leaching; in one recent experiment in Southland we measured the value of nitrate-N lost over the winter from a fallow as $200/ha.

SHEEP FARMING

The energy input for the items listed in Table IV again show that fuel is the major energy input into sheep farming. It is interesting to note that labour at 17 man hours/ha comes out at 49 hrs/week on a 150 ha farm. This very low energy input of 1600 MJ/ha gives a very high energy output/input ratio ranging from 53 to 160, depending on whether one assumes a low yield of dry matter (5000 kg/ha) or a higher one (15,000 kg/ha). This ratio is rather meaningless as humans do not consume herbage directly and I have not attempted to estimate the energy required to extract protein from herbage for direct human consumption. This would be an interesting exercise and should be done to examine the feasibility from the energy angle. I think by far the best way of dealing with herbage production is to evaluate the energy cost to produce 1 kg of meat, wool or milk. If we assume that 150 kg lamb meat/ha is produced on a low-producing farm (Canterbury dry-land Lismore for example), this would cost 11 MJ/kg meat; 300 kg lamb meat/ha would cost only 5.5 MJ/kg meat. If 450 kg lamb meat/ha were produced the energy cost would be reduced to 3.7 MJ/kg. These energy costs exclude transport to freezing works and energy costs of killing, which costs however must also be incurred in other countries. We do have the additional energy burden of getting this lamb to overseas markets. I have not attempted to evaluate the wool produced by ewes and lambs at the same time as lamb-meat. Perhaps the best way of evaluating wool would be to compare the energy cost of producing 1 kg wool with that of producing 1 kg synthetic material or cotton for example. People getting sensitive about the use of fossil fuel to make synthetics might be interested to know how many more MJ were needed compared with the amount needed to produce wool. Spedding (6) gives the energy cost of lowland fat lamb production in Britain as 58 MJ/kg meat and for 18 month grass-fed beef at 88 MJ/kg, although he does not state whether the energy costs of killing are included. These very much higher values in Britain are brought about very largely by the intensive use of fertiliser-N on their pastures. If the energy costs of transport to the freezing works and killing are added to the energy cost of production (C.G. Pearson, pers. comm.), we get values of 20 to 25 MJ/kg lamb-meat for outputs of 150 to 300 kg lamb meat/ha. This still leaves scope for further rather large energy costs of getting this meat to overseas markets before it compares unfavourably with British costs, and if one takes the value of 6 MJ to produce 1 kg corn in the U.S.A. and if it takes 10 kg corn to produce 1 kg beef, the energy costs of converting this to beef in feed lots would be 60 MJ/kg beef for corn alone.

LUCERNE GRAZING BY SHEEP

Professor O'Connor has kindly supplied me with the data in Table V, which are his estimates of the energy costs/ha for fat-lamb produced by grazing lucerne with the minimum of hay-making and some over-drilling with Tama for winter feed. I have let his values for fuel and machinery stand without question to show that people making different assumptions can come up with different answers. These fuel values are much higher than mine for a 150/ha sheep farm based on grass-clover pastures and his use of fuel is about 52 l/ha compared with mine of 21 l/ha. Such factors as length of time the lucerne or pastures are down become important as energy costs of cultivation and seeds for renewal need to be apportioned to the annual energy inputs of grazing.

Assuming a yield of 17,000 kg dry matter/ha and a carrying capacity of 30 ewes/ha, a later date of lambing than usual will give production curves for dry matter production which match demands quite closely (O'Connor, pers. comm.). Lamb meat at 450 and 650 kg/ha will be given for 110% and 150% lambing respectively. The relative energy costs would be 10 and 7 MJ/kg meat which are not very different from my values for sheep pastures. The lucerne, however, would allow greater potential production of wool and meat. It is also clear that in order to estimate production costs more accurately, we need more intensive surveys of farm practice; fuel consumption/ha will probably vary as much as phosphorus status of soils.

FEED-LOT PROPOSALS FOR BEEF

For some years K.J. Mitchell has been proposing that we make use of tall-growing plants such as maize with a higher efficiency for converting sunlight into dry matter than prostrate plants such as clovers, and he has stated that our reliance on white clover as a source of nitrogen is out-dated and holding up agricultural development. If we grew maize for silage in the summer giving, say, 18,000 kg D.M./ha and a suitable winter crop for silage giving another 7,000 kg D.M./ha, this 25,000 kg D.M.

made into silage in feed lots and fed to beef cattle (buying in weaners at the rate of 20/ha) could produce 2,900 kg beef/ha according to Stephen et al. (7).

Ignoring the costs of disposing of all the dung and urine collected in the feed-lot, and many other hidden energy costs such as that needed to produce the weaners, and looking simply at the fertiliser costs proposed by Mitchell (3), these amount to some 36,000 MJ/ha as shown in Table VI. If to this we add twice the cost of growing and harvesting wheat (Table III), assuming that this will be similar to growing and making silage from two crops, we get a total minimum energy cost of 44,000 MJ/ha of which nitrogen accounts for 32,000. This application of 400 kg N/ha/yr is not uncommon on grass in W. Europe and parts of the U.S.A., and, as stated earlier, accounts largely for the high energy costs of meat production in the U.K. The very efficient conversion of the silage into 2,900 kg/ha beef would give an energy cost of 15 MJ/kg which does not compare too unfavourably with the range of costs for lamb (3.7 to 11 MJ/kg) shown earlier. A more accurate costing is likely to give a higher value for feed-lot beef. There is, of course, a much higher production/ha and, not discussed, much greater capital investment, but the big disadvantage as I see it is that we cannot easily beat the N. Americans and the Europeans at their own game and they now appear to be thinking hard about feed-lots because of pollution problems and energy costs.

Before the oil crisis when fertiliser-N was becoming cheaper relative to food prices, we were beginning to use more fertiliser-N on our grassland quite profitably for certain purposes. The increasing price of fertiliser-N has now stopped most of this practice, although when food prices rise it could well become economic to use fertiliser-N again. Because we are now more aware of the rate at which the limited reserves of fossil fuels are being used, the activities which consume fossil fuel will be more closely scrutinized. Although agriculture currently consumes only a small fraction of the total, this could increase alarmingly if the undeveloped countries were to follow the example of W. Europe and the U.S.A. Indeed these latter countries have attempted to export their agricultural technology and in particular the heavy use of nitrogen fertilisers to the rest of the world. I have long believed that If New Zealand has one lesson to teach countries with an undeveloped agriculture, it is the vital role of biological nitrogen fixation. It may well be that recent developments in genetic engineering will allow us to breed the capacity to fix nitrogen into our cereals and other non-legumes, but I am told by experts in this field that it could be many, many years away - it would certainly be unwise to rely upon it.

New Zealand and Australia in particular have both relied upon legumes rather than nitrogen fertilisers in their grazing pastures. I have shown that the low energy input into our agriculture is because of our low use of fertiliser nitrogen and we have good reasons for keeping our energy input at low levels because of the energy costs of transport to our markets. To this end we should be increasing our research into the breeding of better legumes, more resistant to pests and disease, capable of extracting more nutrients such as phosphorus from the soil, managing to grow with smaller demands for phosphorus and capable of more nitrogen-fixation. Fortunately, the energy costs of producing superphosphate, potash and other nutrients are much lower than for nitrogen. In spite of fears that the heavy use of phosphate will deplete resources too rapidly, there appear to be enormous reserves still and frequent discoveries, for example, the recent one in Australia suggest that phosphate rock will be available for hundreds of years before we find it necessary to extract phosphorite nodules from the seabed.

If the world population keeps on expanding, more and more land will be needed to grow crops for direct human consumption rather than to feed animals. This tendency will be restricted in New Zealand because of the small extent of our cultivable land.

I think our aim should be to grow meat and milk products on our grasslands at the same energy costs/kg required to produce grain overseas. We could not then be blamed for using limited resources of fossil fuel to grow luxury foods. We should also be prepared, where it is possible, to make use of the nitrogen accumulating under pastures, by occasional cropping, and, as I have said before, New Zealand's trade symbol should not be a wingless bird that sleeps all day and works all night but a clover-plant rampant.

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TABLE I: Energy inputs for various items of cultivation.

Operation	Fuel Consumption litres/ha	Fuel Energy Input MJ/ha
Plouging	22.5	1,000
Heavy cultivating	22.5	1,000
Light harrowing	5.5	250
Drilling	11.2	500
Spraying	1.7	75

TABLE II: Energy inputs for traditional and reduced cultivation methods.

Cultivation System	Fuel Consumption l/ha	Energy Input MJ/ha
Traditional	47	2,150
Reduced	33	1,500
Direct Drilling)	7.4	) 340
(including 1.12 kg) paraquation/ha)		) 515

TABLE III: Average direct energy inputs to grow 1 ha wheat at the farmgate in Canterbury.

Input	Quantity	Energy Values (MJ)
Labour [1]	7½ man hours	16
Machinery [2]	650 MJ	650
Diesel [3]	68 litres	3,130
Phosphorus [4]	12½ kg	160
Seeds for planting [5]	125 kg	180
Herbicide, etc. [6]	1 kg	100
Total Energy Input:		4,236
Wheat Yield [7]	3,600 kg	6,000
Ratio $\left(\frac{\text{Yield of Energy}}{\text{Input of Energy}}\right)$ =		14
Fertiliser-N [8]	100 kg	8,000

Footnotes:

1. Farm-worker consumes 20,000 kcal/week - 40 hrs work or 500 kcal/hr. 1,000 kcal = 4.2 Mega-Joules.

2. Total weight of machinery (tractor, implements) = 5 tonnes; header = 5 tonnes. Energy for smelting is 20,000 kcal/kg. Cultivation = 6 hr/ha/yr. Working life of tractor and implements, say, 15,000 hrs ∴ for cultivation, apportioned energy for what is $\frac{6}{15,000}$ x 5,000 x 20,000 = 40,000 kcal/ha/yr; and for harvest (working life of header = 1,500 hrs, used for 1½ hr/ha/yr), apportioned energy is $\frac{1.5}{1,500}$ x 5,000 x 20,000 = 100,000 kcal/ha/yr, 140,000 kcal = 588 MJ. Increase by 10% for maintenance and repairs = 650 MJ.

3. Tractor uses 6.8 l/ha/hr for 6 hours = 51 l for cultivation. Header uses 18 l/ha/hr for 1.5 hours = 27 l for harvest
   68 l diesel at 46 MJ/l = 3,130 MJ.

4. 1 kg P in superphosphate (super assumed to contain 10% P, i.e., 10 kg P in 100 kg super) is calculated by Pimentel et al. (4) to consume about 13 MJ/kg P.

5. Seeds evaluated as $\frac{125}{3,600}$ x 4,236 ($\frac{\text{wt seed sown}}{\text{grain harvested}}$ x energy input).

6. Assumed that 1 kg/ha of some herbicide, insecticide or fungicide would be used, and using the energy value of Pimentel et al. (4).

7. Average wheat yield assumed to be 3,600 kg/ha containing 16.8 MJ/kg.

8. Fertiliser-N given the energy value of 80 MJ/kg N although estimated values range from 30 MJ for N in ammonia to 100 MJ for N in ammonium nitrate (de Wit, 1975).

TABLE IV: Average energy input/ha on 150 ha sheep farm.

Input	Quantity	Energy Values (MJ)
Labour [1]	17 man hours	36
Machinery [2]	96 MJ	96
Diesel [3]	19 litres	874
Petrol [4]	2 litres	84
P in super [5]	25 kg	315
Herbicides, insecticides [6]	2 kg	200
Total Energy Input:		1,605 MJ

Footnotes:

1. See Table III.

2. Tractor and motorcycle owned: 80 days feeding out at:

1½ hrs/day =	120 hours
Haymaking, 15 ha at 4 hours/ha =	60 hours
Lambing, 40 days at 6 hours/per =	240 hours
General running about, 150 days at 1½ hrs =	225 hours
Total hours for machinery use on 150 ha =	645 hours

Assume tractor and implements weigh
5,000 kg used for 3/4 of time = 484 hr

Assume motorcycle weighs
100 kg used for ¼ of time = 160 hr

∴ tractor and implements used for

$\frac{484}{150}$ hr/ha, working life = 15,000 hrs

motor cycle used for $\frac{160}{150}$ hr/ha, working life = 1,500 hr

These data used as in Table III to calculate MJ/ha.

3. 484 tractor hours at

    0.75 gal. diesel/hr = 2,200 l diesel/150 ha

    Motor Cycle 320 days at 15 miles/day and 80 m.p.g. petrol

    = 60 gals/yr = 270 l petrol/150 ha

    Topdressing by 6-ton truck (contractor) at 5 ha/hr

    = 30 hrs on farm at 4 gals/hr = 540 l diesel

    Diesel for 5 hours (1½ hrs for 4 days) for truck to and from farm = 90 l diesel 150 ha

    ∴ total diesel used (farmer and contractor) = 2830 l/150 ha = 19 l/ha

4. Petrol used is approx. 270/150 = 2 l/ha.

5. Assumed 250 kg/ha super used at 10% P = 25 kg P.
    Energy value as in Table III.

6. Herbicides, etc., as in Table III.

TABLE V: Lucerne grazing (minimum of hay) and over-drilling with Tama.

Input	Energy Value MJ/ha
Labour	50
Machinery	1,560
Fuel	2,080
Phosphorus	100
Seed and Twine	260
Fencing	520
Total:	4,570

TABLE VI: Feed-lot Proposals for Beef.

Assume double-cropping system for silage, of maize and a winter crop will yield 25,000 kg D.M./ha.

K.J. Mitchell's Estimate of Fertiliser Need kg/ha/yr	Energy Value MJ/ha
400 kg N	32,000
100 kg P	1,200
300 kg K	2,700
Energy cost of fertiliser alone:	35,900

TIPS ON MANAGEMENT ARISING FROM ANIMAL BEHAVIOUR STUDIES

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Grazing or browsing are terms used to describe the manner in which herbage is cropped for ingestion by ruminants. The domestic ruminant can be faced with a number of problems associated with cropping enough herbage to satisfy its needs. Johnstone-Wallace and Kennedy (1944) remind us that each day a cow has to ingest a mound of grass 2 m in diameter and 1 m high in the centre using a mowing apparatus 15½ cm wide. Because of this mouth size, sheep and cattle can reach and crop only a limited amount of pasture in any one bite. Worn teeth in sheep will produce additional problems. Excessive heat with humidity, cold driving rain or sleet make open, unsheltered grazing trying and the changes in daylight length with the passing seasons mean that the ruminant has to adjust to these conditions.

Other over-riding patterns of behaviour can alter normal patterns of ingestion. For example, cows in oestrus disrupt grazing to mount and be mounted by other cattle. Bulls in all male groups at about three years of age spend a great deal of time in mounting, fighting and other social interactions which establish social dominance structures within the herd. On occasions, rams in groups spend time in sexual activity at the expense of normal grazing time. After calving, cows may spend many hours on concrete yards waiting to be milked.

Pasture grasses may be too short to allow adequate sized mouthfuls, or be too springy to be cleanly cut and ingested or too leafy requiring individual bites for each leaf. Some tropical pasture plants are particularly difficult to crop and dairy cows may spend up to 14 hours a day grazing and yet be starving on their feet. Ruminants show decided selectivity and a pasture may revert to a composition of plants which are not to the liking of the grazing animal. A new grass break may contain excellent sward but be too restricted to allow all cows to take their share without social interference from others. Accumulated dung, in pats or carefully harrowed to extend its odour, may mean that cattle will graze the available pasture only under pressure. Animals tramp across grasses crushing, splashing mud on them and pugging the soil. These disruptive factors highlight some of the management problems related to grazing stock. Yet with present rising costs we are more than ever dependent upon the grazing ruminant to do its traditional job of cropping grass to satisfy its own needs, especially in hill country. We do not want to make extra hay or silage - materials which are costly in terms of labour and machines, and which the ruminant may not accept as readily or as efficiently as direct ingestion of grass.

THE NEEDS OF RUMINANTS

Despite some of the recent techniques developed for assessing the nutritional state of an animal from an examination of its blood, the majority of studies concerning the needs of sheep and cows have monitored voluntary intake. Some nutritional studies have been upset by the refusal of the animal to ingest the offered foodstuff but at pasture, the animal's voluntary intake and grazing behaviour can supply some of the answers to questions of animal need. Though Hancock (1953) concluded that individual cattle variation was such that no "normal" grazing patterns could be detailed, the studies since that time in a range of grassland habitats from subalpine range in South Central Alaska to dry Texas or Californian range have found a diurnal rhythm of grazing as a common factor to all cattle. The basic rhythm (Figure 1) consists of an early morning grazing phase starting at morning twilight with lesser phases during the day, then a concentrated period in the late afternoon, ending after evening twilight, and, finally, a period of variable length about midnight.

Although there are fewer grazing studies reported in sheep, consistent grazing patterns can be expected in most of their habitats, though they are more variable than cattle. It seems that the rumen needs to be topped up three times a day at about 8-hourly intervals under natural conditions. This is in contrast to the grazing patterns of horses which have to crop grass throughout the day and night for up to 18 hours to satisfy their needs (Figure 1).

THE NEW ZEALAND DAIRY COW - A GRAZING PROFILE

We have now taken vibrarecordings* of the intake patterns from dairy cows for six seasons. Eight-day clocks hung on the cows' necks have automatically recorded grazing during day and night, and we have selected from the 52 weekly records a profile of seasonal grazing patterns. For this profile we have selected average weekly grazing patterns as a sample of grazing throughout the normal season, including the following periods:

- (i) As a dry cow grazing at the shortest day in winter.
- (ii) Two weeks before calving.
- (iii) Two weeks after calving.
- (iv) Mid-summer, with long daylight hours.
- (v) Dry autumn period, and,
- (vi) At the end of lactation.

