OUR COVER

In the garden of an early homestead the Chinese gardener picks sweet brier for the runholder's wife.
SOME FACTORS AFFECTING LAMBING PERCENTAGES

WHY BIGGER EWES MEAN MORE LAMBS, MORE WOOL

J. G. Hughes

Management Officer

I suspect that many runholders are inclined to accept the lambing percentages that they usually get, with the ups and downs from year to year due to the effect of season on stock and pasture. I am convinced that the heart and soul of better flock production or income on any run is tied up with or is reflected in getting lambing percentages as high as possible.

By this I do not mean a greatly increased number of twins. Under free-range conditions we tend to have a higher death rate with twins and they grow into smaller hoggets. In any case where there is regularly a big percentage of twins produced, the property is often so developed that it can cope with them. What I think is important is that we should aim to get as many ewes possible having lambs, even if only single lambs, by increasing the chances of a ewe conceiving and making sure that she can bear and rear her offspring.

Higher percentages—more to cull from

Having more lambs of course means that there are more to sell—either as fats or stores—in the autumn, but what is more important is that there is a greater number to choose from when it comes to culling. Since the proportion of ewes in a flock is probably fairly constant the more sheep there are to choose from, the better will be the ones retained for replacements—better for conformation and better for wool. And better replacements provide the basis for higher total production from the flock through less variation in the clip, higher average fleece weight, lower death rate, better sale value and better lambing and weaning percentages. All these, except the variation in wool, are linked to the liveweight of the animal; especially is this the case with the lambing percentage.
Fine-woolled compared with paddock sheep

Until quite recently, practically nothing was known about the background to the performance of high-country sheep. But lately useful work has been put in hand, by Dr I. E. Coop and his research team at Lincoln College (supported financially by the Institute) and by the Department of Agriculture, at Tara Hills Research Station near Oamaru. The Institute is very keen to see this kind of work stepped up to match in quality and quantity that being done in the field of soils and pastures. Although still in its infancy, this new research work has shown broadly that the principles of animal production which guide the management of sheep in other environments, also apply to sheep in the high country. In most cases experiments with animals must be carried out on a long-term basis if we are to produce accurate findings, but detailed results will be published as soon as they are available.

There are considerable differences between the various breeds of sheep as regards fertility (the ability of a ewe to conceive) and fecundity (the number of young produced). The Border Leicester, for example, has both high fertility and fecundity. In the Lincoln College studs over the long period for which records have been kept, the Border Leicester has averaged a lambing percentage 15 per cent more than the Romney and 30 per cent more than the Corriedale. The average Merino, on the other hand, has relatively low fertility and fecundity, even under improved conditions. But there are Merino flocks in Australia with lambings of 120 per cent and at least one high-country Merino flock in New Zealand has produced more than 100 per cent of lambs.

**Fertility and breeding**

Within breeds there are strains of superior fertility and even though fertility is a characteristic poorly inherited in sheep this is a point to watch, in addition to wool, when selecting rams. Improvement of the fertility of the flock through the ram, however, can still be faster than through ewe selection and this applies even assuming that dry ewes are removed from the flock.

Rams should show that, besides being able to leave large numbers of lambs, they can sire ewe progeny which conceive readily, are of the right conformation for bearing lambs, are good milk producers, and leave progeny which are open-faced.

**Open face and fertility**

At Lincoln and Ruakura, considerable differences in fertility, leading up to a 15 per cent difference in lambing have been found between open-faced and woolly-faced ewes.
and, contrary to popular opinion, the woolly-faced ones clipped only about one quarter of a pound more wool. The increase with selection for open-faces was found to be due to having fewer barren ewes, more lambs born per ewe and fewer lambs dying. At weaning, lambs from open-faced ewes were heavier. Within a flock, covered-faced sheep are generally lighter than the open-faced ones and, of course, are more often affected by wool blindness. In addition the woolly-legged sheep, rather than benefit from the protection of his legs from the cold, is more prone to get bound up with snow and ice. There is no reason at all why the woolly-faced sheep should have any better constitution than the other—rather the contrary. Fortunately the heritability of open-face and bare-point characteristics is high.

Good milk production is another asset which can be inherited and it is also influenced by the liveweight of the ewe.

**Time of tupping**

An important point is that different breeds have different periods when the ewes are producing the greatest number of eggs ready to be fertilised. Ewes produce these eggs towards the end of their heat period. Thus, at some point in her breeding season, a ewe has, other things being equal, the greatest chance of conception and, although this varies somewhat from one individual to another, each breed has its peak period with the peak being more pronounced in some breeds than in others. For Merinos, half-breds and Corriedales the peak of production of eggs is thought to be about the end of March or early April but no work has yet been done on this in the run country.

**Feeding through the year**

There are two very important periods in the ewe’s year, the period from weaning until successful mating (the autumn period) and the period from a month or so before lambing until the lamb is marked (the spring period). Summer, from marking to the weaning of the lamb, is certainly important to lamb growth and later thrift, but by this time the chances of survival are good. The winter period, from mating to the month or so before lambing, is of much less importance than the other three from the point of view of lamb production.

For many years it was considered that the best conditions under which a ewe could be got in lamb were when she was put on short commons after weaning and kept in store condition until two or three weeks before mating. The diet was then boosted, she put on condition at a rapid rate, and was said to be “flushed” and ready to conceive when the ram was introduced. Only a few years ago Dr Wallace,
now Director of Ruakura Animal Research Station, realised that ewes which had received this treatment did not conceive nearly as readily as those which had been kept on good rations from weaning onwards and even allowed to become quite fat. These ewes, fed on a medium to high plane of nutrition after weaning, reflected their better conception rate in the much higher number of lambs born to them. Dr Wallace's increase of 20 per cent has been confirmed elsewhere. In addition to this, the ewes fed on a higher plane for this period produced almost one pound of wool more than the poorly-fed ewes.

**Fat ewes conceive more successfully than thin ones**

One of the principal deductions from this result was that the old bogey that fat ewes were usually infertile could well be explained in another way. Since the ewe which had not reared a lamb was likely to be in much better condition in late summer than her wet sister, the assumption had been made that store condition was better than fat condition for mating. But it has been shown now that if the wet ewe is brought up to similar condition to the fat dry one, it has a much better chance of getting in lamb. The dry ewe is not dry because she is fat; she is fat because she is dry and should be in good shape to overcome her temporary infertility and conceive if given the chance again.

**The truth about flushing**

The practice of flushing reaches back centuries and certainly it has meant increased lambing percentages. Recent research work in New Zealand produced the following conclusions:

That flushing itself did not reduce the proportion of dry ewes.

That it could, to some extent, make lambing more spread out.

That it did give a very marked increase in eggs shed (though not to a higher level than that of ewes already fat).