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* Manufactured by Kienzle, West Germany.

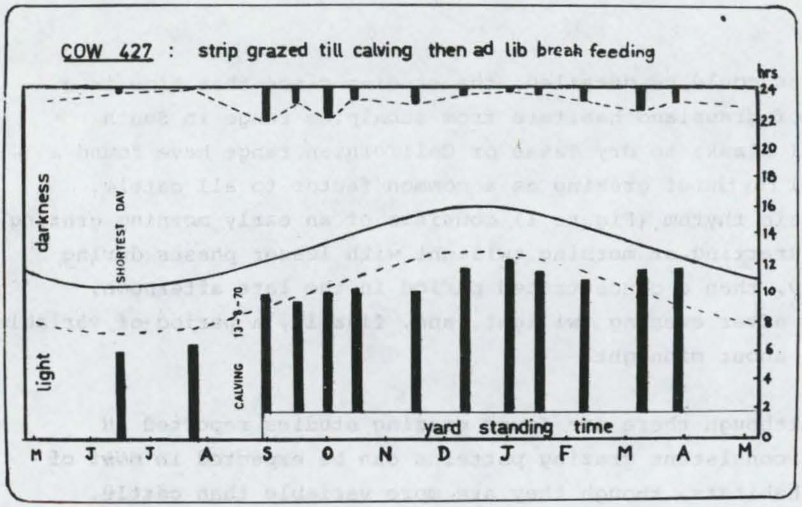

Fig. 2: Grazing profile on Cow 427 showing average daily grazing times:

(i) Daylight below, and

(ii) Night grazing about the mid-line for selected weeks throughout the year.

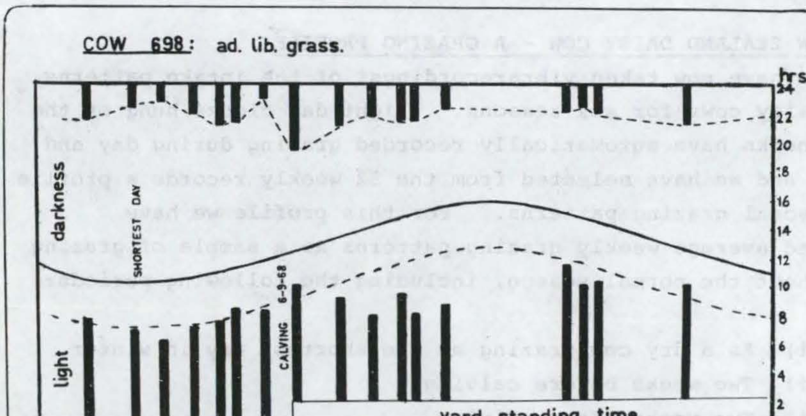

Fig. 3: Grazing profile of Cow 698 showing average daily grazing times:

(i) Daylight below, and

(ii) Night grazing about the mid-line for selected weeks throughout the year.

The times of morning and evening twilight, a time set by the Department of Aviation relating to permissible lighting levels to land aircraft, have been used rather than sunrise and sunset. This means that the figures for night grazing will be less than in most other studies.

Figure 2 shows the grazing profile of Cow 698 fed on adequate pasture throughout the year and Figure 3 examines the data from Cow 427 being strip grazed up till calving and break-fed on adequate pasture thereafter, setting out the proportion of total grazing time occurring within the daylight and dark period to show the changes in average grazing time for the selected weeks over the year. Cows on a new break of grass once a day show very concentrated grazing for the first 5 or 6 hours until the grass has been ingested and then no grazing for the next 18 hours.

From these data we can make the following general comments:

(i) The ruminant has different patterns of grazing from the horse, a monogastric animal. The cow has time for ruminating and idling.

(ii) The regular pattern of three concentrated periods of grazing a day is modified slightly by seasonal influences but more so by animal needs and the management which is imposed. In general, the dairy cow has the flexibility to adjust to these additional strains except at critical times of the year - in particular, after calving in the spring, and during dry periods in summer-autumn.

(iii) After calving, 2½ to 4 hours a day will be spent standing in yards or on raceways and this reduces the available grazing time.

(iv) The night-time grazing increases are the most sensitive indicator of grazing pressure in both the cow and sheep. High night-time grazing should be a warning that the dairy cow has reached the limit of her ability to cope within present management.

(v) A limited break of new grass once a day strongly dictates the grazing rhythm of the cow but may be the only way to ensure that dung-contaminated pastures will be closely cropped.

(vi) Eight-day vibrarecordings on selected cows in a large herd could be useful monitors and allow the farmer to make more precise decisions about critical levels of grazing pressure for the whole herd.

(vii) As the rumen liquor in cows which have grazed a pasture freely is different from that in cows which have had feed from the same grass, cut and given to them, it would seem that an intake once a day on strip grazing, which is far removed from the "normal" diurnal grazing rhythms, may have important consequences for a cow's well-being.

(viii) Some morning milking times may completely disrupt the first grazing phase of the day. This should be avoided if possible, especially if grass is limited. However, tanker collection times or other factors may dictate milking times.

<u>THE CRITICAL PERIODS OF A COW'S YEAR</u>

After examining the grazing pattern records which have highlighted the difficult periods of the year for ruminant requirements, the behaviour during these times must be examined in more detail.

Dairy cows are handled continuously rather than subjected to periodic intensive handling like sheep or beef animals. It is likely that sheep's normal grazing patterns may be disturbed following shearing or other periodic handling and sheep should not be kept in yarded areas for longer than necessary. In sheep, mating and lactation are well separated, whereas in cattle, because of their longer gestation, calving is closely followed by the mating season which occurs during lactation. It is of interest then to examine the needs of the dairy cow at the calving-milking-mating period.

1. <u>The Calving-Milking-Mating Period</u>

   All the vibrarecordings taken pre- and post-calving show greatly increased night-time grazing. In some cows this increased from 40 minutes to over four hours (see Figure 2). Just before calving the foetus size has decreased the capacity of the four stomachs and grazing intake is low. Immediately after calving, many factors call for greatly increased intake, yet there are strict limits to the day-light grazing time. Consider some of these factors:

   (i) Extra energy is required for the calving process and recovery, yet grazing patterns are disrupted over this time.

   (ii) The social tension of having the calf taken away and the adjustments to be made on entering the new herd in spring (Bremner, 1975) disrupt normal grazing patterns. Social tension can be kept at the minimum by ensuring that the herd's calving period is short and that late calved cows entering the milking herd have not been away from herd mates for longer than six weeks. It is good policy to calve heifers early in the season so that they have achieved stability in a milking group before older cows enter.

   (iii) Time spent walking in raceways and standing on yards may mean cows are away from pasture 14% or more of the day.

(iv) Cold, bleak, inclement weather in spring may not encourage grazing. Such conditions, however, may demand three times more energy to be used for grazing than a warm summer's day.

(v) Limited grass growth causes longer grazing time for adequate intake.

The result is that under paddock feeding conditions, additional intake requirements can be met only by longer night grazing, while strip grazed cows can only graze for longer during the day. There is an upper limit of about 14 hours which will be spent grazing by any dairy cow. Most dairy units in the Waikato have facilities for meal feeding in their sheds. This feeding is not justified on economic grounds but is considered a contentment ration to help cows settle in the shed. It is discontinued when grass growth permits a separate break after both morning and afternoon milkings.

2. <u>A Critical Period for the Establishment of Lactation</u>

Does it matter if the dairy cow is under pressure in the post-calving period? A number of studies have produced results which indicate that for a high-producing cow to achieve maximum lactation for the full season, she must receive high intake levels within the first 8 to 10 weeks after calving. Studies in the U.K. (Strickland, 1971, 1972) recorded an additional response from potentially high producing cows when given extra concentrates for 10 weeks immediately after calving. Wallace (1957) also found that during the early weeks of lactation, feeding supplements to cows while they were grazing strictly rationed pasture lifted production. This effect lasted throughout the full season, even after the supplementary feeding was discontinued. It seems that the higher the peak lactation is boosted during this early <u>critical period</u> the better the overall production. It is known that the grass intake and cow body reserves are used for milk production for the first 7 to 8 weeks of lactation. Thereafter some of the energy from intake is channelled back into building up body reserves again. Poor feeding straight after calving produces a depression in lactation which is not rectified by providing extra feed after the peak lactation period. This is also shown in the cumulative lactation graphs of expected production developed and used in the U.K. by O'Brien and O'Brien (1974). The use of cows as nurse cows for the first 7 weeks after calving will provide extra stimulation to the cow and boost her production levels, during this early critical period. This could account for the findings of Everitt and Phillips (1971) where the suckled twin produced as much milk between entering the herd after rearing the calves as the twin member milked for the whole season. Current work at Ellinbank, Victoria, shows that this same effect can be gained in cows suckled by calves at one milking and machine milked normally at the other milking. Production was boosted by up to 12% in these cows suckled once daily for 7 or 8 weeks.

It is evident that this period after calving is a critical period for the establishment of a good lactation and any lowering of feed intake at this time will be reflected in a depression in the annual production. A rising plane of nutrition at this time will greatly aid the cow getting in calf, so fertility rates are also involved.

In the sheep, it is general practice to provide a flushing effect before and during tupping, but some attention should also be paid to establishing good lactations in the ewe after lambing. Arnold (1963) found that the grazing hours of sheep 2 weeks after lambing rose to levels much higher than could be expected at any other times of the year, again supporting our model of the critical period

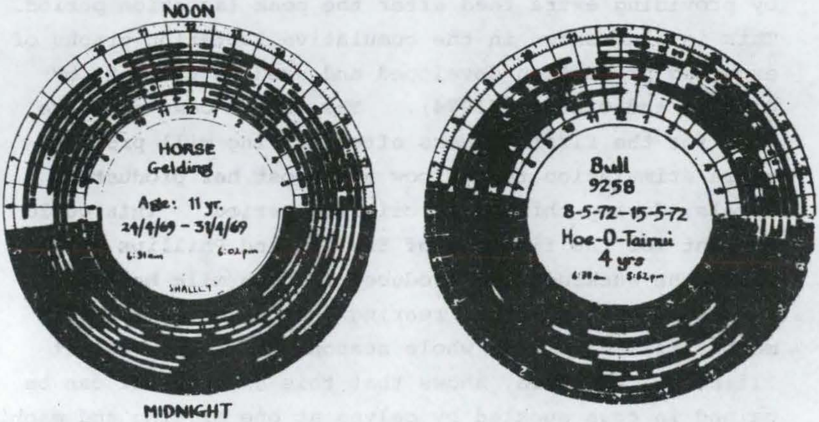

Fig. 1: **The ad lib grazing patterns of a horse and a bull.**

for lactation.

Tips:
Some pampering of cows for the first few weeks after calving can have a pay-off over the total lactation. It is a critical time for establishing the best lactation in high-producing cows and getting cows in calf.

Suckling calves may assist in boosting the lactation peak by giving additional stimulation. This is most easily achieved by under rail suckling while the cow is part of the milking herd and saves the stress of the nurse cow's re-entry to the herd at a later time.

The inter-cow differences in production at 7-8 weeks after calving are likely to remain throughout the season.

3. The Late Summer Dry Period
The second season where longer times spent grazing indicate stress is in the dry period of summer or autumn.

This period may affect flushing in sheep and may cause a fall-off in milk production in cows. We have made some observations on the social dynamics of the dairy herd with the onset of dry conditions. After the morning milking the whole herd settles into concentrated grazing. No cow will go to water at this time. When the grass is exhausted about 2 to 3 hours later, the whole herd moves directly towards the trough. This tends to overtax even the best water reticulation system. Under such pressure only 5 cows can drink at once from round troughs. (The Australians who know most about cattle drinking in dry times always have long, shallow troughs.) Trough water levels drop quickly and cows get very fidgety when drinking in groups if they have to lower their heads into the trough to a point where their eyes go below the trough rim. With the limited time available between the end of morning grazing and afternoon milking, only a limited number of the cows in the herd can get water. The presence of "boss" cows in the group means a much slower turn-round of thirsty cows than if they had moved to the trough in ones or twos as is normal at times of less stress. Milk production, which has been maintained quite well in the early part of a dry spell, falls off dramatically and suddenly, largely through lack of water. The herd may have to be dried-off early. This would be unnecessary if adequate water intake for the cows was assured.

Tips:

For watering more cows - troughs centred in the mid-fence line can put two water points into each paddock at the same cost as one trough in mid-paddock.

For centre paddock troughs a rail or two extending out either side of the midline of the trough could allow more cows to drink in peace.

Water reticulation needs must be set for normal dry season conditions.

Long shallow troughs are best for dry areas.

TRANSFER OF FERTILITY, DUNG AND COW HANDLING

Milk hygiene is the major concern of every milker and the patterns of voiding waste materials in yards and milking stalls should concern us. In 1951 Hancock and MacArthur reported that 2-3% of dung was dropped on yards. Concrete yards were smaller then, farm races were shorter and backing gates were unknown. Now, in most sheds, there is an evacuation of dung 10-12 seconds after the backing gate operates. The dung in these yards gets denser towards the pit rather than being evenly scattered as in the old walk-through surrounds. Exact figures for dung and urine dropped in present-day units are not available but some figures are as high as 22% of the daily output, though a more realistic figure might be 10-12%. With large herds and immense concrete yards, voided material is a more serious agricultural pollutant of streams than ever before and a large amount of energy is needed to return it to pastures where most of it should have been dropped in the first place. It also means that shifts in farm fertility need to be redocumented for modern dairies where changed management has altered the dunging behaviour of milking cows.

Tips:

Because bad handling can affect animal behaviour and this in turn makes management more difficult when the same animals are handled again, it is useful to consider whether factors are detrimental or conducive to easy handling in your milking system.

(a) Detrimental factors would include:

(i) Veterinary inspection carried out in the milking shed.

(ii) An electrified backing gate.

(iii) If you have had voltage leaks in your plant?

(iv) If the backing gate is sometimes turned on and forgotten.

(v) If dunging during milking occurs in more than 1 cow in 10.

(b) Conducive factors would include:

(i) Bail feeding of a contentment ration.

(ii) Direct visual contact through the shed to the return raceways to pasture.

(iii) No need to resort to the use of polythene pipe to get cows to move.

A similar assessment of factors in sheepyards could include an assessment of:

(i) The approach to the sheep dip and/or the woolshed.

(ii) The steepness of the slipway into counting out pens after shearing.

(iii) If sheep have enough vision to see what is happening in stock movements in the yards, i.e., the precise height above ground of sheep yard rails.

Similar factors could be considered and scored for cattle yards.

STOCK DISPERSAL IN HILL COUNTRY

The daily movement patterns of sheep and cattle in hill country has not been adequately documented. When the slope is easy no pattern of sheep track is discerned, but when slope increases then horizontal tracks are normal. In very steep country tracks have to rise and fall to bypass obstacles. Thus, tracks in New Zealand hill country are related to topography rather than to the position of the water hole as in semi-arid Australia (Lange, 1969). Ridge fencing runs completely counter to these horizontal sheep tracks and it is noticeable after new subdivision that many of the old tracks fall into disuse. In their use of horizontal tracks it seems that sheep, in contrast to cattle, are helping to minimise erosion. Some down hill movement by cattle may trigger off gully erosion.

Ridge fencing may also mean that sheep, driven by bad weather, may be trapped in very exposed positions for lambing with consequent high lambing losses.

We have begun (Kilgour, Pearson and de Langen, 1975) to look into the manner in which sheep of different breeds spread out across hill country to forage for pasture. Under conventional stocking systems, certain breeds show characteristic movement patterns and it seems that these patterns can be predicted from season to season. For example, Cheviot sheep move more rapidly than other breeds when foraging. Mob stocking for short periods is likely to change the pattern of movement and ensure that sheep spread more evenly across hill country pastures. It also affects the dunging pattern. We are slowly gaining a better understanding of the contribution of the animal in the hills where stock are required to crop the grass, control noxious growth, help reseed areas and not accelerate erosion or overgraze and destroy their habitat (Whateley et al., 1974).

Tips:

More thought to the correct position of fencing in hill country could save lambs and ensure the better use of pasture lands.

Narrow tracks cut for access for farm bicycles and/or short lengths of directional fencing can sometimes channel animal flow to areas normally avoided by stock.

SUPPLEMENTARY FEEDING IN EXTENSIVE SYSTEMS

Are there methods of supplementing stock so that the animal does not become lazy and stop grazing? We have found, when strip grazing dry cows in winter, that when at night there is no remaining pasture, the stock go to licks at normal grazing times. There is a peak intake in the early evening and at midnight. It seems that the supplement is being taken in accord with the normal daily grazing rhythms. It appears worth giving supplements, if necessary, at the times of the day when intake would normally occur.

However, we know that if cows are fed a supplement regularly at a particular times of the day, they quickly learn to delay their feeding until the supplement arrives (Coppoch, 1973). So an irregular pattern of feeding with some days missed out altogether might be in order. Allowing cows access to feed for short periods by using a drum roller which can be turned on or off could be one method of successful distribution. Where such drums or feed racks have been used in Australia, farmers have been able to position them in such a way that stock will be drawn to unused pasture areas or poorly utilised hill slopes. Supplementary feeding must remain supplementary and not be a substitute for pasture grazing. A supplement in spring before the time of major grass growth, to boost dairy lactation curves during the first 8 weeks after calving, fulfills the criteria of a supplement with a productive pay-off.

Tips:

(a) Animals will learn to wait for the supplement and not graze the available grass if a regular time of feeding is used.

(b) The best times for intake will be when the animals would be grazing normally, i.e., early morning, late afternoon and midnight.

In general, this paper has discussed animal behaviour during normal, grassland management. Other areas of practical importance have been summarised elsewhere. The results of behaviour studies directed at animal handling in Freezing Works (Kilgour, 1971) outline principles which have some application for yard handling on farms. Current behaviour knowledge and its importance for lambing (Kilgour, 1972) and tupping (Kilgour and Winfield, 1974), as well as summaries of the studies on dairy cows during yarding and milking (Kilgour, 1975) are available. Two other important areas - the behaviour of bull beef animals and the best way of training animals for their everyday adjustments in farming routines - are currently being written.

SUMMARY

(a) With inflating costs, the best use must be made of stock to crop their own pasture.

(b) Although sheep and cattle can adjust to seasonal changes in grass growth, worn teeth and other factors, there is a limit to which they can be pressured to graze and still maintain satisfactory production.

(c) Under natural conditions the rumen requires regular filling and sheep and cattle establish normal daily feeding rhythms.

(d) Increases in dairy cow night-time grazing are a sensitive indicator of grazing management stresses. This information may be easier for some farmers to use for management decisions than estimates of dry matter or other pasture factors.

(e) Additional care given to animals at critical seasons such as at mating or during the establishment of lactation can have economic consequences. Maximum intake adjustments should not be required of cows after calving as this is a time of social stress and can be considered one of the critical periods of the cow's year.

(f) Social dynamics found within every herd or flock can have adverse effects. They can affect water intake during seasonal dry periods and indirectly limit production.

(g) New farming practices change behaviour patterns and the patterns of fertility transfer on the modern dairy farm have probably changed. Mob stocking of sheep in hill country will also bring about a change.

(h) Breed behaviour differences appear to be of sufficient importance in hill country farming to warrant full study. The behaviour traits of the new exotic sheep will need to be understood if full use is to be made of their potential within the sheep industry.

(i) More knowledge of ways to feed supplement to stock without it acting as a substitute for the intake of available pasture are required. Australian experience in this field is generally not applicable to New Zealand conditions.

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WHAT'S THE VALUE OF WOOL CLASSING?

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Any reasonable answer to this question will depend on circumstances but close examination suggests that some of the commonly held beliefs on which conventional woolclassing is based are wrong and that some of the practices we indulge in are unnecessary.

Woolclassing is a component of an elaborate system of production, marketing, distribtuion and utilisation of wool. It is, therefore, reasonable that we examine its place and estimate its worth in relation to changes in technology and in the face of all kinds of increasing economic pressures.

Historically, woolclassing evolved in the early days of colonial settlement and it is probably correct that it had its origin in Australia. The people who devised the system were English and Scottish woolsorters who had been meticulously trained in an elaborate procedure of wool classification. Someone judged this work to be necessary and no doubt a whole procession of people along the line of distribution had their say. However, it is true of all classification procedures that as one becomes more knowledgeable about the thing being judged, the more one is inclined to elaborate. The excuse may be that it is a conscious or unconscious way of demonstrating knowledge. No doubt the people who devised the conventional woolclassing system were partly motivated by this but also their procedures must have been influenced by requests or pressures from the industry to which they delivered. It was a system developed without the support of good technical information but it had behind it extensive personal expertise of all kinds.

It is inevitable that where success depends on personal expertise and on the declared or hidden belief that one possesses valuable secrets in the exercise of this, that communication is stifled and unnecessary procedures may be allowed to flourish. Perhaps some extra expense is deliberately incurred in order that real or imagined benefits may be preserved.

The implicit overall aim of woolclassing is to assemble wool into lines each of which:

(i) Has a specific manufactured end point, different to that of other lines in the same clip, or

(ii) Possesses some advantage in processing, or

(iii) Has some special value in terms of end product, or

(iv) Appears to be even within itself but different from other lines.

It is a case of "not only must justice be done but it must be seen to be done". This is what is intended, the question is how well is it carried out?

The most important characteristics that influence utilisation of wool are, in order of importance, average diameter or fineness of fibres, fibre length and colour. Crimp itself has very little influence on efficiency of processing and on the characteristics of the finished fabric but what may loosely be called "style" and which really embraces crimp definition and regularity, definition of the staple and nature of the tip, and, to some extent, shape of staple, does have some influence. You will no doubt have noticed that no mention has been made of evenness.

Now why are these characters important and how efficient is the classing operation in providing for efficient utilisation? And when we talk about individual characteristics it is necessary to think not only of an average but also of the variation about the average. Both are important.

Fibre diameter is by far the most important character affecting utilisation. It determines the fineness and length of yarn that can be spun and, through this, influences the weight of cloth. It is a factor determining softness of the fabric. These features have a major influence on price of raw material. On average, a difference in fineness between two lines of greasy wool accounts for about 80% of the difference in price paid for those two lines, and one can understand the emphasis that both buyer and classer place on this measure.

Implicit in the conventional system of evaluation of wool for a particular purpose is the belief that evenness is a virtue and, in the language of the trade, one hears of classing lines into what are known as "straight" counts, in turn, the woolsorter who breaks the fleece, sorts to "straight" counts. Experience has shown that buyers find it more convenient to value such lines and the sorter has no doubt been instructed by the processor who is aiming to produce a particular count of yarn from a particular "straight" count of greasy wool. The efforts to attain evenness are sometimes quite extraordinary. They can be apparent in the low daily output of classers and sorters which is expensive and becoming more so and, in the marketing of small lines of wool which is inefficient and expensive.

While conceding that anyone making an eye appraisal of a line of wool, for whatever reason, finds it easier when all the wool in the line appears to be similar, the real test comes in the hands of the processor. Does evenness influence efficiency of processing? Well substantiated information shows that it does not unless it is extreme. As a rough measure of what is extreme, it can be said that unevenness within the standard type of mixed age flock of one breed is well within acceptable limits.

Now let us look at an actual example and see what kind of situation the classer has to deal with and how well he achieves the stated objectives. We will confine the examination to fineness.

Extensive measurements have shown that of the total variation in fibre diameter within a whole clip:

64% is caused by differences between fibres within staples
16% is caused by variation in diameter along single fibres
16% is caused by differences between fleeces
4% is caused by differences between regions within fleeces

It should be noted that the proportion due to variation along fibres will increase with such things as poor winter nutrition. However, the real point of importance is that a minimum of 80% of all unevenness in diameter is contained within staples and cannot be influenced by the woolclasser. Since he normally deals with the fleece as a unit he is left with the 16% due to differences between fleeces on which to practice his skills. Obviously any reduction he can make is small in relation to the total.

How does he go about this? It is well known that in estimating fineness (or implicity, fibre diameter), the classer relies most on spacing of crimp and his judgement is partly influenced by softness and perhaps length. He cannot estimate the actual diameter but he can distinguish difference.

Crimp spacing is associated with fineness but the association is loose as can be seen in Figure 1. Note a trend to more crimps per inch in finer wools but a considerable range of crimp spacing for any one fibre diameter. Obviously, there are great difficulties in using crimp spacing to judge fineness. The example is for a Corriedale clip and we know that more reliance can be placed on crimp in medium and strong Merinos but less in coarse wools and very fine Merinos.

We have recently checked the accuracy of an experienced and registered woolclasser working with a good commercial Corriedale clip. He classified fleeces into straight quality groups and retained a staple from the midside of each fleece to give a bulk sample of each. In addition, a cut amounting to 150 fleeces was separately identified. These and the bulk samples have been measured with the results shown in Figure 2.

First, the classer, in attempting to class into "straight" quality groups, achieved a clear difference between lines. This difference averaged 1.2 microns and is smaller than the standard difference between quality groups. However, it provides for the supply of wools of different average fineness. On the other hand, in this clip, and mostly because of the particular relationship between crimp spacing and diameter, the classer consistently over-estimated the average fineness of these lines by an average of 1.8 microns or approximately one quality interval. In other words, his 60's were, in fact, 58's. The most significant outcome is that the range of fineness within each of the supposedly straight quality groups is nearly as much as exists over the whole flock.

The lessons to be learned are these:

First, by classing, it is possible to offer lines of different average fineness. This is definitely wanted by the trade and there is no reason to doubt that it always will be. However, work done by Wool Research Organisation shows that processors have an equal chance of obtaining wools of particular fineness by choosing clips instead of lines within clips. The conclusion must be that work done on separating a clip into lines is not necessary, providing the purchaser can be satisfied with a measure of what he is buying.

The second conclusion is that a classer's estimates of fineness within a clip may be consistently displaced, either above the true fineness or below it. This can be important because it means, on the one hand, that everyone is misled, and, on the other, that, because of the different crimp/fineness relationship that exists between different flocks, mixing of fleeces such as occurs during binning, and when buyers or processors mix wools from different sources, variability is actually increased over that existing within any one whole clip. This increase in variability is not necessarily a disadvantage but in principle it completely negates one of the supposed desirable objectives of the classer.

With this in mind, the third conclusion is that the classer has not been able to reduce variability within his lines by any significant amount over and above that of the whole clip. Within each line the wool appears to be similar but in fact it is not.

Although fineness has been used as an example because it is the most important, a similar argument can be put forward so far as the next most important characteristic, fibre length, is concerned. Average fibre length strongly influences strength of yarn but processing can, and does, significantly reduce fibre length. Logically, however, the longer fibres are before processing, the longer are fibres in the yarn; but we have now a situation in which very high variability is a virtue and we may well ask why purchasers consistently insist on uniformity of staple length within lines.

Conventional classing, therefore, leads to fragmentation of a clip into a number of lines and, following this, there is a necessity for separate documentation, valuation, sale and distribution, with consequent expense. The alternative is minimum skirting, the classing out of fleeces which differ radically from the bulk, and the accumulation of remaining fleeces into one line which is then described by measurement of fibre diameter, staple length and clean scoured yield. These measurements may, for valuation purposes, be supplemented by an accurately-drawn sample for appraisal of colour or other characters that might be considered important.

The idea of describing and selling wool by measurement and on sample is not new, although the idea has been vigorously promoted in recent times with the backing of a considerable volume of technical information. There are some arguments in its favour and some against.

Arguments for it are that it can provide an accurate measure of the most important characters and those most difficult to estimate. Measurements of these can predict and are directly related to processing performance and, through this, provides a processor with greater control over his stock and output. This is a declared statement by the largest topmaker in Great Britain. Taking full notice of technical evidence that high uniformity is not attainable and, furthermore, is not necessary, much wool that is now classed into many small lines can be left in bulk with obvious economy. And, while admittedly difficult to appraise by eye, this wool can be accurately sampled and measured, and if there is confidence in these measurements, then other economies such as sale by sample instead of elaborate stacking and showing may be promoted.

Arguments commonly advanced against classifying wool by measurement and selling by measured sample are several. First, sampling and measurement are costly and this must be set against the costs of conventional classing, and the uncertainty inherent in eye appraisal. However, it may be justifiably suggested that someone skilled in wool handling is necessary to guide any large shearing operation irrespective of whether classing is done, and the uncertainty of eye appraisal is neatly cancelled by purchasers by filling orders from a number of sources rather than from one or two so that over-estimates are cancelled by underestimates.

A second reason has to do with alleged inaccuracy of sampling and/or measurement. Extensive work on this has shown that such errors are, on average, smaller than errors of eye appraisal, and attention to detail should make them less important and in fact insignificant.

The third objection is based on the argument that practical measurements so far devised cannot provide a full description of any wool nor can it be used for all wools. Both objections have some basis in fact. Special characteristics of raw wool believed, to be necessary for producing special properties of the fabric, are, for various reasons, not easily measured, and appraisal calls into play personal expertise. The argument that measurement cannot be used for all wools is not a good one because for the wools most difficult to measure, fibre diameter and length are seldom critical.

The remaining part of the argument has to do with people. At the beginning I drew attention to the complexity of the overall distributing system that exists for wool. It employs many kinds of people with all sorts of expertise and much of this expertise has a marketable value which, understandably, is often jealously guarded. A point also to be noted is that wool is a valuable commodity traded in large quantities and small mistakes of measurement can be costly. Naturally, there is personal suspicion of a new system.

Acceptance of a new and rational system of wool classification and appraisal depends, therefore, on economy, on demonstration that it satisfies the real requirements of the consumer, in this case the processor, and on overcoming purely personal resistance. Personal resistance is a very real problem not entirely related to inertia. It contains a lot of social elements well founded in fears of redundancy, the necessity to learn new skills and, above all, the surrender of perhaps jealously guarded personal expertise.

Any new system usually involves a redistribution of cost and savings. For wool the cost of measurement is borne by the producer and is easily identified. On the other hand, savings are spread over a number of sections in the distribution chain and Australian experience is that they are difficult to identify and that there is even more difficulty in showing that they finally benefit the man who suffered the original and whole cost of the alternative to conventional classing.

Well now, what is the value of woolclassing?

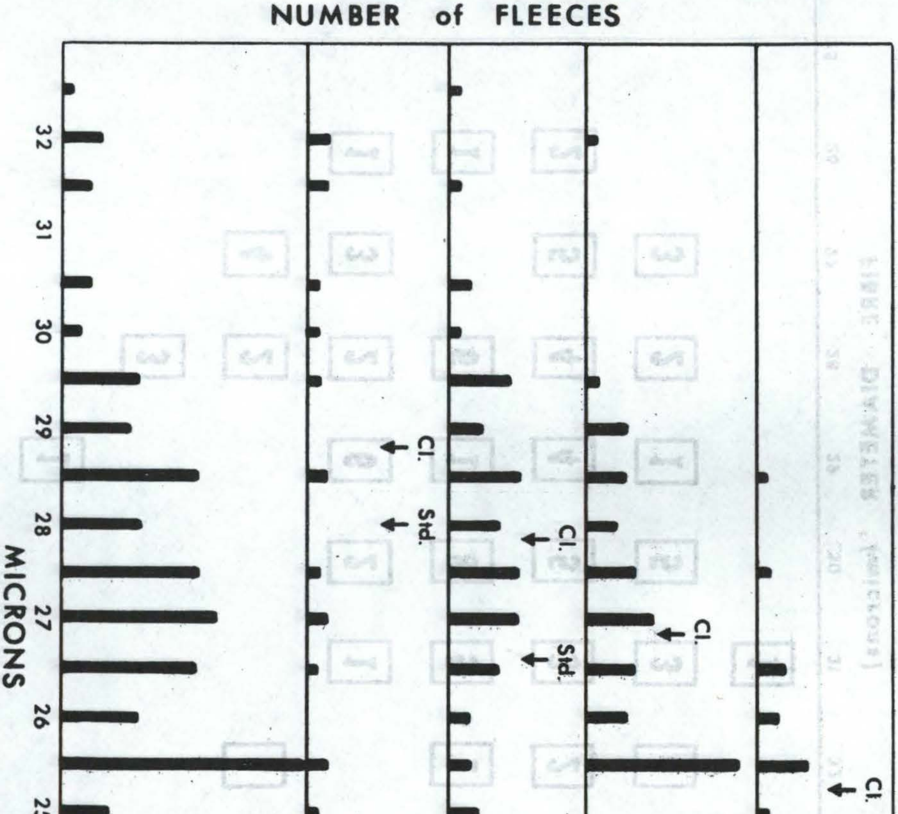
In low grade clips that are short-stapled, discoloured and faulty, it is of little or no value.

For clips averaging below 50's, the end use of most wool is coarse, low-count yarn to be used in carpets and heavy woollen and worsted fabrics, and elaborate preparation and classing is not critical.

Wools finer than 50's can be exploited much more fully and specifications of a line, largely in terms of fineness, length, soundness and colour become much more critical. As I have already explained, it is technically impossible for a classer or anyone else to make more than a token improvement on a situation already achieved by a flock-owner who selects and breeds the classical mixed age flock of dual purpose or Merino sheep. He already has a clip which can be handled and marketed by rational low cost methods with in fact no conventional classing.

The clips I have mentioned account for the majority of our wool and for this a much reduced classing procedure is possible and is being increasingly accepted; but so long as we offer wool on an open market, which includes some purchasers practicing their own expertise in the old conventional way, then acting on the principle that the customer is always right it is probably safer to also indulge in some of the conventions, and this includes classing. At the same time we must recognise that rationalisation is taking place. It is soundly based and should be regarded as an important factor in cost control.

<u>Figure</u>: Distribution of Fibre Diameter in Whole Clip and Classed Lines (Cl. = Classers average. Std. = expected average diameter according to proposed National Standards).