That it led to the production of more twins and thus to a higher lambing percentage (even up to 30 per cent higher than for unflushed ewes).

But it is now reasoned that a large part of the increased ovulation and increased lambing due to flushing has been due to the ewes having a higher liveweight at mating because of it. There are other factors at work too, but this effect of higher liveweight is specially important. It supports the contention on sheep fertility that **liveweight of the ewe at mating is the most important single factor determining whether that ewe produces a lamb or not.**
Weight of ewe at tupping affects lambing percentage

Experiments with Corriedales on light-plains land at Lincoln showed that below a liveweight of about 90 pounds the chances of a ewe being barren increase rapidly the lower her liveweight was at mating. Above a liveweight of 100 pounds the chances of a Corriedale ewe being barren, although small, did not fall very much more if her weight increased further. Thus the ewe had to be of at least 90 pounds liveweight at mating to have a very good chance of conceiving a lamb. (The number of run ewes which are over 90 pounds is not very high—but most are well below it.) It was also shown that it was not until the ewe was above 90 pounds that significant numbers of twins were produced.

Liveweight and milk production

As liveweight increases (and the number of twins anticipated) so does milk production. The big ewe is generally a better milker and thus better able to handle twins.

Further work indicates that the lower breeding performance of two-tooth ewes is due more to lower liveweight than to anything else.

Liveweight and wool

Ewes of bigger liveweight also produce more wool and it is generally found that there is one half to two thirds of a pound increase in the wool clip for each 10 pounds increase in the body weight of a ewe.

Better survival

Another fact associated with higher body weight is that the stronger ewe is more likely to survive a hard winter. Of course a well-fed but naturally-small ewe is just as likely to survive as a well-fed bigger ewe, but if frame size is the same and level of feeding causes the difference in weight, one could confidently expect the better-fed ewe to have a better chance of survival.

Maintain condition

On grazing runs, ewes after weaning are put out on the summer country, often with the wethers. If there is not sufficient feed for all, the need to keep the ewes well fed right through the autumn must be remembered, for reasons already given. Quite often, where there is careful management, the fall (autumn) muster brings in the ewes in forward condition. But they may be brought into paddocks or, at best, small holding blocks where a concentration of ewes on food of low quality and insufficient quantity cannot be kept in good condition for long. The ewes are drafted and redrafted, perhaps crutched, and then put on a hold-
ing block or direct to the tupping block to await the rams. One wonders how often ewes are kept in good condition during all this handling and shifting. But if better lambing percentages are aimed at, then ewes must not be allowed to fall away during the period from the muster until they are successfully mated. They should be in good, rising condition throughout. It is admitted, of course, that there still are risks of low inherited fertility, of physical restrictions to conception, of defective rams, and of bad weather at tupping but, apart from the last, the effects of these factors can be reduced by good husbandry.

It is just as important to have good early-autumn and autumn holding and tupping blocks as to have the good winter and early-spring blocks which have long been the hallmark of a desirable property.

From successful mating through to a few weeks before lambing the ewe is best kept on or near the so-called maintenance ration; and here we must recognise that bigger liveweight does mean more food intake. For instance, two trials have shown that a 10 per cent increase in liveweight needs about a seven per cent increase in food intake for maintenance.

The diet of the ewe must be increased from about a month before lambing is due to commence. There is danger in over supply which can result in a high percentage of single lambs too big to pass easily. On the other hand, too low a level of feeding causes death among twins and, carried to the extreme, losses with sleepy sickness. Skill in maintaining the happy balance is a mark of the successful flockmaster.

Anything between 10 and 20 per cent is not an unusual figure for losses of lambs at and soon after birth. Climate, the great unknown, is often the killer. Other than making full use of natural shelter or providing artificial shelter, one of the few forms of protection we have is to breed a big-framed, good-milking ewe and to keep her well nourished the better to protect her lamb.

An improved block is useful

The end of the winter is, of course, the bad time for feed, and lambing dates are governed by the time new growth starts on the hill. This is when a naturally early block, assisted by the introduction of clover and better grasses can be invaluable. It has been shown that such a block, regularly topdressed, will provide quality feed a month earlier than native pasture. And that month and that food coupled with the right ewe can considerably assist lambing percentages.
Marking to weaning

The period from marking to weaning does not normally cause much worry. It is usually a period of ample food supply and with good pasture set-stocked there is every chance for the good lamb to grow into a healthy hogget and later a well-proportioned flock ewe.

Summary

To ensure high lambing percentages and greater wool weights we should aim for well-grown young ewes, brought to the ram for the first time in really good and rising condition. (There is no reason why, even with Merinos, it should not be at the two-tooth stage if they are big enough.)

A stimulus of extra feed from three weeks before tupping to four weeks afterwards will also help.

For the winter, a maintenance diet only is needed and from four weeks before lambing a steadily rising plane of feeding sufficient to keep the ewe in fit and forward condition.

After lambing there should be enough feed to keep up a good supply of milk for the first two months. If the lambs are well grown there is no reason why they should not be weaned at three months instead of a month later.

After weaning avoid starving the ewes; if they are turned out on the tops there must not be such competition as will keep them hungry. Better than the tops would be improved shady blocks at lower altitudes until the tupping season approaches.

While the difficulties of carrying out these recommendations are fully appreciated, the rewards are there for sheep men who can combine good shepherding and good husbandry with reasoned scientific guidance.

BOWIE IN HIGH-COUNTRY SHEEP

C. S. M. Hopkirk

(DeHopkirk was Director of Wallaceville Animal Research Station when the original research was carried out.—Ed.)

The condition known as Bowie or Bandiness is not uncommon in high-country hoggets in Marlborough and Canterbury, particularly in the spring. Research work was carried out some years ago in Marlborough by L. W. M. Fitch, who was then stationed at Wallaceville, and in North Canterbury where a lameness appeared in growing ram lambs on good feed.

There appear to be two conditions which may lead to Bowie; the one on the better country and associated with rickets, and the other on high country associated with defi-
ciency of good feed. In rickets, lack of ultra-violet light reduces production of Vit.D which, in turn, reduces the deposit of calcium in the ends of long bones. Unless corrected by the use of calciferol in a protective or curative dose, deformity of bones can occur and bandiness result. This is an uncommon sequel.

In the high country, available minerals and protein are deficient. Occasionally chamois and thar living on the flora of the high slopes show bone softness. This is corrected when these animals feed on lower slopes, but can be serious enough to cause malformation of jaws which results in starvation. Whether this is a phosphorus deficiency or phosphorus plus protein or plus other minerals such as selenium is unknown.
With Bowie all that is definitely know is that it occurs on native pasture and can be prevented by improvement of pastures or by withdrawing hoggets on to lower, more fertile regions. Usually the bending of a bone takes place in the distal extremity of the metacarpus and radius but sometimes hind limbs can be affected also. If Bowie is noticed in the early stages it can be corrected by better feeding, otherwise a permanent deformity results.