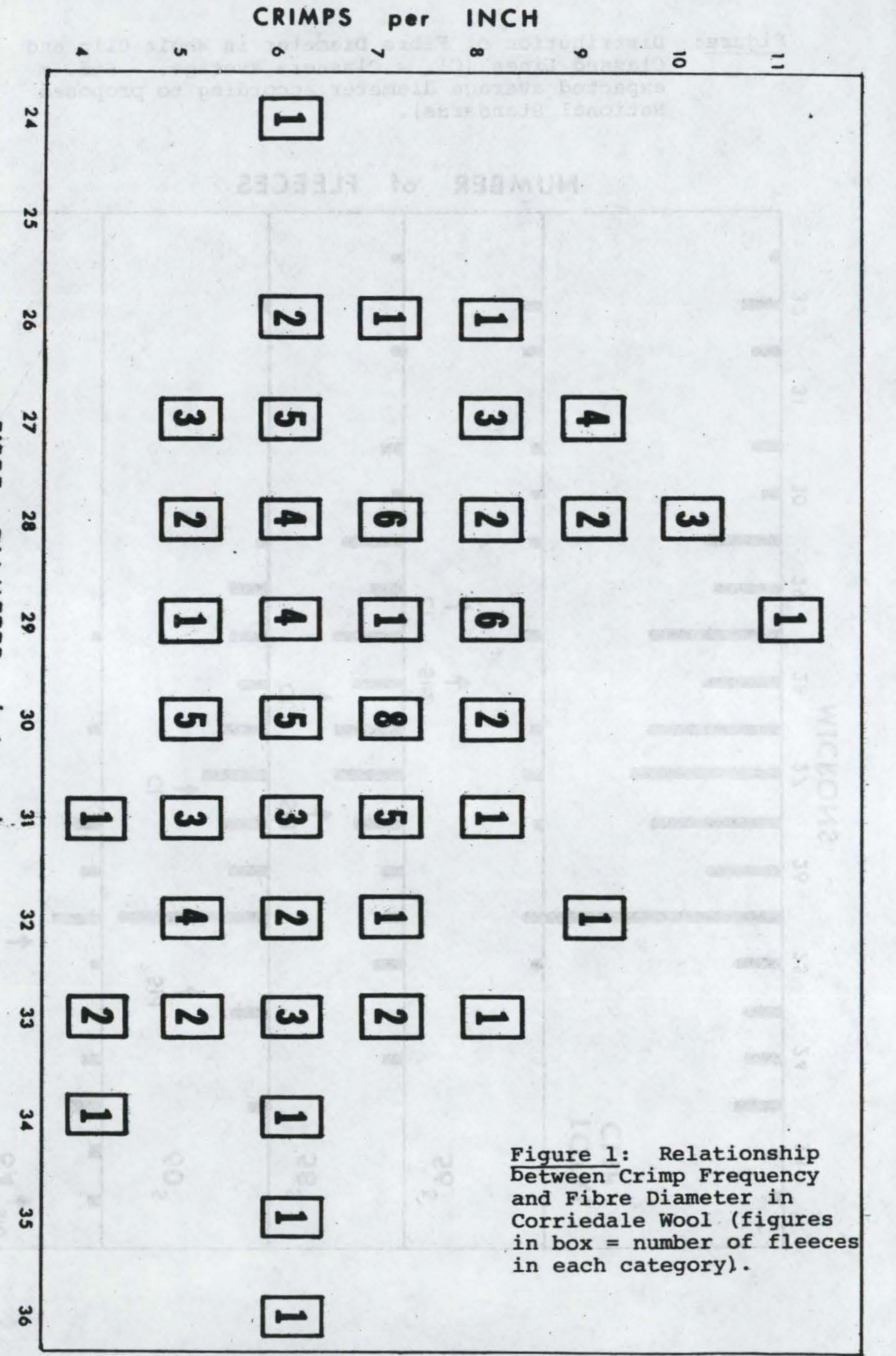


Figure 1: Relationship between Crimp Frequency and Fibre Diameter in Corriedale Wool (figures in box = number of fleeces in each category).

TREES AS A MEANS OF INCREASING PLANT AND ANIMAL PRODUCTION

MR P.W. SMAIL

FARM FORESTRY ASSOCIATION

HORORATA

When asked to prepare this paper on Farm Forestry I deliberately chose the title of "Trees as a Means to Increased Animal and Plant Production", for this is exactly what my experience has been.

In a world of modern science and technology to say "the planting of trees is a means of increased animal production" may seem remote. I'd be better and much more "with it" were I to advocate giving the "old girl" a shot with some hormone so that she produced twins, regardless of the fact that they may both very well die of exposure at birth. A survey carried out some years ago by Vet. Clubs proved exposure to be the greatest cause of stock losses.

I do not intend to point out the problems of climate to Canterbury farmers but rather to put forward some proposals in combating them. We have the coastal strips affected by a nagging Easterly wind, whilst further inland these are replaced by harsh, drying Nor'West winds, the whole province being subject to cold Southerlies, often resulting in disastrous stock losses at lambing and shearing time. Hence the need for

well planned and managed shelter.

I well recall in the early days of developing this property out of revenue these disastrous losses suffered during storms. The gross inefficiency incurred by these losses, after having used all one's technical know-how in the mating and nurturing of one's ewes through the winter, compelled me to embark on a shelter programme. I don't claim to have completely eliminated the problem but I consider I have come a long way in reducing it.

Shelter requirements can be divided into two types - Permeable and High Density shelter.

PERMEABLE SHELTER

The object of permeable shelter is to have a filtering effect of the wind, thus reducing its velocity for the greatest possible distance into the paddock. Twelve times the tree height is a conservative estimate of the sheltered area.

The pattern for this type of shelter is on the two-tier system, one a quick-growing variety, plus a complementary species planted on the windward side. There are numerous combinations which can be used, subject to soil types. For myself, on the windswept Canterbury plain, I use one row of Radiata, 2 metres from the fence line, plus Cedrus Deodar, 3 metres from the pines and 3 metres from the fence line. This gives the maximum shelter for the minimum land usage. As the Radiata establishes, the sides are trimmed mechanically to within 18" of the trunk, eliminating any branches overhanging the fence line. The side next to the complementary species can be treated similarly - this is done on a contractural basis at reasonable cost. As the pines mature, every second or so tree can be pruned to control the air flow through the shelter belt and this, of course, leaves you with a quality saw or peeler log at the time of maturity. Also, there is an upgrading in the remaining trees due to the fact that their low branches green and produce live knots.

This form of shelter also affords the best protection for pasture and crops; reduced wind velocity means less evaporation of moisture from the soil and less stress of plants through transpiration. Also, this open type of shelter helps to prevent congregation of stock at the base of the shelter planting, thus eliminating the build-up of fertility which induces the growth of barley grass and horehound, plus an increased chance of animal disease. There is a 2:1 subsidy for this type of shelter, covering the cost of one permanent fence, soil preparation, the trees and planting.

Dr Hamish Sturrock (D.S.I.R.) has been away at Nottingham University studying the effect of wind damage on plants, experiments being conducted in a wind tunnel, using an electron microscope. The damage shown by these experiments is quite astonishing.

Reference - Birds.

<u>HIGH DENSITY SHELTER</u>

High density shelter is almost self-explanatory. This is a much denser form of shelter required to afford protection from the bitterly cold Southerly gales. This could be multi-row and of mixed species. To make the best use of this form of shelter often requires fencing to hold the stock for how often have you seen ewes and lambs driven before the storm? To get this protection I plant the Sou'West side of a central lane that runs through the farm. I consider the most efficient method of obtaining maximum shelter is in the farm woodlot concept. Here, an area of five or more acres, properly tended, with the branches of the marginal trees left unpruned, forms about the ultimate in desirable high density shelter. The interior trees are pruned and the stocking rate reduced as quickly as you obtain reasonable canopy cover.

Having tried many and varied methods of ground preparation, I have found the most satisfactory technique is the use of a desiccant spray, this eliminates all plant competition.

This sprayed strip should be double ripped to a depth, subject to soil conditions. This allows for easy planting and a free soil for root run. I plant my Radiata as deep as I can, often two-thirds of the tree is in the ground.

EVALUATION

How do you put a figure on the value of shelter? A forester looks at the trees and says "so much per cub. ft". The assessment of shelter is not as easy. Here, I must relate my own experiences. I unhesitatingly say "a large proportion of my production is related to my shelter concept". From blade shearing in October to machine shearing on 1 August, without snow comb, speaks volumes to all sheep farmers.

AFFORESTATION

This is a very big topic and one that's very dear to me for it ties in with my interest in land utilisation.

To some of you the image of forestry in Canterbury may not be very good, a stop-gap job in times of unemployment, then a burn-down at Balmoral and a blow-down at Eyrewell.

However, forestry would be one of New Zealand's fastest growing industries. (In 1969 export value for forest products was $57.4 million; in 1974 it is $109 million.)

Forestry was once complementary to farming but now is becoming a competitive form of land usage. Recent estimates on the availability of marginal land for planting quote A.P. Thompson's paper. F.D.C., a marginal land resource of 1.4 million hectares, add to this 750,000 hectares, available for planting on farmland. This will give you some idea of land availability.

Therefore, I am concerned at a time of falling stock prices that the big forestry companies may be in a position to spread a monolithic carpet of forest on our better class land. By the same token, I am concerned that we as farmers have this big land resource available for planting and are not using it. There is the Forestry Encouragement Grant Scheme which provides finance, dollar for dollar, to the extent of $600 per hectare in forestry establishment and tending.

I think that as you sit here, as farmers, you must individually be able to pinpoint some awkward triangle, a gorsy gully, or perhaps a terrace which could be applied to afforestation, whilst at the same time being utilised as a shelter concept and a source of post material.

On my light Lismore soil I have an increment of 250 cub. ft per acre per annum but taking 250 cub. ft per annum as a conservative figure and a realistic price of 30c per cube for tended material, this country is returning $75 per acre per year in trees.

There is evidence to indicate, from a recent survey, that lack of knowledge, expertise and management were the main reasons for farmers not utilising this resource. However, this knowledge is readily available from the Forest Extension Service and private Forest Management companies.

As farmers you are in the box seat for you have the basic requirement - the land - so let's get organised and utilise it to the best advantage. Now, having promoted the planting of trees, I must refer to <u>marketing</u>.

It never fails to amaze me how the farmer, who produces a large quantity of timber for local consumption, will haggle over the price of his sheep and cattle, demand the last cent for his dairy produce, yet be prepared to see this very valuable asset, timber, leaving his property at whatever price the logging contractor offers.

The thought of sending lambs away uncounted, with no killing sheet, and putting your wool in to the store with no return of recorded weights, etc., would be ludicrous, yet how often do we see this situation arise with timber sales? A bloke arrives at your planting, points out all the branches and all the faults, and somehow an agreement is reached. But how can the grower obtain its worth when in reality he has no idea of its value? Hence the need for a uniform and orderly marketing system.

I understand that after Mr Leith Knowles' paper there is to be time for discussion and I hope that you will bring up any points that need clarification.

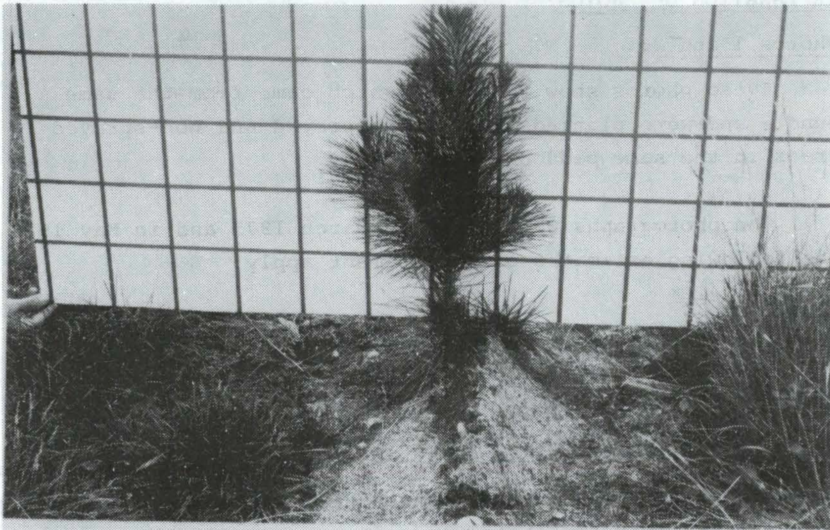


Photo 1: A tree planted into a strip-sprayed area in May 1974.

Photo 2: A tree from the same bundle planted at the same time but planted into a non-sprayed area.

EXPLANATION OF PHOTOS:

Photos 1 and 2:

These photos show two trees which came from the same bundle and were planted into strip-sprayed and non-sprayed areas in the same paddock in May 1974.

The photographs were taken in March 1975 and in May 1975 the following estimates of measurement apply:

	Total Height	Survival Rate
Sprayed area	1 metre	99%
No spray	35 cm	15%

Note that the 10 cm grid in Photo 1 is placed approximately 5 cm higher than in Photo 2, hence the difference in vigour is even greater than the photos suggest.

This graphic demonstration of the early results of spraying to control grass and weed competition underlines the need to ensure that young trees are given every opportunity to obtain maximum nutrition and moisture from the site.

Photos 3 and 4:

These are of a 15 year old, double row, permeable shelter-belt using the fast-growing Pinus Radiata for quick shelter with low shelter provided by Cedrus deodara. Trimming of side branches of the Pinus Radiata and the high pruning of approximately half of the stems (as shown in Photo 4) ensures that no branches overhang the paddock (see Photo 5). The ability of Pinus Radiata to produce quality timber is utilised to the full, land is utilised right up to the fence and an effective wind filter from ground level upwards is obtained with this design and management.

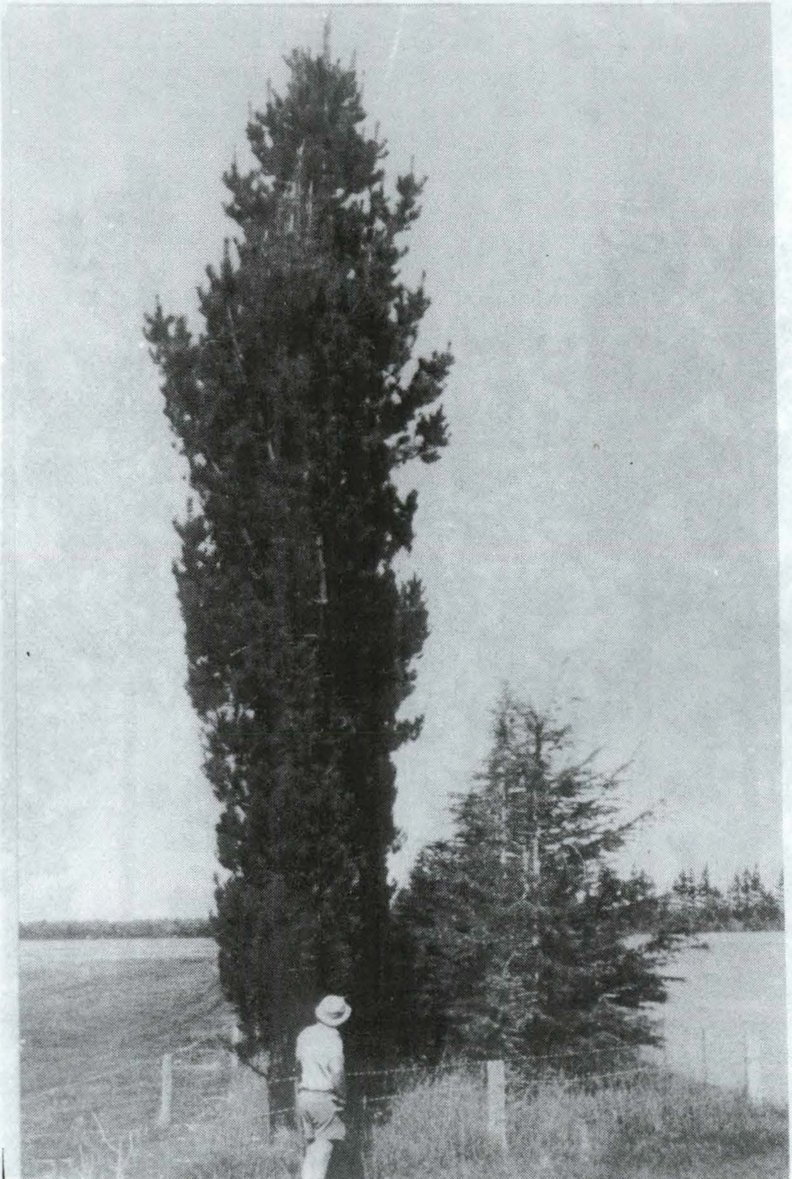


Photo 3: A 15 year old, permeable shelter-belt utilising Pinus Radiata and Cedrus deodara.

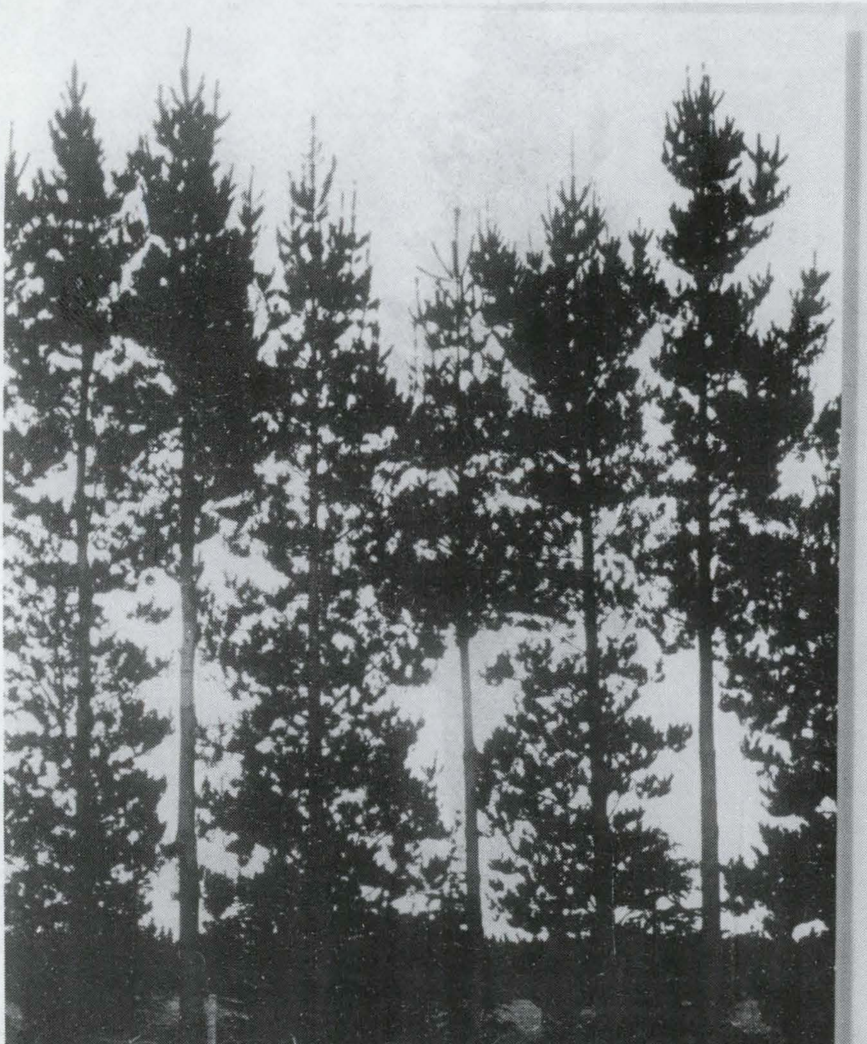


Photo 4:

The same shelter-belt as Photo 3, illustrating the effective wind filter obtained with this design and management.

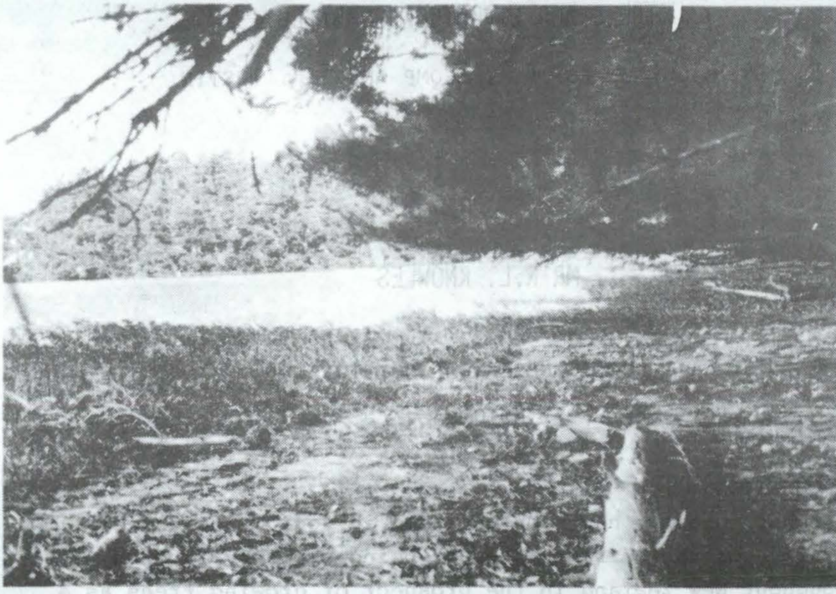


Photo 5:

This shows a scene well-known to us all! Problems of stock infection, weeds, loss of productive paddock area, damage to machinery and poor timber quality all combine to make the trees a nuisance, except for their contribution to paddock shelter. The draughty gap at the bottom of the trees and the disease-ridden soil close to the fence are probably the greatest disadvantages of the over-mature, untended shelter-belt.

GRAZING UNDER TREES

(TREES AND LIVESTOCK COMBINED)

BY R.L. KNOWLES, B.K. KLOMP AND I.R. TUSTIN

MR R.L. KNOWLES

FOREST RESEARCH INSTITUTE,

ROTORUA

INTRODUCTION

That forestry has been included in your Conference is indictive of the current interest being shown by farmers throughout New Zealand in the prospect of growing trees as a significant adjunct to agriculture. Although interest in farm forestry must, to a large extent, be a result of the downturn in prices for agricultural produce, it is also due to the improvement in log prices following the export of logs to Japan and, to a lesser extent, the development of new management systems combining trees and livestock.

In 1968 profitability studies prepared at the Forest Research Institute, Rotorua, showed clearly that site index and location affect the financial viability of Radiata Pine plantation forestry. They also demonstrated the profitability of adopting shorter sawlog rotations by maximising growth on pruned final crop trees. Such management entails freeing crop trees from competition at an early age. This means intermediate yields from thinnings are foregone but the stands are sufficiently open to maintain a grass sward, enabling intermediate yields to be obtained from grazing. This realisation has led to further refinements in the silvicultural regime aimed at reducing shade, slash and costs by planting fewer trees at wider spacing, more timely pruning of fewer trees and earlier removal of culls.

Initial interest in this concept has come from the forestry sector, particularly from forest companies who have acquired grassland for planting, because they have appreciated the advantages of very early agricultural returns, easy stand access, simpler stand management and reduced fire risk. More recently, however, agriculturists have shown interest also. They acknowledge the role that tree crops can have in diversifying and raising production, reducing market and biological risk, promoting soil stability, ameliorating the microclimate and, for farmers, in providing an asset which can be readily liquidated to pay death duties.

CURRENT RESEARCH

Our research programme has been examining three main aspects:

1. Short-term trials on site preparation, tree establishment, and early pasture and livestock management.

2. Long-term trials on measuring the effect of a developing tree crop on both pasture and the livestock production.

3. Examining the financial possibilities of the concept under various assumptions so that both experimental priorities and the farm types and localities in which private ventures should be encouraged can be better identified.

1. Short-Term Trials on Site Preparation and Tree Establishment

The objectives here are to get the trees established with the minimum of browsing by livestock, to maintain the sward and to obtain some return from the pasture. Results from extensive trials carried out in the central North Island in conjunction with farmers, the Department of Lands and Survey and the Ministry of Agriculture and Fisheries are as follows:

(a) Weeds and pests must be controlled prior to planting. Lax grazing, which seems necessary to allow the trees to get established, will encourage weeds such as gorse and blackberry if these are not controlled before planting.

(b) The pasture should be sprayed with a herbicide (such as paraquat and simazine) prior to planting to reduce the competition for moisture between the tree and the pasture in the first spring and summer following planting. Spots 1 m in diameter are hand-sprayed on hill country and strips 0.8 m wide are sprayed by tractor on easier terrain. This method has been found to be cheaper and more effective than spraying or hand releasing the seedlings after planting (Anon, 1973) and is essential in areas experiencing a dry summer or where small seedlings are likely to be overtopped by the pasture.

(c) Only sturdy, good quality seedlings (about 0.4 m tall) should be used and these must be planted deeply and carefully to ensure that the root systems are not bunched or distorted in the planting hole. If this is not done, seedlings are more liable to "topple", be blown over or be pushed over if livestock rub against them (Anon, 1975).

(d) On hill country, three levels of pasture utilisation in the two years following planting have been compared:

(i) Ewes or hoggets introduced in the spring soon after planting with the intention of fully utilising the sward have readily eaten the

Figure 1

Fig. 1: Lambs at 25/ha introduced to a radiata plantation for the first time in the Autumn - 6 months after planting.

Figure 2

Fig. 2: The same area three months later. Most of the rank grass and clover has been grazed or trampled while damage to the trees is negligible.

seedlings along with the pasture.

(ii) No grazing or only very lax grazing during the first two years will prevent any damage to trees but would be unacceptable to most farmers because of the deterioration in the pasture.

(iii) Introducing either lambs or older sheep in the period between January-March (5-7 months following planting) has resulted in minimal tree damage and, although the pasture has become rank by this time and the proportion of ryegrass is reduced, clover does not seem to be seriously affected. The reason sheep don't browse the seedlings seems to be that the mixture of clover and rank grass which occurs in the Autumn offers the animals a wide range of diet.

(e) If terrain permits, tree rows should be spaced to permit inter-row cropping of hay or ensilage.

(f) Dairy cattle are not suitable for grazing among young pines. Angus weaners have given variable results but there is some evidence to suggest that cattle which have had recent experience of grazing among older pines are less likely to browse or debark young trees.

Although browsed trees can show remarkable recovery, especially where they are not repeatedly browsed, we advocate Autumn introduction of livestock as this minimises such damage and, therefore, allows the seedlings to quickly grow beyond reach of sheep. A grazing system which has been found suitable for both weaned lambs and older sheep is to introduce the livestock at 12-25 animals/ha in the late Summer-early Autumn following planting and to keep the area stocked as long as possible. If 10-20% of the tree leaders have been browsed, the animals are removed. Invariably this degree of damage would appear the following Spring (August-September). The sheep would then be removed for 3-4 months during this critical Spring period and then re-introduced about December. Provided the area can be frequently inspected, continual grazing by sheep should then be attempted so as to retain the better pasture species.

Other avenues of research which are currently being investigated to enable earlier grazing are:

(i) The use of large seedlings.

(ii) Using simple tree guards which could be moved once the trees are established.

(iii) Changing the composition of the pasture by using an overall paraquat spray. Clover-dominant pastures have indications of being easier to graze without tree damage.

(iv) Using a nursery-applied chemical repellant to prevent or reduce the browsing damage which occurs in the Spring following planting.

2. <u>Long-Term Trials to Measure the Effect of Trees on the Pasture and Livestock</u>

A comprehensive 95 ha trial has been established near Rotorua by the M.A.F. and F.R.I. to measure the effects of a range of tree stockings of Radiata Pine on both the pasture and livestock. Planted in 1973, this trial incorporates six treatments (open pasture and final crop stockings of 50, 100, 200 and 400 s/ha, with an unevenly distributed 100 s/ha) replicated four times.

As it will be several years before information will be available from this trial and since it is the latter half of the tree rotation which raises most queries concerning pasture production, another trial is being installed into a stand of

Figure 3

Fig. 3: Cows with calves grazing amongst 6 year old radiata pine thinned to 400 stems/ha. The trees have been pruned to 2.5 m.

Radiata near Putaruru - which was planted on to pasture eight years ago. An additional 2 ha area of fourteen year old trees located near Putaruru is also being used by the Grasslands Division of D.S.I.R. and the M.A.F. to compare the performance of several species and mixtures of grasses and legumes. This stand has been thinned to 200 s/ha and pruned to 11 m. The average tree height is 20 m and diameter 34 cm. The pasture beneath the trees was recently sampled in the period between December-February and in 50 days produced 1,400 kg/ha D.M. Sampling at distances of 1 m, 2 m and 4 m on the North and South aspects from individual trees did not indicate any differences in pasture production due to the proximity to or aspect from individual stems.

3. Financial Comparisons

Despite the lack of information on the effect a tree crop will have on the pasture, several attempts have been made to compare the profitability of conventional livestock farming with trees, plus livestock. The assumption is made that very little grazing will be obtained in the first two years. By the third or fourth year about 80% of the grazing which would be expected from open pasture would be obtained. From then on the grazing would diminish to practically nothing at year 25. (Bell, 1973, Grant, 1973, Grant, 1973) showed that for the combined concept to be considered by a farmer, it should satisfy two criteria:

(i) It should be more profitable than conventional farming.

(ii) Since the combination of reduced income from livestock and increased expenditure to cover tree establishment and silviculture must be met from normal farm income, the concept is more likely to be acceptable on a large farm (i.e., 3,000 s.u. minimum) with a low to moderate stocking rate (i.e., 12 s.u./ha or less). Because of these financial limitations, it is unlikely that many farmers could afford to plant more than 10% of the farm (Jackman and Knowles, 1973).

A typical Wairoa farm of 1,100 acres (with 1973-74 prices of 130c/kg for wool and $8/head for fat lambs) would have shown an economic farm surplus of $66/ha under conventional farming. Assuming that a paddock of this farm was planted in trees and that the logs would be sold for export through Napier (112 km distance) Knowles (1974) showed that the trees, plus livestock option could have yielded an economic farm surplus of $85/ha. (The forestry component of this was $59/ha.) Although these figures suggest the combined concept could be more profitable than farming alone, the forestry component was very sensitive to the road class, haul distance and site quality. Another important point is that this profitability is dependent on relatively high stumpages. These are being achieved with export sales but prices paid for local sawlogs are notoriously variable and depend on such factors as the prices being paid for logs in nearby State Forests, in the competition between sawmills and in the lack of any formal structure for marketing woodlots.

OTHER RECENT DEVELOPMENTS

To co-ordinate research into combined farming and forestry, a working group of research workers from the research organisations was formed in August 1974. This group has had two meetings so far and several of the trials previously mentioned have been instigated at their suggestion.

Several management aspects which were considered to be impeding the adoption of the concept on a wider scale (Tustin and Knowles, 1974) now form part of the formal recommendations made in the report of the working party on afforestation at the Forestry Development Conference (Anon, 1975) held recently in Wellington:

1. Finance: Acknowledging that the availability of finance is one factor limiting the inclusion of forestry in farm development plans, the working party recommended that the Government consider - "Providing long-term loan finance on a deferred interest basis ... conditional on the adoption of an overall farm plan.".

2. Taxation: At present expenditure on farm woodlots is not tax deductible. The farmer either obtains a Forestry encouragement grant which requires him to pay half the costs from after-tax income or carries the costs forward to be deducted from the clearfelling returns. The working party recommended "that private landholders be allowed the option of obtaining grants ... or deducting forestry expenditure from income before tax ...".

LABOUR

The availability of contractors would be an essential requirement for many farmers to consider planting part of their farm in trees. The working party recommended that the Forest Service examine the prospect of providing forest management contractual services for other Government Departments, local bodies or farmers who wish to test the concept on their land but lack the expertise and skilled labour to handle the forestry aspects of the enterprise.

GROWING OTHER SPECIES

The working party recommended that the Forest Service:

1. Evaluates the opportunities for establishing sufficient resources of selected eucalypts and other species to enable viable processing plants to be established.

2. Encourages the private sector to plant alternative species by establishing stands in strategically located State forests.

3. Intensifies research on the growth, yield and use of species which could readily substitute for indigenous species, and to extend its research on combined land use to examine whether the grazing concept can apply to species other than Radiata Pine.

MARKETING

In addition to the recommendation concerning labour, the working party recommended "In order to promote the orderly establishment, management and eventual marketing of private woodlots and small forests, that Government take positive measures to encourage the development of owner co-operatives and/or forest management groups to carry out these functions.".

Other recommendations likely to be of interest to farmers considering combined farming and forestry are those requesting the maintenance of a viable log export trade, the examination of the potential for premiums for high-grade timber arising from stands which have been timely pruned and thinned, and the need for an urgent review of the Forestry extension services, with a view to improving, extending and upgrading them.

If these recommendations are accepted and implemented, many of the constraints on the wider adoption of combined farming and forestry will have been removed. The lack of knowledge on the effect of a tree crop on the pasture and livestock will still remain but in many situations secondary benefits alone could be sufficient to justify using land for both farming and forestry. Just as soil stabilisation is a major concern on the East Coast of the North Island, shelter could be ample justification in parts of the South Island. The development with species other than Radiata Pine may be necessary if our flatter, more fertile sites are to be considered. Progress is already being made in the use of walnuts in Canterbury and the use of at least two eucalypts which provide attractive timber - saligna and regnans - would appear to be a worthwhile development, particularly on the North Island hill country.

Figure 4

Fig. 4: Sheep grazing beneath 12 year old radiata pine thinned to 200 stems/ha and pruned to 11 m.

CONCLUSIONS

The concept of combining trees with livestock is a new development which could considerably alter our traditional concepts of the role of forestry on farms. Existing research trials and working examples of management scale operations using Radiata Pine will be of particular benefit to the hill country farmer. As it is the hill country which cannot diversify into alternatives to livestock grazing and Radiata Pine can grow as well or better on hills as on the flat, it is the logical choice for this type of country. For the concept to be considered for our flatter, more fertile land, more attractive and valuable species should be investigated.

If the recommendations pertaining to this concept made by the afforestation working party at the Forestry Development Conference are accepted and implemented, then many of the constraints limiting the wider application of the concept will be removed. Basic information on the effect of a tree crop on the pasture and livestock is still lacking but in many areas secondary benefits such as soil stabilisation or amelioration of the climate could be sufficient incentive to justify adoption of combined land use.

Anon, 1974: "New Success in Establishing Trees on Pasture" - What's new in Forest Research No. 11. New Zealand Forest Service, Forest Research Institute, Rotorua.

Anon, 1975: "Grazing Livestock Among Young Radiata Pine" - What's new in Forest Research No. 22. New Zealand Forest Service, Forest Research Institute, Rotorua.

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EXPORT MEAT GRADING

(AMENDMENTS AS FROM 1 OCTOBER 1975)

MR G.J. HERLIHY

MEAT PRODUCERS BOARD

WELLINGTON

May I thank the Conference Committee for their invitation to the Meat Producers Board to address this Conference today. The invitation is timely because, as you have no doubt gathered by the title of my paper, there are a number of changes to be introduced as from the start of the coming season.

Grading is one of the major functions undertaken on behalf of producers by the Board. It is a subject that comes under much scrutiny by many farmers and indeed at times much criticism. This is no doubt due to the fact that farmers generally know little about the intricacies of shipping or the operation of overseas promotion, thus tending to focus their attention on that facet of the Board's operation that most directly affects the return they receive for their stock slaughtered.

There tend to be many misconceptions about grading. Therefore, before discussing in depth the various standards and systems that apply to lamb, sheep and beef, it may be best to review the purpose of grading or classification. Grading is simply the operation of placing carcases with similar characteristics into groups, that is, to put like with like. Grading has both a production role and a marketing role.