To prevent Bowie in high country, feed must be improved. It is difficult to get sheep to eat mineral licks so that the most natural way is to improve pastures. Phosphatic topdressing will go a long way to do this with possibly the sowing or broadcasting of better pasture seed. It may be that dosing with selenium to improve appetite, once better pasture is established, would also help to prevent bone deformities. The work of Fitch on high-country Bowie was not conclusive and did not directly associate phosphorus with deformity, so that the subject from a research point of view should be re-opened.

(A recent rapid survey on a number of runs showed that cases of Bowie in hoggets may amount to as high as 10 and 12 per cent. The Institute would welcome information from runholders affected by Bowie so that it can decide whether a special research project should be planned.)

**HOGGET SURVEY**

The Institute is so convinced of the importance of hoggets in the economy of tussock runs that it has decided to make a survey of the methods used in feeding and rearing them. With this issue of the Review all farmers on our mailing list will receive a brief questionnaire. The Institute would be grateful if the questions could be answered and the sheet returned to the Institute in the envelope provided. Postage is payable by the Institute.

An analysis of the questionnaire and any conclusions made will be published in the next issue of the Review.

**HOGGETS**

V. R. Clark  
Lincoln College

Hoggets! The word all too often brings thoughts of problems, losses, hard work and the disappointments associated with stock not thriving.

Is this state of affairs something we should accept, or by understanding the hogget and its requirements is it possible to improve it? The answers are, of course, NO, we
should not accept things as they are, and YES, it is possible to improve hogget growth and reduce losses.

Hoggets should always be considered as potential high-level producers; that they are the basis of the flock there can be no argument. Therefore hoggets are of paramount importance to the future success of the flock and deserve much better treatment than many of them receive.

Well-grown hoggets suffer less from hardship, produce more and have a longer productive life than those poorly reared.

To achieve the ideal, a hogget must be kept growing steadily right through its first year of life, a task which is not easy to accomplish on high or hill country. During the first year of a sheep's life it grows more rapidly and converts food into bone and muscle more efficiently than at any other time. To capitalise on this natural ability, management practices should be arranged to fit hogget requirements and eliminate as much as possible the stresses to which they are subject.

As a young lamb, nourishment is supplied by the ewe as milk, but after three to four weeks, grass becomes part of the lamb's diet and milk supplies a diminishing portion, until at about 10 to 12 weeks there comes a stage when the ewe is producing very little milk, and in fact becomes a serious competitor with her lamb for available feed. At this point the lamb should receive priority, and every effort be made to maintain its growth rate. The obvious thing then, is to wean the lamb on to a saved block or on to specially-grown or saved feed. In most cases this will be several weeks ahead of normal weaning and may need some readjusting of management to permit it. Advantages from early weaning have been demonstrated in both the North and South Island on high, hill and plains country.

They are:
- Improved growth rates of lambs.
- Reduction in internal parasite infestation.
- Saving of feed and earlier spelling of ewe or winter blocks.

Weaning is also a convenient time to drench lambs for the removal of worms, where necessary, and can be combined with a dose of selenium. Removing worms is also removing one of the problems which can beset young sheep and slow their growth. One of the new drenches is considered to be the best yet produced and gives effective control of most worms. Selenium has been shown to be beneficial in preventing white muscle disease and stimulating appetite.
which in turn increases growth. Its cost is low and responses to its use have been obtained in most areas.

While referring to minerals it would be well to stress the requirements of calcium and phosphorus by young sheep. These minerals which are essential for good, strong bone development are unfortunately deficient in much of the undeveloped high country. It is therefore advisable to put weaned lambs and hoggets on to topdressed country or improved sown pastures to enable them to take up sufficient for requirements. A phosphate deficiency on undeveloped, non-topdressed areas may lead to the bone-weakening disease called “Bowie,” associated with which is slow growth rate.

At all times hoggets should be considered as delicate individuals unable to adjust quickly to changing conditions and likely to be adversely affected by even slight changes in food or climate. Climate cannot be controlled but its effects can be modified by putting hoggets on to the warmest blocks or driest, most sheltered areas. Food, however, is a different proposition which can come directly and fully under the control of the flockmaster.

Shifting hoggets suddenly from one feed to another is likely to cause digestive upset—even shifting from one pasture type to another can be disturbing.

Why? Because the rumen (first stomach or pouch) of a sheep is in effect a fermentation vat, relying for its activity on micro-organisms (bacteria, etc.) which are of various types.

For each feed, different organisms in varying numbers are required to ferment and break down the digestible portion for the animal to absorb. For example, lambs which have been grazing tussock grassland will have built up a rumen micro-organism population to suit that feed, but if changed suddenly to a diet mainly of swedes or turnips, the micro-organisms may be quite unsuited to deal with those root crops. Following this there can be a digestive upset so severe in some animals that they scour.

Allowing hoggets on to the new feed for a short time each day, for a few days, before expecting it to form the bulk of the diet, will enable the animals’ rumens to become adjusted.

Mention of turnips and swedes makes one think of winter feeding and the utilisation of these crops for hoggets. That both crops can supply a bulk of feed is never in question, but thought should be given to the amount of nutrient a sheep assimilates in relation to the bulk consumed. Remembering that root crops are low in dry matter and protein, should make the flockmaster conscious of the need
for additional fibre and protein from a supplement. Good quality lucerne or clover hay would be adequate in most cases, provided the hoggets have been educated to eat hay, that it is fed in sufficient quantity to allow the animals free choice and that the total fed will make up the difference between turnip intake and requirement for body maintenance and growth. All too often hoggets are run on roots (often frozen) all day and are then expected to collect the remainder of their needs from poor pasture pickings on a run-off or are fed small quantities (1/2 lb/hogget/day) of hay. To eat frozen roots is a difficult, slow process, calling for expenditure of energy in collecting the food, then warming it, removing the high water content and finally assimilating what is left.

The greater the energy requirement in collecting food, the greater the maintenance requirement of an animal becomes. If carried far enough it is not difficult to see that in a cold climate, on low-energy foods and taking a great amount of time and distance to collect that food, a hogget can quickly get to a stage where it is fighting a losing battle. In other words, even though on turnips for several hours, the quantity it eats may not be great and certainly the food value is not high; it therefore requires some readily accessible high quality food on its run-off to ensure sufficient for maintenance and, it is hoped, some left for growth.

Feeding methods, the feeds used and the type of management will, by both necessity and choice, vary from property to property and district to district, but the principles must always be the same. Hoggets are growing animals, efficient converters of food into bone and muscle, requiring careful management and good, high-quality feed in sufficient quantity to permit full development, enabling them to express their ability to grow and produce wool.

When young sheep are well grown, losses are lower and body weight and fleece weights are higher, giving an immediate higher return. Apart from the direct profit to be derived from improved thrift of young sheep, there are the important long-term effects on the flock.

Lowered hogget mortality gives greater opportunity for selection apart from the extra return from more stock available for sale. Giving hoggets equal but good opportunity to grow, allows those with the higher potential to show themselves and become obvious choices for flock replacements.

Within a breed, and within a flock the better the hoggets, the bigger will be the two-tooths, and subsequent production of both wool and lambs will improve.
MANUKA AND KANUKA

With so much attention focussed on the introduced weeds such as sweet brier, nassella and gorse, we are inclined to forget that certain native species are our worst pasture weeds, among them the two tea-trees—manuka and kanuka. They belong to the genus *Leptospermum* (meaning "slender seed") which has about 35 species, mostly Australian, with a few in New Zealand and others in New Caledonia and Malaya. The two common New Zealand species are both known as tea-tree, probably because of the occasional use of the leaves in "making a brew" in the early days when real tea ran out. Sometimes they are differentiated as red tea-tree for the smaller species and white tea-tree for the larger, but it would be much more satisfactory to refer to them as manuka and kanuka respectively.

**Manuka.** *Leptospermum scoparium.* (The specific name means "broom-like.")

This is quite the commonest of New Zealand shrubs and in some ways must be considered one of the world's most remarkable plants. It is extremely plastic and is able to adapt itself to every possible variation in environment, from sea-level to high altitudes. In mountain habitats it may be a prostrate plant only an inch or so high, spreading like a carpet over the surface; in good soil it may grow to a height of 25 or 30 feet or more with a trunk up to two feet in diameter. Not only does the habit vary but the plant varies in the size and colour of the leaves and flowers according to the conditions under which it grows.

The flowers, from a quarter of an inch to a half inch in diameter, are produced singly, either in the axils of the leaves or at the tips of small twigs or branchlets. Plants as small as one inch high may produce flowers and develop fertile seed. The fruit is a woody capsule which may remain unopened for several years.

The timber on larger specimens is of a deep-red colour, straight in the grain, strong and tough. The Maori used it for making paddles and spears and over 120 years of settlement the pakeha has used it for fencing, firewood, stakes, rails and poles.

The whole plant is aromatic, the leaves, flowers, fruits and young twigs being impregnated with an oil, the smell of which is the easiest way of distinguishing the plant from kanuka; the latter smells of eucalyptus.

The minute seed, produced in vast quantities, blows about freely and is readily carried in the coats of animals, especially in the wool of sheep. In spite of its small size it germinates readily on the surface of the ground and a fireswept hillside may soon become a dense carpet of seedlings
which in a few years produce an impenetrable thicket. Thriving as it does on low-fertility soils, manuka may become a serious weed following on attempts to control fern by fire and crushing. As the fertility falls away, manuka may take control. The best description of the process is that given in "Tutira" by H. Guthrie-Smith:

"The increase in the number of other plants and seedlings was, however, as nothing compared to the increase of manuka. The heights everywhere were now crowned and crested with its dense thickets and winding shrubberies. Seedlings appeared in millions of millions of millions. After the heat of a fire which had rather scalded and withered than burnt the scrub, its berries opened fully and shook forth their innumerable tiny brown seeds. On the dry
surface, in company with charred morsels of stick and stem, mingled with dust hardly more minute than itself, manuka seed was whirled downwards in nor'-west gales and eddying whirlwinds. In wet weather it was everywhere transported in sheep's hooves. In deluges and tropic showers it was poured downwards along the hard stamped tracks. On every wet pebble that rolled from the conglomerate slopes, the little seeds clung fast. Plants did not appear one here and another there as in former periods; they germinated, sometimes in tens, sometimes in thousands, on every acre of burnt ground. Over certain portions of the paddock they sprung up like hay-seed round the edges of a stack.”

Kanuka. *Leptospermum ericoides*. (The specific name means “heath-like.”) While not so common as manuka and not so versatile in colonising unfavourable sites, kanuka is still one of the commonest of native plants. On favourable sites it may reach a height of 60 feet with trunks up to three feet through. It can also be so small and prostrate as to form a turf. The leaves are smaller and narrower than in manuka and the flowers are much smaller but are produced in clusters in vast profusion. The capsules open and shed their seed during the first season. The bark on large trees hangs in huge ribbons which were stripped by the Maori for use as roofing for buildings.

The timber which is still an important firewood, was formerly used also for house blocks and piles for jetties, and for rails, posts and poles. (The main identification points distinguishing kanuka from manuka are the larger size, the smaller flowers in clusters, the shedding of the capsule in the first year, and above all the smell of eucalyptus.)

Both manuka and kanuka make useful garden plants but it is manuka which has been specially developed for use in horticulture. Plant collectors have assembled a variety of forms with an equal variety of coloured flowers. Working on these, hybridists, both in New Zealand and in California, have produced a wide range of attractive cultivars popular in gardens all over the world.

**Manuka and Kanuka as Weeds**

In the North Island these plants are possibly the most important weeds on low-fertility hill country, with manuka being the more serious. Weak, over-grazed pastures assist establishment. Control over the years has involved the use of the slasher, followed by fire, oversowing and topdressing. These processes are arduous and expensive and may have to be repeated every five to ten years.
Manuka Blight

Because of the high cost of control of manuka, jubilation throughout the country followed on the destruction of manuka in the South Island by a blight. Manuka was known to have been killed in South Canterbury as early as 1937 but it was after the big snow of 1945 when manuka died over wide areas in Canterbury that attention was attracted all over New Zealand. "Diseased" plants were offered for sale in the North Island between 1946 and 1948 and the "blight" was soon established over wide areas.

Our knowledge of the insect, *Eriococcus orariensis*, which ultimately destroys manuka is due largely to Mr J. M. Hoy of the Entomology Division of the Department of Scien-
tific and Industrial Research. He showed that the insect responsible was an accidental introduction from Australia. In vast numbers it feeds on the sap of manuka to such an extent that the plant will die in from two to five years. Infested plants are characterised by a fire-blackened appearance due to a black mould which grows on honey-dew given off by the insect. The main indication of approaching death is a gradual browning of the canopy foliage.

The insect may be found on kanuka but, except in rare cases, death of the plant does not occur.