From the production viewpoint, it allows a framework for rewarding farmers for the value of their produce and through the schedule system provides a means of reflecting consumer requirements back to the producer. From the marketing angle, New Zealand's export grade standards allow for the purchase of our meat sight unseen.

Some form of compromise between the production and marketing function has to be made when deciding on the number of grades for a product such as lamb. Splitting the lamb kill into a great number of grades may ensure more equity between producers. However, from a marketing viewpoint, the confusion that could result from having a multitude of grades could work against the farmer.

WHO SETS THE STANDARDS?

The responsibility for establishing grade standards for export carcases is vested in the Meat Board under the powers conferred on it in the Meat Export Control Act 1921/22.

A Committee within the Board, known as the Grades Committee, makes recommendations to the Board on any changes to export grade standards. In addition to the Board's permanent Grades Committee, the Board has, on two occasions, set up an independent Meat Export Grades Investigation Committee. The most recent independent Committee reported to the Board in June of last year and it is from that report that the changes which will be discussed this morning are principally based. This three-man independent Committee, chaired by the Hon. Duncan MacIntyre, included Mr Alistair Nicol of this College who will be well known to the majority of this audience.

OPERATION OF GRADING

In New Zealand, carcases are graded at the end of the processing line by personnel employed by the processing company. To ensure uniformity, both within and between plants, the Board employs some 30 supervisors spread throughout the country who visit each plant daily to check on the individual company's grading standards. While ensuring that grade standards for export meat are maintained, the Board Supervisors also check on such matters as the packaging and the loading of meat at the wharves.

It should be noted that the Board only has control over meat killed for export. The grading system for meat killed for the local market is substantially different to that applicable for export meat.

GRADES AND SCHEDULE

As already indicated, the main objective of grading is to group carcases with like characteristics together. The meat exporters then ascribe various prices which they are prepared to pay for each grade through the medium of the schedule. Frequently, however, the grading system comes in for adverse comment when the comment should more correctly be aimed at the schedule price. For example, many producers complain bitterly about the return they receive from over-fat grade lambs and immediately feel that the grading system is inequitable. It should be stressed, however, that the price a producer receives is offered by the schedule and, as you are all well aware, there are a number of alternatives open to a farmer such as company pools and shipping "own account" if he feels that the schedule does not fully reflect the return of his product.

CARCASE CHARACTERISTICS CONSIDERED IN GRADING

In our export grading system, carcases are firstly segregated according to sex (for example, steers as against cows) and then, in the case of sheep, are segregated according to age (for example, lambs as against hoggets). The carcases are then segregated principally on fat cover while specific types of fat cover are further segregated on the basis of conformation. In addition, carcases are further segregated into weight ranges.

Let us now look at how this segregation process or, more simply, classification, applies to the various classes of animals.

LAMB

As can be seen on this first plate, lamb carcases are firstly graded on the basis of fat cover into one of four groups. At the bottom end of the scale we have those carcases that are devoid of fat and these will be known next season as "A" grade carcases. This type of carcase is currently known as the "Alpha" grade. While we see very few Alphas in Canterbury, they are relatively common in the North Island.

At the other end of the scale we have carcases with excess fat cover which are currently known as the overfat grade and these will be represented next season by the symbol "F".

With respect to conformation, only one of the four levels of fat cover (namely, the "P" grade) is further broken down into two classes, principally on the basis of their muscling in the hindquarter region. These two classes will be known as "P" and "O", the "P" representing the well-muscled leg and loin, currently known as the Prime grade, while the "O" will represent the grade of lamb that is quite familiar to the Canterbury scene, the Omega.

The first slide shows the four levels of fat cover that all lambs are subdivided into. The second slide shows the two conformation classes (namely, "P" and "O") for that type of cover that has a "medium" level of fat cover.

These five resulting grades are then broken into weight ranges as is shown in the next plate. There are principally three weight ranges which will be characterised by the symbols "L", "M" and "H" to depict from the marketing viewpoint the light, medium and heavy weight ranges that New Zealand lamb is produced in. Next season the term "Prime D" will be replaced in your killing sheet by the symbol PL. There is only one weight range for "A" lamb while the "F" grade is not subdivided into weight ranges.

To summarise the changes in lamb grading, you will see we will no longer use the rather meaningless symbols of "D", "2", "8" and "4". These have been replaced by the symbols "PL", "PM" and "PH", with the old Prime "8" and "4" amalgamated into one grade known as "PH". Hopefully gone forever will be the term "Second" which many farmers and, lamentably, many industry people still ascribe to the "Y" grade lamb; that is, lamb with a light fat cover. It is the "Y" grade lamb that is most keenly sought after by a number of our developing markets such as the Middle East, Japan and Continental Europe, principally because it has less fat than our traditional "P" grade lamb. It was the demand for "Y'" in the early part of this year that prompted the Board to actually offer more for "Y" grade lambs than for the Prime grade.

Producers will be aware that the Board this season reduced the allowable fat cover on Prime grade lambs. Fat is not required by the marketplace and the standard would have to be further tightened if we were to reduce the fat cover of our Prime grade to what has been deemed "optimum" by the MacIntyre Committee. However, before contemplating any further change, the Board will be awaiting the market reaction to the tightening of the standard this season.

As Secretary of the Grades Committee, I have the invidious task of answering many letters sent by farmers to the Board concerning various facets of grading. One dealing with the change in the over-fat grade this season concerned a farmer who has been in the habit of collecting his over-fats from the

Works for the last 20 years. This season he wrote to no one less than the Chairman of the Board and gave him both barrels at close range. To quote from his letter:

> "I don't mind honest over-fat grading but I do dislike what I'm getting at the moment, Mr Hilgendorf. By booting the producer in the face with this over-fat lark, combined with these damned hygiene regulations, you are forcing farmers to sell out of sheep."

I constructed a suitable reply on behalf of the Chairman to placate this particular gentleman but it was not until I was visiting the Works last month that I learnt the truth of the story. Farmer X had called at the office late on a Friday afternoon to pick up <u>his</u> over-fats. However, by this time the Works had inadvertently sold Farmer X's lambs through their wholesale store. The management on the cooling floor, hearing that Farmer X was on the way up to collect his lambs, panicked, removed the required number of Prime lambs from the Prime rail, put over-fat tickets on them, labelled the tickets "Farmer X - to hold" and thought they had another satisfied client. But Farmer X was smarter than they thought. He went home and carried out the check measurements that define an over-fat lamb and, as would be expected, found none of them in the over-fat range. He then vented his wrath on the Chairman of the Board.

The moral of the story? - never underestimate the farmer or, alternatively, the Board is not always wrong!

In addition to the lamb grades described above, there is an additional grade known as the "Cutter" grade for lambs that, due to trimming or mutilation caused by either processing faults or the removal of pathological defects, leave the carcase unsuitable for export as a carcase grade. An example of the two grades of Cutter is shown in the next slide.

To be eligible for the Cutter 1 grade, all primal cuts must be able to be salvaged. The Cutter 1 has a flap removed as well as a shank, allowing a square cut shoulder to be salvaged from the damaged forequarter. With the Cutter 2, as you can see, not all primal cuts are intact.

EWE

The next slide shows the four carcase grades for ewes. As you can see, there is a progression of fat cover starting with the "MM" grade (currently known as Canners), progressing through to the "FM" grade (currently known as the over-fats). The weight ranges for these four grades are shown in the next plate. The current symbol used for the Prime grade of "1", "7", "3" and "9" have been replaced by the symbol "EL", "EM", "EH1" and "EH2". The "MM" and the "FM" grades are not broken into weight ranges.

In addition to these carcase grades, there are the Processing No. 1 and Processing No. 2 grades which are broadly equivalent to the Cutter lamb grade where damage to the carcase does not allow it to be exported in the carcase form.

WETHER, HOGGET, RAM

As to the remaining classes of sheepmeats, the next plate shows that wethers and hoggets are broken into two grades on the basis of fat cover - the "X" grades shown in red having a light fat cover and the "H" and "W" grades having a medium fat cover. Any wethers or hoggets carrying excess fat are graded "FM" which is equivalent to over-fat ewe grade, while those that are very lean are graded "MM". There is only one class of ram, represented by the symbol "R".

To summarise the amendments arising from the Meat Export Investigation Committee Report relating to sheep and lamb grading, changes principally involve the introduction of symbols to represent grades rather than having grade names implying some sort of quality of the meat. Gone is the terminology of such descriptive terms of "Seconds" or "Fair Average Quality".

<u>BEEF</u>

The system the Board will be introducing for beef is more of a classification system than a grading system where animals with similar carcase characteristics will be grouped together. The current beef system has grade names which would suggest that the meat is of a certain quality; for example, one of the current terms in our grading system for beef is "FAQ", the symbol for "Fair Average Quality". I doubt whether a Charolais breeder who has a carcase graded "FAQ" would agree that this meat produced is of a "fair average quality" as the grade name would imply. Under the new system, after the animal is identified as to sex or gender (i.e., steer, heifer, cow or bull), the carcase will be classified into one of five fat categories, depending on the external fat cover. At one end of the scale is the "M" grade carcase which is practically deficient in fat cover, while at the other end is the "O" grade that has excess fat.

As a guide to our grading system, objective measurements on the cold carcase have been set down, relating to the depth of fat over the exposed surface of the eye muscle cut at the 12th rib. The plate shows the tie-up between marketing and grading with the potential use of the five types of carcases being shown. It should be stressed that these measurements are a basis for determining grades and other factors such as the evenness of fat cover will be taken into consideration. However, the setting of these objective measurements should aid the quest for uniformity in the application of grade standards. As you can see, to be acceptable for table use, the "T" grade beef would require some trimming while the "O" grade beef would require substantial trimming. One can visualse the waste involved in processing a carcase of the "O" type. Unfortunately, we have seen an increase in this type of beef produced in the Canterbury region this season.

The "P" and "L" beef, which will be practically similar in fat cover to the current Chiller and "FAQ" grades, will be further broekn up into two categories on the basis of conformation. This will be determined by the muscling of the hind leg which is evidenced by its shape or profile. The well-filled, well-muscled leg that one would expect from the traditional beef animal and the exotic breeds will be known as Conformation Class 1, while the legs with inferior muscling as evidenced by their straight or, in some cases, concave hind leg profiles that one would expect from dairy cross, will be classified as Class 2. The difference in the shape of the muscle in the rounds in quite marked. However, it should be noted that for carcases to qualify for the "P2" grade, their cuts, especially from the hindquarter, must be of such a quality that they can be packed with animals of the "P1" or "T" grades. The slide illustrates the difference between an L1 and an L2 steer hind.

Before getting you too confused, we will look at the relationship of the new grades to the present grades that you will be more familiar with. We, therefore, have seven grades or classifications replacing the current five grades. In effect, the current FAQ grade has been split up into two grades on the basis of conformation while the Chiller grade will have two conformation classes enabling the producer of high-yielding beef to be adequately rewarded.

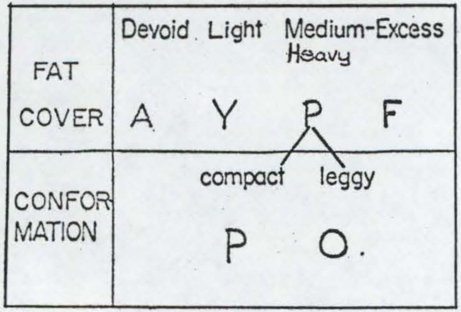
The next plate shows the various weight ranges that the seven grades of steers and heifers are broken up into for schedule payment purposes. For the "L", "P" and "T" grades, carcases are divided into four weight ranges while the "M" grade is divided only into two, namely, up to 140 kg and 140.5, and above. It is hoped that some time in the near future when all companies have the necessary electronic processing facilities, that weight ranges for schedule payment can be done away with to reduce the variation in return where an animal falls at the margin of a weight range.

With respect to cows, the "L" and "M" fat covers are combined as, from a marketing viewpoint, we have no market for lean cow cuts. We, therefore, have only five cow grades.

Finally, for bull there is no subdivision of the carcases on the basis of fat cover or conformation, with bull carcases being simply broken up into three weight ranges.

In summary, although this has no doubt left you in a state of confusion which I would sooner ascribe to my incompetency than to the complexity of the new grading system, it is believed that we will have a grading system that will not only ensure a degree of equity for producers but will also aid in the orderly marketing of our meat in the overseas marketplace. I am sure that these grade changes will not be the last that you will see, simply because grading must change as people's tastes change and new markets are opened up. While we would hope that our grading system is flexible enough to cover foreseeable requirements, it is likely that marginal changes may have to be made in the future as new markets develop or science and technology discover new ways of objectively classifying carcases.

LAMB

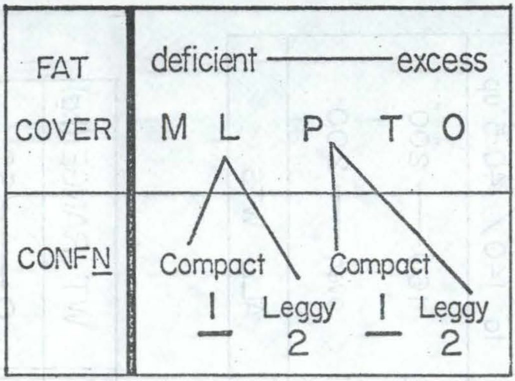


LAMB (kg)	A	Y	P	O	F
80– 12·5	A	YL	PL	OL	
13·0– 16·0		YM	PM	OM	F
16·5– 25·5		YH	PH		

EWE

kg				
to 22·0		EX	EL	
22·5– 26·0	MM		EM	FM
26·5– 30·0			EH1	
30·5– 36·0			EH2	

kg	WETHER		HOGGET		RAM
to 22·0	WX	WL	HX	HL	
22·5– 26·0		WM		HM	R
26·5– 30·0		WH1			
30·5– 36·0		WH2			



AS FROM OCTOBER

SYMBOL	FAT THICKNESS (M M)	POTENTIAL USE
M	1	processing
L	1–3	lean cuts or processing
P	4–12	prime export cuts
T	13–18	cuts after trimming
O	over 18	cuts after substantial trimming

NEW GRADE	PRESENT GRADE
M	manufacturing
L 1	FAQ: well muscled
L 2	FAQ
P 1	chiller or GAQ 1
P 2	GAQ medium muscled
T	GAQ: overfat type
O	trimmer

STEER & HEIFER

FAT	CONF.	WT RANGES (kg)
M	—	to 140 / 140·5 up
L	1	160 — 220
	2	220·5 — 270
P	1	270·5 — 340
	2	over 340
T	—	
O	—	ALL WTS

COW

FAT	CONF.	WT RANGES (kg)
M	—	to 140 / 140·5 up
P	1	160 — 200
	2	
T	—	over — 200
O	—	ALL WTS

BULL

	ALL FAT LEVELS
	ALL CONFORMATIONS
kg	to 160
	160·5 — 260
	over — 260

VEAL

Fat Level	WT RANGE (kg)
M	0 — 60
L	60·5 — 115
P	115·5 — 160

BIG BALE HAY-HANDLING SYSTEMS

MR J.S. DUNN

PRINCIPAL RESEARCH OFFICER
N.Z.A.E.I.

Two new shapes have appeared on the rural scene in the past few months and there is little doubt that they will soon become an everyday part of the farming pattern. A rectangular bale 5 ft square and 8 ft long with a slightly round top is made by the Howard Big Baler from England. A round bale 5 ft wide and almost 6 ft in diameter is made by the Hesston 5600 "Rounder" baler from the U.S.A.

Both machines have been used by the N.Z.A.E.I. in a range of crops and the comments which follow are a summary of our experiences to date.

THE PRESENT POSITION

The conventional baler has been developed over the past 35 years until it is now a most efficient machine but unfortunately the package it produces cannot be housed and subsequently fed out without a considerable amount of physical effort. This is still acceptable where bale numbers are low but the growth of larger holdings with bigger herds and mobs, together with increased labours costs and a decrease in labour availability, makes it quite unacceptable under these conditions. The development of a larger package with full mechanical handling at all stages is imperative.

It is estimated that making and housing the present annual hay crop of four million tons costs New Zealand upwards of $30,000,000, and this is for convenience only and adds nothing to the feed value of the crop. A further charge is incurred when the bales are fed out.

Harvesting aids in many forms have appeared in recent years but none of them has adequately fulfilled farmers' requirements. The N.Z.A.E.I. considered the many systems in use throughout the world in 1972 and compiled a list of the criteria which the ideal system should possess:

1. The system should preferably be workable by one man.
2. It should not be unduly expensive in outlay.
3. The unit it produces should be:

   (a) Uniform and compact.
   (b) Moveable by a normal tractor loader.
   (c) Stackable.
   (d) Saleable.

4. The unit should be easy to feed out in large or small amounts.

When the appraisal was made only one machine appeared to fulfill most of these requirements - the Big Baler developed by two Gloucestershire farmers in England and in limited prototype production by Howard Rotavators Ltd. One of these first 50 machines was imported by the N.Z.A.E.I. and over 500 big bales were made in a range of hays and straws between January and April 1974. A further 500 bales were made in the 1974/75 season.

About this time Verneer in the U.S.A. introduced the big round baler and several other manufacturers there were quick to follow with their own versions made under licence. These were really an overgrown and simplified version of the Allis Chalmers Rotobaler introduced 30 years earlier. They gained immediate acceptance in America and when seven Hesston "Rounder" machines were imported into New Zealand in 1974, it was decided one should be purchased to assess its performance here and at the same time provide a comparison with the Howard machine.

COMMENTS

1. HOWARD BIG BALER

The machine is towed in line behind the tractor and the swath is straddled. A conventional pick-up lifts the swath so that it can be gathered by packing fingers and fed behind an oscillating gate. Three twines are laid across the throat of the bale chamber and these are carried into the chamber as the hay accummulates. The material is packed in vertical layers as in a sliced loaf of bread and each consists of a number of individual mouthfuls gathered by the packing fingers.

As the bale develops, pressure in the chamber is indicated on a gauge on the front face of the baler. This is actuated through a hydraulic line from a pressure pad on the rear gate.

At a chosen reading the operator stops his forward travel, after completing the last slice at the front of the bale, and when the pick-up is clear he trips the knotters. At the end of the knotting cycle, latches on the rear gate automatically open and allow the gate to hang free.

Forward travel is resumed after this momentary halt which is normally of three seconds' duration. As a new bale is formed, the tied bale is slowly pushed rearwards until it makes contact with the ground and slides out. This allows the hinged gate, which has been pushed into a horizontal position, to swing down and relatch itself.

A Leyland 270 tractor (57 h.p. on the p.t.o.) was used for most of the work and it handled the job comfortably. The baler weights 2½ tons empty and was normally run at 6 m.p.h.

Crop Presentation

The windrow should occupy the full width of the baler's pick-ups and be of a uniform thickness. Any windrowing machine which will do this is acceptable. A Vicon Sprinter rotary type was used in most crops but an additional hole for adjusting the tine angles was drilled mid-way between the spreading and windrowing positions to give a five to six feet wide windrow.

The narrow roped windrow so often produced by finger wheel rakes leads to uneven feeding and may force the twine out of position. A good driver with a finger wheel rake can place two swaths together to give an acceptable, although not the best, performance. A finger wheel rake is quite acceptable in straw.

To prevent twine chafing, it is advisable to work on a full windrow at all times and form the bale as quickly as possible.

Moisture Content

Meadow hay and straw were baled satisfactorily over a range of moistures. A lower density than that of the conventional small bale allows for good ventilation.

Lucerne was baled satisfactorily at a moisture content of 20% and less but troubles occurred at higher levels. The lifeless, shapeless material would not rise in the chamber and shapeless bales were formed. These occasionally fouled the bale chamber exit so that the rear gate failed to close cleanly. Knotting troubles were common under such conditions too.

Friction between the twine and damp lucerne was so high that the twine frequently pulled out of the retainers rather than feed through the needles and round the bale.

Canterbury farmers will often bale lucerne at moisture levels of 30% and above to prevent leaf loss. This would be impossible with the Big Baler but is hardly necessary as observed leaf loss at 20% and even down to 15% was low. The action of the baler is extremely gentle.

Twine and Knotters

The baler is fitted with heavy duty "Rasspe" knotters and although of conventional design, they proved temperamental at times. Various twines of U.K. and local manufacture were used; polypropylene was the main ingredient but some polythene was included to reduce friction. The eventual New Zealand product was somewhat stronger than that from the U.K. and performed as well.

Capacity and Rate of Work

The 5' x 5' x 8' bales weighed 850-900 lb in straw, 1,000-1,100 lb in meadow hay and 1,200-1,400 lb in lucerne, and were frequently produced at the rate of one every two minutes. On one occasion in oats and peas ten bales were made in 17 minutes, a rate of 35 bales or approximately 19 tons an hour.

Over the two seasons the machine made over 1,100 bales. No mechanical breakages occurred.

Loading

A gripper attachment supplied with the baler was fitted to a standard Jones loader on the Leyland 270 tractor. A counter-balance weight and carrying frame for attachment to the hydraulic lift arms were also supplied.

Hydraulic movement of one of the two parallel arms of the gripper was originally on the squeeze movement only and reopening of the arm relied on a return spring. This was often hesitant and a double-acting control was fitted for the second season's work.

The outfit proved excellent for handling the bales and these were stacked two high on vehicles and three high in barns or stacks. To form a more stable load or stack, bales on the bottom course were often rolled on their side before loading to present parallel faces top and bottom. Bales fitted neatly across the deck of vehicles and roping was unnecessary for on-farm transport. Three bales fitted comfortably between the piers of a 15' bay.

Bales could be loaded in the paddock at the rate of one a minute.

Feeding

Bales were easily and quickly recovered from a barn or stack using the gripper and were normally fed out from the deck of a trailer or truck. The bales came apart in the same manner in which they were formed and meadow hay separated into 5' wide rolls weighting 10-15 lb.

Although a Big bale is equivalent to perhaps 20 conventional bales, it was not necessary to feed out a whole bale at one time. After cutting the three strings and removing what was required, the strings could easily be retied by hand and the bale moved elsewhere.

No particular weather-proofing qualities are claimed for the Big bale and it relies on its high overall rate of baling and housing for its appeal. The manufacturers claim one man can bale, load, cart and stack 50 tons of hay in a 10 hour day and our work has shown this to be so.

Figure 1

Fig. 1: Hesston Rounder baler discharging completed bale.

Figure 2

Fig. 2: Howard Big baler and bale.

2. HESSTON "ROUNDER"

The bale is formed as the windrow is rolled up between a wide platform belt and a set of 9 narrow upper belts. Material is lifted into the machine by a conventional pick-up as the baler and towing tractor straddle the windrow. Bale width is 5' but the diameter can be varied from 2½ to almost 6' and this is indicated by a pointer during the rolling process.

At the required diameter, the operator draws a twine tube across the pick-up so that a loose end of twine is entrained with the last wrap of material. Forward movement of the tractor is then stopped. By slowly releasing the control rope on the twine tube, with the bale still rotating, the bale is bound 10 or 12 times. The twine is cut at this stage and the loose ends left free. No knotters are fitted.

To eject the completed bale the tailgate is lifted hydraulically and the platform belt drive engaged. The tailgate must be closed before moving forward to start the next bale.

The baler weighs just under 2 tons and was operated for most of the season with an I.H.C. 674 tractor (59 h.p. on the p.t.o.). The high capacity hydraulic pump of this tractor (more than 10 g.p.m.) showed to advantage when opening and closing the tailgate. Gate operation was much slower with a Fiat 615 due to a lower pump capacity but this tractor also operated the baler quite satisfactorily.

Crop Presentation

Any windrow width could be accommodated but it was important that it be of a uniform cross-section. The tractor was driven from side to side of the windrow to ensure even feeding into the belts and to form firm edges to the bales.

Moisture Content

Hay and straw were handled satisfactorily over a normal range of moistures but lucerne had to be fit or several difficulties could occur. Sometimes the swath would pass through the baler without rolling or material might wrap around the pressure roller. If rolling did start, it was sometimes impossible to complete the bale because friction between the bale and the chamber walls was sufficient to stop the bale from turning.

Some leaf loss was observed during the baling process but no attempt was made to measure the amount of this or compare it with that of a conventional baler under the same conditions.

Bale density was higher than that of a conventional bale and hay would have to be fit to prevent heating, although no evidence of this was seen.

Twine

Standardised baler twine was used to begin with to conform to the manufacturer's recommendations but later it was found that light-grade sisal worked justed as well. If a particularly heavy bale was dropped, the light-grade twine sometimes snapped on one wrap but the other wraps would hold and the bale did not come undone. A few bales were made and discharged without twine but were unsatisfactory when handled.

Capacity

Under good conditions with the I.H.C. 674 tractor, a bale was produced in 2 minutes. Bales were a little heavier than those from the Howard; in barley they weighed 1,075-1,125 lb and in lucerne 1,375-1,450 lb.

Loading, Transport and Stacking

The Howard gripper handled the round bales satisfactorily and they could be stacked on end or on their side. A Hough industrial loader was also used by a local contractor to handle normal bales of ryegrass straw. The rate of loading was the same as that with square bales.

Although for outdoor storage, stacking is not advocated; bales have been stacked on their side three high without any problems from rolling.

Weather-Proofing

Tightly tied uniform bales on their side appear to be weather-proof provided their ends are not exposed to the prevailing wind. Barley straw was in sound condition after four months exposure and almost 16" of rain. Only an inch of straw showed signs of weathering. Rain ran off the bales at their widest part and did not track along the underside. The soil on which the bales lay was quite dry. Adjacent bales should be set about a foot apart.

Feeding

Round bales are frequently fed whole to cattle in the U.S.A. and apart from a simple two-pronged tractor-mounted carrier, no other equipment is required. However, where any degree of rationing is practised, the need to spread the material thinly arises. A thick carpet can be produced merely by unrolling bales along the ground but few animals could gain access to the small area covered and wastage through treading and soiling would be high.

A mechanical unbaler has recently appeared in the U.S.A. and this shows promise of providing a true one-man feeding system. The bale is impaled on its longitudinal axis and rotated by a driven rubber rotor in line with the tractor. Hay may be spread as thinly or thickly as required either into racks or as a narrow swath on the ground. A North Island firm has gained the New Zealand agency and one of the first machines imported has been promised to the N.Z.A.E.I. for trials.

In the absence of such mechanical devices, enterprising farmers have evolved their own methods of feeding. Several place the bales end-on on their trailers and, after removing the twine, walk round the bale pushing off each layer in turn as though unrolling a carpet. One farmer who experienced trouble trying to feed very compact bales this way used a chainsaw to quarter the upright bales.

Comparative Twine Usage and Cost for 1 Ton of Hay Baled

(April-May 1975)
(Twine Prices)

Baler	Twine Type	No. of Bales Per Ton	Total Twine Length Meters	No. of Lengths	Cost Cents/Ton	Cost Cents/Bale
Conventional	Sisal	30	160	60	147	4.9
	Synthetic	30	160	60	106	3.4
Howard Big Baler	Polypropylene + Polythene	2	40	6	57.6	28.8
Hesston "Rounder"	Sisal (heavy)	2	144 (12 wraps)	2	132	66
			120 (10 wraps)		110	55
	Sisal (fine)	2	144 (12 wraps)	2	53.3	26.6
			120 (10 wraps)		44.4	22.2

CENTRE-PIVOT IRRIGATION

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The object of this paper is, firstly, to describe the central pivot system for those that are not familiar with it and, secondly, to discuss some of the applications and limitations of this method of irrigation.

One type of central pivot sprayline is shown in Figures 1 and 2. The sprayline is mounted on wheels and moves under its own power around a pivot turn, irrigating a circle of up to 100 ha. Water can be supplied to the pivot point in a number of ways. If the water is from a well, the most common method is to have the well at the pivot point and the pump driven either by a diesel engine or electric power. Where electric power is used, the power cable has to be buried underground from the edge of the circle to the pivot point.

If the water is from a river or some other source outside the area, it would be piped underground to the pivot point. It is also possible to take water to the pivot point in a canal and to pump directly from the canal to the sprayline. In this case small bridges have to be constructed over the canal to allow the wheels of the sprayline to cross. These wheels track in exactly the same place every time they get around, hence, a bridge such as a Railway sleeper across the canal would be adequate.

Three and four main types of central pivot spraylines on the world market today:

1. Electric drive with pipe supported by a truss.

2. Water drive with pipe supported by a truss.

3. Electric drive with pipe supported by cables from towers.

4. Water drive with pipe supported by cables from towers.

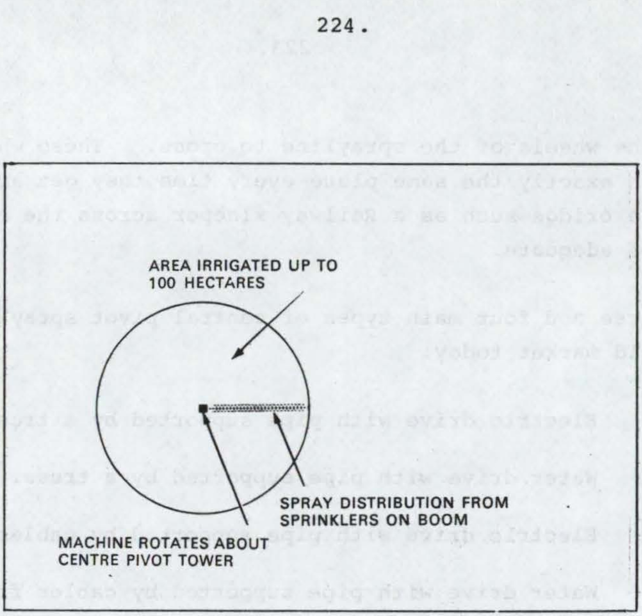
Figure 3 shows a water drive model with cable and tower support and Figure 4 an electric drive model with the truss support. The electric drive with truss support is the most expensive of the alternatives and the water drive with tower support the cheapest.

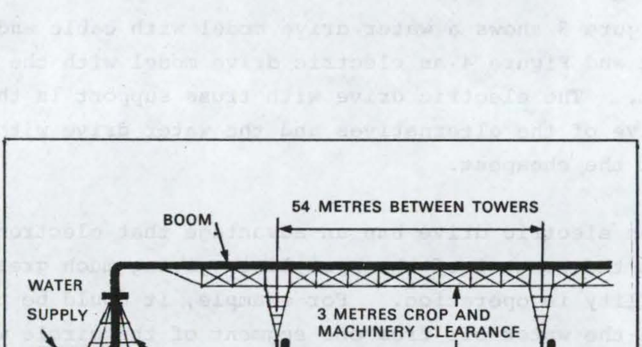
The electric drive has an advantage that electronics can be used in the control of the sprayline, giving much greater flexibility in operation. For example, it could be programmed to turn the water off from one segment of the circle where a different crop may be growing and to recommence irrigating when it has travelled over that segment. Maintenance is probably lower with electric models, however, when maintenance is required, a skilled electrician is usually needed.

The water driven models are simpler and most maintenance can be done by the farmer.

<u>ADVANTAGES</u>

The most obvious advantage is the very low labour content required to irrigate an area. They start at the press of a button and the only other labour required is for maintenance.


AREA IRRIGATED UP TO
100 HECTARES
SPRAY DISTRIBUTION FROM
SPRINKLERS ON BOOM
MACHINE ROTATES ABOUT
CENTRE PIVOT TOWER


54 METRES BETWEEN TOWERS
BOOM
WATER
SUPPLY
3 METRES CROP AND
MACHINERY CLEARANCE
PIVOT TOWER
GROUND LEVEL
DRIVE WHEELS

They irrigate by applying small frequent applications. Most spraylines will do one revolution in 12 hrs, however, it is more usual to set them so that they take one or two days to do one revolution. This means that in Canterbury, which has a peak evapotranspiration of about 3 mm per day, the machine could be set to apply 3 mm each day. In this way the soil can be kept at the moisture that gives maximum plant growth.

Application of water is more even than with conventional spraylines. This is because the continuously moving sprayline tends to even out the effect of wind on the sprinklers.

Tall crops such as maize can be irrigated by this method whereas they are difficult to irrigate with normal spraylines.

Bogging of the wheels is not a problem on most soil types. I have heard that on some problem soils in Texas, U.S.A., the wheels created deeper and deeper ruts, and finally ground to a halt, but this is not a common occurrence.

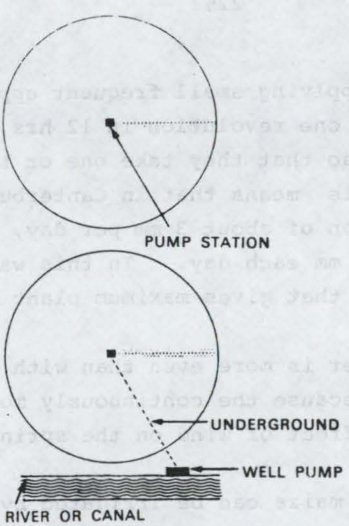
The system will handle relatively undulating ground, especially the truss type, which has more flexibility in the joints between the trusses.

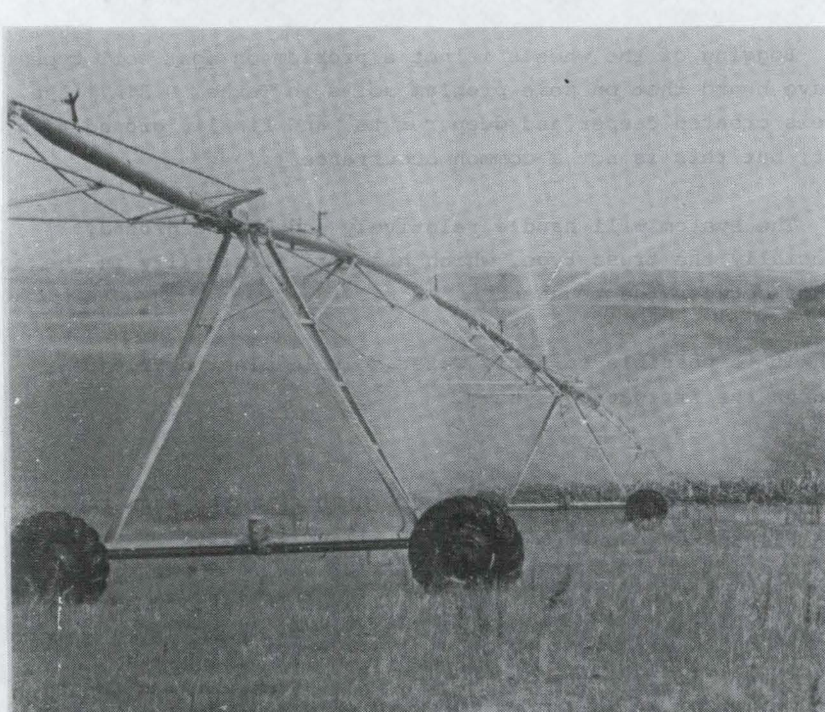
It is possible to apply water soluble plant nutrients through the irrigation system.