The result of the spread of the insect in the North Island was to destroy manuka over considerable areas as effectively as it had done on the east coast of the South Island. However, in 1954 manuka was reported to be recovering from insect attack in an area near Gisborne and subsequently this has happened over most of the North Island. The reason is that the insect itself is attacked by a fungus which penetrates the body of the insect and kills it. This fungus seems to thrive in the North Island and in the northwest of the South Island, usually where rainfall is over 40 inches per annum and temperatures are mild. It does not appear to be effective on the east of the South Island.

So over large parts of New Zealand we are back where we were as far as control of manuka is concerned. Unfortunately, chemical control is expensive and not very satisfactory. According to the Department of Agriculture, "Seedling plants up to four to six inches are susceptible to 2, 4, 5-T at rates of three to four pounds either as the emulsified ester or oil-soluble concentrated ester, provided complete cover is obtained."

**Manuka and Conservation**

When the insect was being widely distributed, there was some concern that widespread destruction of manuka might result in an increase in soil erosion particularly on steep hill country. Fortunately these fears were not realised, probably because the slow death of the plants enabled other forms of cover to replace it, particularly where oversowing of dying manuka was practised. In the South Island it is highly desirable that dying manuka be replaced by a good turf of grass and clover rather than by kanuka, blackberry, gorse, fern or low-producing grasses. In some areas if manuka is replaced in this way, the conditions for infiltration and reduction of run-off and soil loss may be greatly improved.

The Institute is sponsoring a study of manuka and kanuka and their relation to tussock grassland in Otago. Results when available will be published in the "Review." In the meantime we would welcome comments on these plants as weeds or as agents of soil and water conservation.
STATION SHEEP WINTERED ON GRAIN OATS

During the past two years, 15,000 Corriedale ewes on Hakataramea Station have been wintered on oats which have entirely replaced hay, turnips and green feed. The station has ample areas of arable land on which a 60-bushel crop can be produced at a cost of 4/1 a bushel.

One bushel of oats feeds a ewe for 80 days, the normal rate being half a pound per ewe fed on six days a week. To the back of the truck is attached a hopper from a spinner type of topdresser fitted with a piece of two-inch galvanised pipe for the oats to run through. (Over the pipe is fitted a piece of radiator hose to prevent damage.)

A sack of four and a half bushels of oats feeds 360 sheep and the truck is driven at a slow pace to enable a narrow heavy band of oats to be laid, 130 yards long. This gives a line of feed sufficient for 360 ewes without crowding. With the initial feed, only one quarter of the quantity is used and this is gradually increased until the full amount is fed in a week.

Mr C. B. Hercus, the manager, who has developed this system of feeding, says a utility vehicle is quite capable of feeding 3,000 sheep with one load. He considers oat feeding the greatest break-through in closing the gap between the summer and winter carrying capacity on the property.
THE ESTABLISHMENT OF GRASSES IN HUMID TUSSOCK GRASSLAND REGIONS

K. F. O’Connor
Grasslands Division, D.S.I.R. Lincoln.

Many New Zealanders are now familiar with the success story of Molesworth and the outstanding re-vegetation programme, extending oversowing of cocksfoot and clovers to more than 40,000 acres. Skilful judgment of the timing of the sowing of scree to coincide with the natural healing and stabilisation processes has resulted in good establishment of cocksfoot in particular, even without the assistance of fertiliser topdressing. These induced scree slopes, e.g. in Alma Valley on Molesworth, have been shown by O’Connor (1962) to have no field deficiency of phosphate although sulphur deficiencies apparently develop as such scree are stabilised by oversown vegetation. Similar examples of improved grass establishment on marginally stable scree and denuded soil slopes have been observed elsewhere in South Island, e.g. Sly (1960) at Mid Dome in Southland, and also at Te Aka and Tara Hills in the Waitaki Catchment. In all of the areas where such grasses have not only established but survival there is little evidence of phosphate deficiency. On a wide range of Kaikouran soils, the steepland moist yellow-brown earths of the high country, I have had numerous examples of some cocksfoot establishment without fertiliser but little or no survival. Phosphate has improved establishment but at higher altitudes in particular, plants have been destroyed by solifluxion during their first winter. This contrast between success in the generally sub-humid areas without phosphate deficiency and failure in the humid areas with phosphate deficiency, leads to the present review of a wide range of fairly detailed experiments in the humid sector of tussock grasslands, principally at Broken River in the Waimakariri Catchment. These experiments have attempted to reveal the importance of different factors in treatment and environment which could affect establishment of improved grasses such as cocksfoot and ryegrass.

The roles of nitrogen, phosphorus and sulphur and seedbed preparation were studied in a trial involving 252 plots at Enys Flat on Craigieburn soil, beginning in 1958. Sulphur did not affect establishment itself but nitrogen and phosphorus had a joint effect on establishment where seedbed preparation was little or nothing. Where soil was cultivated in orthodox fashion, added fertilisers had no positive effect on cocksfoot establishment, expressed as numbers of...
plants per square foot of ground, three months after sowing broadcast without attempting seed coverage. These results are shown in Table 1.

TABLE 1
Density of Cocksfoot Three Months after Sowing in October 1958. (Craigieburn soil, Enys Flat, 2,400ft a.s.l.)

<table>
<thead>
<tr>
<th>Sward treatment</th>
<th>Nutrient applied</th>
<th>P</th>
<th>N</th>
<th>P + N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nil</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Herbicide</td>
<td>3.7</td>
<td>3.9</td>
<td>3.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Ploughed</td>
<td>10.2</td>
<td>15.2</td>
<td>12.4</td>
<td>8.5</td>
</tr>
</tbody>
</table>

Sward treatment improved establishment significantly in the above experiment. In another experiment begun in October 1961, burning, spraying with herbicide, autumn and spring cultivations were compared with no treatment. Sowings were followed by drier weather than in the first experiment and establishment of both cocksfoot and the new hybrid ryegrass was very poor, except where the seed was drilled into the cultivated ground. Again there was little gain in actual establishment from the addition of fertilisers on cultivated ground although those plots receiving phosphorus and sulphur or phosphorus, sulphur and nitrogen were generally slightly superior to those receiving no fertiliser. In both experiments all three nutrients, N, P and S, had marked effects on sown grass growth, measured in grass height three months after sowing. The cumulative effect of height and density is shown in yield in the first season of growth. The effect of fertiliser nutrients on yield of the sown grasses is best shown in Table 2 from drilled and cultivated plots of the 1961 experiment.

TABLE 2
Yield in Pounds of Dry Matter per Acre of Newly-Sown Ryegrass and Cocksfoot 1961-62 Season (Craigieburn Soil).

<table>
<thead>
<tr>
<th>Nutrient applied</th>
<th>P + S</th>
<th>N + S</th>
<th>N + P</th>
<th>N + P + S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield:</td>
<td>1</td>
<td>13</td>
<td>2</td>
<td>232</td>
</tr>
</tbody>
</table>

This table shows the striking effects of phosphorus and sulphur in the nutrition of grasses in the presence of adequate nitrogen. Because of the acknowledged importance of sulphur and phosphorus in the nutrition of clovers, there
is a constant temptation to regard nitrogen as the only practical deficiency affecting grass growth. The superior competitive ability of resident grasses to obtain and utilise scarce sulphur and phosphorus in tussock grasslands results in the failure of legumes more quickly than grasses, if nutrition is inadequate. However, the example in Table 2 is a clearcut one showing that phosphorus and sulphur are of vital importance if grasses such as cocksfoot and ryegrass are to utilise applied nitrogen or nitrogen built-up in soil by vigorous legume growth and livestock returns of urine. It should be observed that on a soil with such severe phosphate deficiency as the Craigieburn soil, the need for phosphorus is primary to the need for sulphur. Significant responses to sulphur were obtained when it was added to both nitrogen and phosphorus.

A further experiment was begun in 1961 to study the effect of lime on grass and legume growth, including its effect on establishment. The trial was done at two levels of superphosphate, 3 cwt per acre and 6 cwt per acre, and at two levels of applied nitrogen 0 and 200 lb N per acre, applied as urea. Lime was applied at 0 and 2 ton per acre. Lime and fertilisers were raked into the upper four inches of soil or left on top after broadcasting. Seed was all drilled with 200 lb lime, a mixture of new hybrid ryegrass and cocksfoot, with either lucerne or white clover. Table 3 summarises results of grass establishment three months later.

**TABLE 3**

**Percentage Cover of Sown Grasses within Drill Rows after Sowing in October 1961 (Craigieburn soil, Enys Flat).**

<table>
<thead>
<tr>
<th>Method of Application</th>
<th>No Nitrogen</th>
<th>200lb Nitrogen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3cwt Super</td>
<td>6cwt Super</td>
</tr>
<tr>
<td></td>
<td>No Lime</td>
<td>2t. Lime</td>
</tr>
<tr>
<td>Raked in</td>
<td>10.8</td>
<td>19.4</td>
</tr>
<tr>
<td>Surface</td>
<td>16.1</td>
<td>23.6</td>
</tr>
<tr>
<td></td>
<td>3cwt Super</td>
<td>200lb Nitrogen</td>
</tr>
<tr>
<td></td>
<td>No Lime</td>
<td>2t. Lime</td>
</tr>
<tr>
<td>Raked in</td>
<td>38.1</td>
<td>40.3</td>
</tr>
<tr>
<td>Surface</td>
<td>38.5</td>
<td>44.9</td>
</tr>
</tbody>
</table>

22
Statistically significant responses were found to higher superphosphate (5 per cent level); lime (5 per cent level); and nitrogen (1 per cent level). It was also found that raking-in of fertilisers significantly depressed percentage sown grass cover at the low level of superphosphate but not at the higher level. This apparent adverse effect of diluting the superphosphate by mixing it in the soil, coupled with the relatively large response to lime at the low superphosphate level without nitrogen, suggests that the effect of lime may have been connected with the availability of or efficiency of use of phosphate. This apparent effect of lime on grasses is not novel or unusual. A marked response to lime was observed in 1957 in the height and bulk of cocksfoot on a Monowai soil, near Te Anau, five years after the trial had been laid down by Mr N. C. Holmes, then Soil Conservator, Ministry of Works, Invercargill. Both these trials are noteworthy in that when observations were made, no evidence could be seen of response of legumes to lime.

On a lime-rich soil with basal dressings of gypsum, potash, phosphate and molybdenum, fairly good results have been obtained from cocksfoot oversowing even into dense fescue tussock and other grasses, provided that the nitrogen level was high. The use of 22DPA as a herbicide improved establishment of cocksfoot but nitrogen supply was perhaps equally important in promoting yield. Results are summarised in Table 4.

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Annual application of Nitrogen for 1957 and 1958 (16lb per acre of N)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nil</td>
</tr>
<tr>
<td>Percentage ground cover of cocksfoot April 1958</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Yield of cocksfoot (lb DM/ac) 1958-59</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Yield of cocksfoot (lb DM/ac) 1959-60</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>

These results suggest that building up soil fertility may be the most important factor in preparing humid tussock grasslands for the establishment of improved grasses wher-
ever that is considered necessary for a well-designed stockfeeding programme. They also suggest that development of appropriate soil fertility is even more important when minimal ground preparation can be done to reduce the competition from resident vegetation. The widespread validity of the conclusions about the need for both nitrogen and phosphate is indicated by some preliminary results from oversowing on exposed Kaikouran subsoil at Black Birch, Awatere at 4,500ft altitude. These are summarised in Table 5. Levels of nutrients used in this trial are: N1 32 lb N/ac; N2 160 lb N/ac; P1 180 lb superphosphate; P2 900 lb superphosphate. Materials and seed were broadcast in November 1962, a mixture of short-rotation ryegrass, perennial ryegrass, cocksfoot and white clover was used. Estimates summarised in Table 5, were made on 24 April 1963.

<table>
<thead>
<tr>
<th>Fertiliser treatments</th>
<th>Nil</th>
<th>N1P1</th>
<th>N2P1</th>
<th>N1P2</th>
<th>N2P2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main leaf length (ins.)</td>
<td>1.7</td>
<td>4.0</td>
<td>4.5</td>
<td>3.8</td>
<td>6.5</td>
</tr>
<tr>
<td>Estimated yield (lb DM/ac)</td>
<td>50</td>
<td>350</td>
<td>430</td>
<td>450</td>
<td>1180</td>
</tr>
</tbody>
</table>

It is not argued that it is economic to apply such high levels of fertiliser in a wide range of locations. It is concluded, however, that it is not likely to be economic to spend considerable sums on seed and seeding methods if fertility is not already or concurrently built up to high levels.

REFERENCES

TUTU
An ex-musterer has sent the following note:
"When droving sheep, especially when they are hungry, through tutu there is always a danger of their becoming victims of poisoning.
One of the courses we carried out to combat it, was to cut the vein on either or both sides of the face, just below the sheep's eye, and in most cases this was a satisfactory cure. It had the advantage over cutting the ear of not defacing an earmark."
When we were droving and were faced with the probability of many cases, we used to make up beer bottles of water containing a large tablespoonful of baking soda and the mixture was well shaken up. A good mouthful of this fluid was sufficient in practically every case to have the sheep on its feet and cured.

I have never tried this treatment on cattle as they would be difficult to handle, but they would, I think, respond to a treatment of this nature although a much larger quantity of the fluid than would be the case for sheep would no doubt be required."