LIMITATIONS

The spraylines irrigate a circle which means that there will be corners of every farm that will miss out on irrigation. In the simplest case with a 402.9 m (20 chain) sprayline, irrigating a 809 m square paddock, 21% of the area would not be irrigated.

This percentage can be improved with some models that have a large "gun" nozzle at the end of the sprayline which is programmed to switch on when the end of the sprayline is at a


PUMP STATION
UNDERGROUND PIPELINE
WELL PUMP
RIVER OR CANAL

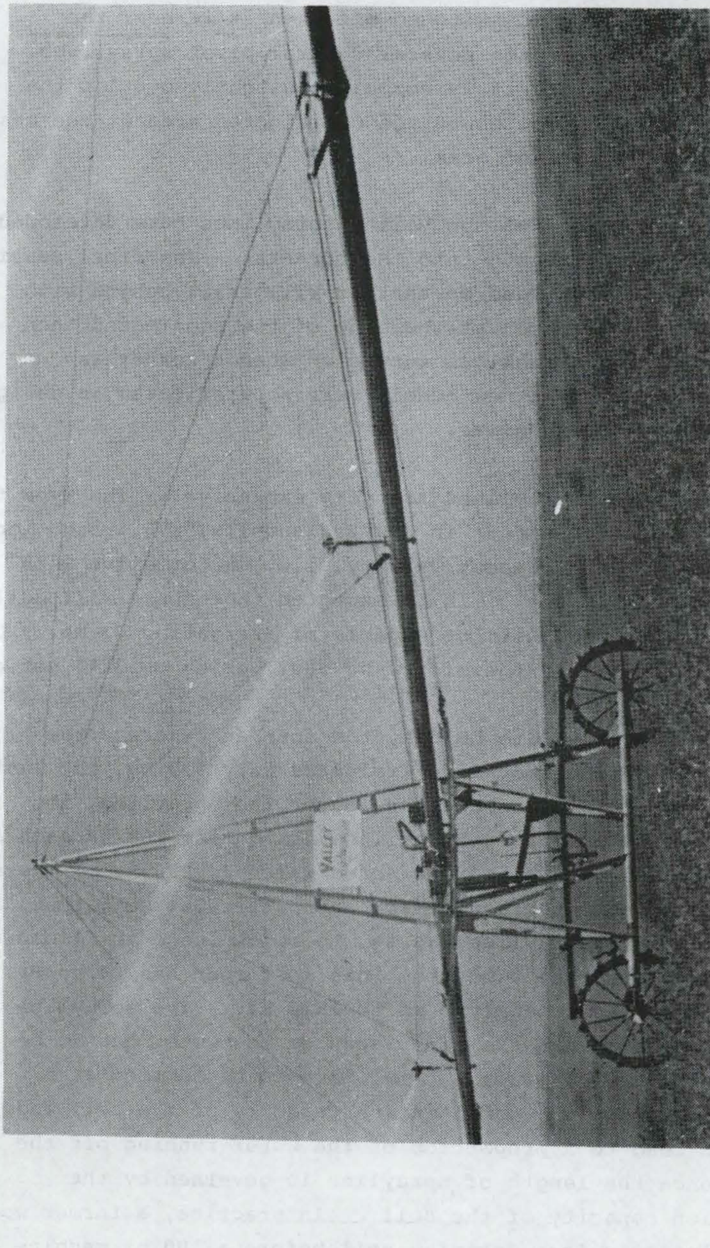


corner of the square and switched off when it is near the side of the square. When several central pivot spraylines are installed together, it is normal to slightly overlap the circles. This also decreases the unirrigated area at the cost of a small over-irrigated area.

The manufacturers of the Valley spraylines have developed a model that will irrigate into the corners. The final section of the sprayline is hinged so that it will trail behind with the water turned off when at the side of the square and then swing out with the sprinklers turned on when a corner is approached. This is a new model, very sophisticated in design and naturally very expensive.

Central pivot spraylines are very expensive. The type that will be the first to appear in New Zealand (1975/76 irrigation season) will be the cheapest variety, i.e., water drive with tower and cable support. It is expected that these will sell for about $44,000 and will be capable of irrigating 73 ha. Cost of the sprayline will, therefore, be $602 per ha or $244 per ac.

These spraylines are held by the span and whereas the first span in a nine span line irrigates only 0.9 ha, the last span irrigates 15.6 ha, hence the longer the sprayline, the cheaper the cost per ha. Spraylines irrigating 100 ha each are quite common and I have heard of ones which do 200 ha. There is, however, a limit to the length for any particular soil type. For example, if a sprayline was set to rotate once in 24 hours and apply 3 mm in that time, the innermost span has 24 hours. The ninth span has to apply 3 mm to 15.6 ha. The sprayline is moving a lot faster at the ninth span so the water has to be applied quicker. In fact, it may have to be applied at a rate which exceeds the infiltration capacity of the soil and this would lead to a proportion of the water running off the area. Hence the length of sprayline is governed by the infiltration capacity of the soil. In practice, a farmer would need a relatively free-draining soil before a 100 ha machine could be installed.


VALLEY

PRODUCTION OF BERRY FRUIT ON A FARM SCALE

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Berry fruit and apples are normally considered to be horticultural crops. They require intensive management and a high labour input. Holdings growing such crops are relatively small and are usually sited adjacent to populated areas on which they rely for the necessary labour force at harvest.

However, as a result of work by the N.Z.A.E.I. during the past six years blackcurrants are now being mechanically harvested on a commercial scale, quality raspberries have been harvested by development, and prototype machines in 1973 and 1974 and an apple harvesting system is showing considerable promise. Such developments will effect considerable changes in our thinking about these crops and could well bring them into the sphere of agriculture.

THE PRESENT POSITION

Recent increases in labour costs and a decreasing labour force have caused concern to many fruit growers. Those producing the smaller berried fruits are particularly vulnerable to such changes and, within the last year, it was reported that more than half the raspberry acreage in South Canterbury was being pulled out. This is understandable when it is realised that in harvesting one acre of raspberries, with a yield of five tons, upwards of one and quarter million berries must be picked. Ripe fruit will not wait and quality deteriorates rapidly if picking is delayed only one or two days.

Without mechanisation of the harvest, it is quite conceivable that some fruits could disappear from our markets. The cool winters and high sunshine hours of much of New Zealand provide favourable conditions for quality fruit production and it would be ludicrous for these to be lost because there was no alternative to hand picking.

RESULTS OF MECHANISATION

Present holdings growing currants and raspberries are generally too small to justify sole ownership of a harvester ($10 to 15,000), although syndicates or the use of a contractor service are possible solutions. The limited harvesting period with currants and more particularly raspberries and the need to pick at two to four day intervals, however, do not give much latitude for moving between small properties. Full utilisation can only come from large areas, long rows and the minimum of time spent travelling.

With the advent of mechanical harvesting, the grower is freed from the need to have a large labour force on his doorstep. Crops can be grown on lower cost land perhaps remote from centres of population.

The export potential for berry fruit has often been discussed but markets have been erratic from year to year and in the main opportunist. With raspberries most fruit has been bulk packed and of process quality only. It is difficult to ensure a continuity of supply and a uniform standard of quality with numerous small and often part-time growers. Fewer and larger growers producing a quality free-flow product in large enough parcels may find new markets opening up and overseas buyers more willing to enter into long-term contracts.

N.Z.A.E.I. DEVELOPMENTS

Blackcurrants

In 1969 the Horticultural Research Centre at Levin requested the help of the N.Z.A.E.I. in designing a complete harvester for blackcurrants. Instead of growing canes in bush form with plants 4 to 5 ft apart in 8 or 9 ft rows, they had developed a hedgerow system using cuttings inserted at a 6 to 12" interval. At this close planting all the canes grow vertically. A uniform shake could be imparted to such canes and ripe fruit removed.

Over a period of four seasons, the N.Z.A.E.I. developed an effective self-propelled harvester and this is now being produced commercially by Peco Ltd in Christchurch. In work the machine straddles a row of canes which are parted into two streams and individually vibrated by a pair of horizontal finger wheels mounted on near-vertical square driving shafts. The two balanced vibrator units are positively driven and have a lower power requirement. Their design is the subject of an N.Z.A.E.I. patent. The amplitude and frequency of the heads can be simply and quickly adjusted to effect selective harvesting of the ripe fruit only.

Detached fruit is received by a flat belt conveyor on each side of the machine and delivered by flighted elevators to two small trailers drawn by the harvester on each side of the row. A ducted air blast system removes leaves as the fruit drops in cartons on the trailers.

Rate of harvesting depends largely on the density of the crop and the amount of ripe fruit. On bushes in their second year of cropping, 1½ tons of fruit have been picked in two hours. Two or three passes of the harvester at intervals of several days are normally required to clear a crop completely. In addition to the driver, one operator is required on each trailer to replace filled cartons. Fruit quality is of a higher standard than that picked by hand.

Raspberries

All raspberry harvesters rely on cane vibration for fruit removal but it is unlikely that they will ever produce an acceptable sample of fruit if the natural upright habit of the raspberry cane is maintained as at present.

Variations in the height and density of new cane growth and in the relative positioning of fruiting and new canes makes it impossible to impose a uniform shake on each berry. A shake of sufficient strength to remove ripe berries on exposed canes will not be strong enough in areas of dense new growth. Yet a stronger shake to overcome such cushioning will be severe enough to remove unripe berries in exposed areas.

In effecting a compromise some ripe fruit will be left and and some unripe fruit will be removed. The result is not only loss in yield and contamination of the sample with green and stalked berries, but contamination of the following pick with over-ripe or moulded fruit.

With the large number of vibrator fingers, which have been built into raspberry harvesters in the past, to penetrate the mass of fruiting and new canes, some damaging contact between the fingers and the berries is inevitable. Other berries falling from the upper part of the canes, even if not struck by the vibrating fingers, will reach a damaging velocity before they are arrested on the conveyors three or four feet below.

Agitation of the tender growth on the new canes during harvest frequently causes damage and although this has not been measured, the cropping potential of the following year could be reduced.

To overcome these problems, the N.Z.A.E.I. began looking at mechanised methods of harvesting raspberries in 1971 following requests from the Ministry of Agriculture and a number of growers. Eventually a canopy system of growing was entered into which

Figure 3

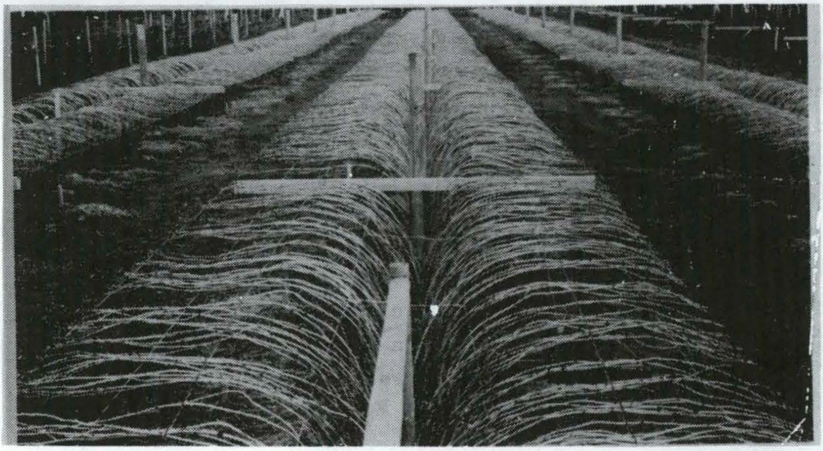

Fig. 3: Lincoln canopy system of growing, August 1973. Developed by N.Z.A.E.I. for mechanical harvesting studies on raspberries.

Figure 4

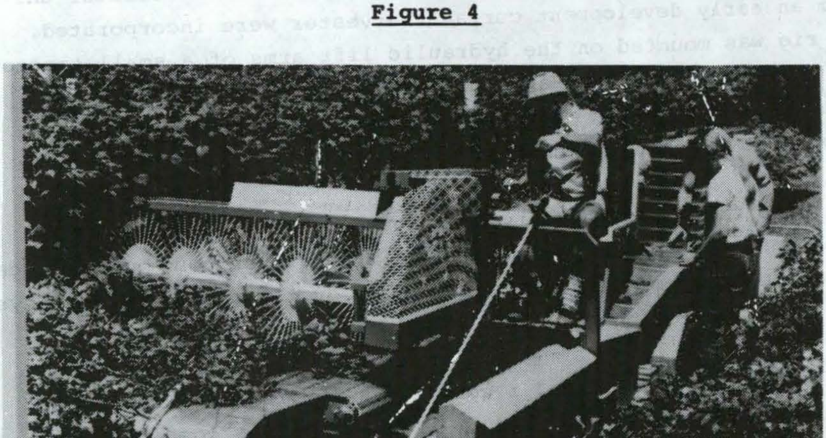

Fig. 4: N.Z.A.E.I. self-propelled raspberry harvester working on Lincoln trained canes, December 1974.

the fruiting canes and the new growth were separated.

In an existing crop of Marcy raspberries growing in 8 ft rows alternative rows were removed. Simple 10 ft wide "T" frames were erected at 33 ft intervals in the rows remaining and the canes trained on to horizontal wires on the frames to form canopies and 10 ft wide Polypropylene twine was used to hold the canes down.

New canes which grow up between the two arms of the canopy during the summer were supported vertically in the normal manner. Trickle irrigation was installed on each row and a regular watering programme adopted to ensure the plants were never subjected to stress.

During the 1973 harvest a simple rig using four vertical finger wheels mounted on a horizontal shaft carried at right angles to the row was used to vibrate the canes. Vibrator units from an early development currant harvester were incorporated. The rig was mounted on the hydraulic lift arms of a small tractor and powered by a 4 h.p. air-cooled petrol engine. Fruit was collected in trays on an angle arm frame built out from the rig to project beneath the canopy.

Ripe fruit was selectively removed and the quality was excellent. A rate of harvesting of 1,800 lb an hour was recorded. Harvesting was completed in three picks over a period of ten days. A rate of harvesting of 1,800 lb an hour was recorded.

With this experience, a complete self-propelled harvester was built for the 1974 harvest. The season was completed with little or no modification and a very good sample was again produced. Some fruit was sent direct from the harvester to a Riccarton Mall supermarket and sold readily without further sorting. Following a particularly wet winter and spring, more trash was removed than in the previous year and provision for only two sorters restricted throughout to a rate of 800 lb an hour. Increased facilities will be provided for next season should it again be needed.

Fruit was delivered into plastic kilogram punnets which were carried in sixes in trays which stacked compactly into magazines holding eleven trays. A small trailer drawn at the rear of the harvester accommodated three magazines.

The canopy crop of Marcy yielded approximately five tons of harvested fruit and four passes over a period of eleven days were required to clear the canes.

Four new North American raspberry varieties being grown on the canopy system by the Horticultural Department of Lincoln College were harvested during December/January 1974/1975 and showed excellent promise, their berries are firmer and denser than Marcy and seem ideally suited to mechanical removal.

Apples

Despite a larger fruit unit than with either currants or raspberries, a good crop (2,000 bushels/acre) will still require the collection of 300,000 apples an acre. In most orchards a proportion of the fruit must be gathered from a height well above normal reach.

Initial N.Z.A.E.I. mechanisation studies considered the use of access platforms to place pickers in a tree's fruiting zone. However, overseas work has shown their use led to little increase in picking rate per man and the cost of such platforms could not be justified. The aim then became to harvest fruit in an undamaged condition without the need to handle individual apples at all.

Mechanical removal of apples is possible using conventional tree shakers but the resulting damage is severe as the fruit strikes projections, branches and other apples as it falls from a

Figure 5

Fig. 5: Lincoln canopy growing apple trees for mechanical harvesting.

conventional tree.

However, it was considered that if a tree could be grown with all its branches in a simple plane, fruit might be detached and caught without striking any obstruction or being struck itself. This is in fact what was attempted.

A row of 54 Hawkes Bay Red Delicious trees on MM106 stock was trained so that all the branches lay in a single horizontal plane. They had started life as centre leader trees and were three years old when the change was made in 1971. The canopy was developed on large mesh sheep netting supported horizontally on wooden "T" frames 8 ft wide and 5 ft high erected at 50 ft intervals along the row.

The 1973/74 season was the first in which any attempt at mechanical harvesting could be made and pneumatic impacters were constructed and tried in March 1974. However, during their development a much quicker and simpler method was found. By grasping the supporting netting by hand and shaking it laterally, the entire fruit load of a tree could be removed in seconds. Twelve shakes in five seconds with an amplitude of about 10" have normally been sufficient to remove all apples from one and sometimes two trees. As many as 250 apples have been removed at a time.

For the 1975 harvest, two 21 ft long trailers were built so that each could carry four apple bins. They were offset on their tractors so as to run beneath each half of the canopy. A padded collecting head and retractable cascades were carried on a light superstructure above each trailer so that falling apples were caught and delivered directly but gently into the bins.

The system requires further development before it can be considered a commercial proposition but it shows considerable promise. Yield has been comparable with that of three adjacent rows of similar trees pruned along conventional lines and damage has not been so great as to be discouraging.

IN CONCLUSION

Recent advances in mechanical harvesting techniques may bring the scale of growing some fruit within the scope of agriculture, but the overall effect on our farming pattern is likely to be small as the acreages involved will not be great. Yields of well grown crops are high and the markets within New Zealand are limited.

However, the production of larger and more predictable quantities of quality fruit which mechanisation could bring may result in the establishment of new and more reliable markets overseas. This is particularly so for raspberries and blackcurrants.