WEED SEEDS

We have been asked to print a list, with the common and botanical names, of the weed seeds which could possibly occur in seeds used for oversowing in tussock grassland. The Seed-Testing Station of the Department of Agriculture at Palmerston North kindly supplied the following list. It gives the weed seeds commonly occurring in various kinds of seeds tested at the station in recent years. The kinds of seed included were:

Perennial ryegrass, Italian ryegrass, short-rotation ryegrass, cocksfoot, crested dogstail, white clover, cow grass, Montgomery red clover, lucerne.

Because certificates of analysis may go to other countries it is necessary that the seed impurities be recorded by their botanical names. It is hoped that the list below will assist farmers in reading their certificates so that they can decide whether the impurities in a line offered for sale are those which could be harmful if oversown in tussock grassland. For instance Carduus nutans—nodding thistle, would definitely be avoided, whereas there would be no worry about a little Trifolium glomeratum—clustered clover.

Acaena anserinifolia
Achillea millefolium
Agropyron repens
Alchemilla arvensis
Alopecurus geniculatus
Alopecurus myosuroides
Anagallis arvensis
Anthemis cotula
Anthoxanthum odoratum
Avena fatua
Barbarea verna
Bromus mollis
Capsella bursa-pastoris
Carduus nutans

Piri piri, Bidi-bid
Yarrow
Couch grass or Twitch
Parsley piert
Knee-jointed foxtail
Slender foxtail
Scarlet pimpernel
Stinking mayweed
Sweet vernal
Wild oats
Winter cress
Goosegrass or Soft brome
Shepherd’s purse
Nodding thistle
Cerastium glomeratum
Chenopodium album
Chrysanthemum leucanthemum
Cichorium intybus
Cirsium arvense
Cirsium vulgare
Crepis capillaris
Cuscuta epithymum
Daucus carota
Dianthus armeria
Echinochloa crusgalli
Erodium cicutarium
Festuca arundinacea
Galium mollugo
Geranium dissectum
Geranium molle
Geranium robertianum
Holcus lanatus
Hordeum murinum
Hypochaeris radicata
Juncus bufonius
Lapsana communis
Leontodon taraxacoides
Leptospermum scoparium
Linum cartharticum
Linum marginale
Matricaria inodora
Medicago arabica
Melandrium noctiflorum
Melandrium album
Odontites viscosa
Plantago aristata
Plantago lanceolata
Plantago major
Picris echioides
Poa annua
Polygonum aviculare
Polygonum persicaria
Potentilla recta
Prunella vulgaris
Ranunculus paviloflorus
Rumex acetosella
Rumex crispus
Rumex obtusifolius
Senecio jacobaea
Sherardia arvensis
Silene cucubalis
Silene gallica
Mouse-eared chickweed
Fathen
Ox-eye daisy
Chicory
Californian thistle
Scotch thistle
Hawkweed
Dodder
Wild carrot
Deptford pink
Barnyard grass
Storksbill
Tall fescue
Hedge bedstraw
Cut-leaved geranium
Doves-foot
Herb-robert
Yorkshire fog
Barley grass
Cats ear
Toad rush
Nipplewort
Hawkbit
Manuka
Purging flax
Australian flax
Scentless mayweed
Spotted medick
Night-flowering catchfly
White campion
Tarweed
Bracted plantain
Ribgrass
Broad-leaved plantain
Ox tongue
Annual meadow-grass
Wireweed
Willow-weed or Red shank
Tall cinquefoil
Self heal
Small-flowered buttercup
Sorrel
Curled dock
Broad-leaved dock
Ragwort
Field madder
Bladder campion
Catchfly
Sisymbrium officinale
Sonchus asper
Spergula arvensis
Stellaria media
Taraxacum officinale
Trifolium arvense
Trifolium glomeratum
Trifolium striatum
Verbascus thapsus
Vulpia sp.

Hedge mustard
Prickly sow-thistle
Spurrey, Yarr
Chickweed
Dandelion
Haresfoot trefoil
Clustered clover
Knotted clover
Woolly mullein
Hairgrass

THE SIZE OF GRAZING BLOCKS

J. G. Hughes
Management Officer

One cannot generalize, in terms of acreages, about the most suitable sizes of grazing blocks for tussock grasslands. Rather is there need again to consider each property as a separate case, since an annual grazing pattern must be fitted to the best advantage within the boundaries already established. It is, however, reasonable to put forward principles as guides to better subdivision. How far these can be followed in an attempt to make the best grazing use of improved and unimproved grasslands, depends on several factors.

The Land

If the Land Capability classification is understood, division of an area of country into regions of similar vegetation, slope, soil and aspect is simplified. Within each capability class unit (or sub-class unit), is placed a similar land area. This, because of its physical characteristics will contribute best to a farming pattern when handled in a different manner from its fellows within other class units.

Thus a warm, open, fairly steep, fescue tussock face could be divided, in this classification from, say, the face adjoining, which may be of a more shady aspect and somewhat better covered although of similar steepness. In like manner further areas each differing significantly one from the other are classified as having a different capability or potential.

Ideally, subdivision, as a first principle, should follow these land class boundaries wherever topography permits. That is, areas of similar slope and vegetation should be fenced and managed in a different way from other and dissimilar areas. In its most simple case this finds expression in the different classes of land on each side of a spur extend-
ing from a mountain range. If the stock are allowed free grazing, they will universally favour the warm, open, and north-facing side, whereas an abundance of feed may well be going to waste on the more shady aspect. Here is an obvious site for land class fencing . . . but the proposition is clouded when other important topographical factors have to be considered. The spur given as an example may be small, or it may be only one of many similar spurs where the maze of fencing necessary for complete class division would be unwarranted. Again, in a different situation, the class boundary may be on a high contour across a face, perhaps where fescue tussock gives way to snow tussock. A grazing-block boundary could be desirable here but may not be practicable when the risks of snow slide and rock fall are considered. Here are particular problems about which decisions can be made only on the site but while giving due regard to these limitations, the broad principle of individual land-class blocks should still be followed wherever possible and practicable. At least one runholder considers that fencing land-class boundaries on a hill face is unnecessary. His view is that if the lower and better areas are sufficiently improved by oversowing and topdressing the attractiveness of the improved grazing will reduce the movement of sheep up the slope into less useful areas.

The Vegetation

The quality of the vegetation—both present and proposed—in the land-class block and on the property, is undoubtedly the most important general determinant of the extent of subdivision. On native grasslands, a certain stocking rate per acre can be carried indefinitely without visible harm and within the given boundaries of a property the stock numbers and classes are adjusted to this. Consequently, it has been the practice, governed by the limitations of the property, to arrange the block sizes so that particular areas can be grazed comfortably for the period required by the particular numbers of sheep normally carried in each class. Thus, the hogget block would be of sufficient size to hold the number of hoggets needed to maintain the flock; and to do them as well as possible while considering the demands of other classes of stock.

On some properties, “snow” fences have been erected to provide safe grazing in winter below them and thus physically divide the winter from the summer grazing block. On many others still, the snow depth increasing with altitude forms the only winter boundary. This is a product of the general policy of keeping the number of grazing blocks, and
thus fences, to a minimum. It is a policy dictated partly by the need to reduce capital cost and maintenance but also by the strongly held opinion that hill sheep fret below fences and thrive in proportion to the scope of their grazing.

The Grazing Influence

Practice of this theory of extensive grazing unfortunately means that favoured areas are often relatively over-grazed and unless there is total exclusion from a block, winter feed on the warm, steep faces cannot be saved. At the same time, shady faces of good quality and reasonably low altitude (and this is particularly the case on ewe country grazed through to the autumn) are largely ignored—that is until the sunny aspect is eaten out. But even if stock are excluded through the summer from a winter block, any areas of shaded aspect again remain ungrazed since they are too frozen up in winter to attract sheep.

The saving of standing winter feed has been mentioned. This is, surprisingly enough, only a reasonably general practice, more often carried out on the hogget block than anywhere else and then often only because it is convenient to shift the rising two-toothes out with the dry sheep early in the summer. It is, however, increasingly accepted as a good management principle. The logic of it is promoted in almost every speech and article dealing with the conservation of soil and water on pastoral lands, for conservation and increased plant cover (or feed) go closely together.

Stimulation of Sparse Growth

Saving means spelling, and spelling, to be of any use at all under a moderate to low rainfall or on winter faces where summer evaporation is high, requires the closing of the particular areas involved from the start of the growing season in early spring through to at least early autumn to allow reseeding in addition to plant growth. If the spelling is for winter feed, it should be carried through the autumn to the winter unbroken. Such grazing control cannot be carried out where the blocks are too large or where widely varying classes of country are enclosed within them. It is even, in fact, desirable in regions of lower effective rainfall, to carry subdivision to the point where critical blocks (critical for importance in the routine or for their depleted state) can be taken out of the grazing rotation for a full year or more at recurrent intervals, say, every three to four years. This principle of making allowance for deferred spelling becomes increasingly of value when improvement by oversowing is undertaken. Unless the seeding is prohibitively
dense, natural seeding of improved grasses must be allowed to take place at least periodically to ensure their spread and survival.

**Control of Rank Growth**

By comparison, the fencing of shaded aspects or of areas naturally rank in growth should be planned with a different grazing pattern in view. Block size needs to be such that some measure of control of the vegetation can be achieved with the available stock. This, of course, is easier said than done, but the aim should be to reduce selective grazing and to open dense areas. Unfortunately, under the grazing system in vogue, stock are often not available for this purpose at suitable periods of the year which are principally the summer and autumn. At such time, the wethers (and the ewes when weaned) are usually grazing the “tops.” Nevertheless, if the grazing of the high-altitude country is to be reduced, it is in these shaded blocks with rank growth that the stock can be accommodated, especially if improved plants are established to increase the attractiveness and food value of the area. The wethers can well be depastured here between coming off the winter blocks and before putting out in early autumn to the high country (which they would often otherwise have grazed to its detriment right through from shearing). Or, perhaps if the rank areas are a large proportion of the country and the “tops” are not to be grazed, the wethers could instead be kept on their blocks right through until the winter again. The ewes also, after weaning, could be grazed on such a block which had been partially improved, as long as their condition was not allowed to fall back too far. Cattle could well be run concurrently.

The conclusion is, therefore, that the reasons for the extensive grazing of hill sheep, have to be tempered with the need for full utilisation of available pasturage if the best use is to be made of the asset.

**Stock Thrift, Water and Labour**

One point needs to be emphasised, however. Subdivision should not be carried so far to the other extreme that there is excessive shifting of sheep. Taken as a general principle and with the limitations of feed supply, stock bred for extensive grazing, thrive best when set stocked for as long periods as possible. This is particularly so of ewes with lambs at foot.

No planning of block size, it is obvious, can ignore the supply of stock water. This restriction on smaller subdivision is of little consequence where there are adequate mountain streams but of prime importance elsewhere.
The amount of available labour can also influence the extent of subdivision. Certain properties have already reduced the size of their blocks so that the need to employ casual labour for mustering can be avoided. At the other end of the scale, an intensive grazing pattern can require extra permanent shepherds.

**The Cost**

The principal restriction on the extent of subdivision and hence the size of blocks on a property is a very real one—the cost.

The availability of finance imposes its limitations in several ways having regard to:

a. The capital cost of new fencing at £500 per mile or more.

b. The high cost of repair on fences in a high maintenance area.

c. The addition to invested capital in the property—the capital on which interest must be earned if the farm is to be a sound business concern.

d. The additional rates in a county where rating is on capital value.

A balance can be struck between fence quality and first cost to keep this and maintenance requirements to a reasonable minimum.

**The Historical Division**

On some properties where there was a fair proportion of flats and downs, hill subdivision was, and occasionally still is, non-existent. In spite of this, provision had to be made somewhere for the separation of various classes of stock if differential feeding was to be practised. Since there are few hill flocks without wethers, the blocks then became quite frequently a wether block (or perhaps separate summer and winter blocks) two to three ewe blocks (with one kept for dry stock), a hogget block and several small holding blocks used for shearing, sale sheep, tupping, or early winter grazing.

**The Proposed Division**

Modern practices aimed at better feeding of the stock and more care of the land include an intensified system of grazing stock classes by requirements, the saving of standing feed for pinch periods, the utilisation of pasture on dark faces, consideration of the reseeding and growth periods of plants, and artificial oversowing with or without topdressing.
While completely agreeing that every property has its own special problems, the suggestion is made that the planning of subdivision on some such pattern as the following should be worthwhile.

The summer country usually must be grazed as one block. Due to altitude and block size the high-maintenance, high-level fencing here is frequently uneconomic. It is, too, part of the property where capital investment is in most cases inadvisable. Summer country can well include most land down to the present limits of improvement which are 3,000ft to 4,000ft. Below this region artificial improvement is possible and subdivision should take cognizance of the land-class boundaries mentioned before. The winter country—the warmest and most snow-free faces—should be divided into three, possibly four blocks as a minimum. This allows for separate hogget, two-tooth, ewe and wether grazing (if all are necessary) with the block favoured for each depending on its value for feed and its safety. An arrangement such as this also makes allowance for spelling one block in rotation for a longer period than one summer—an almost essential requirement if cocksfoot and other grasses are to be established. If yet a further block than the three to four is feasible on winter country (and winter country can include downs and flats if there is a safe run-off or supplementary feed is saved) it will be of real benefit for use in the early spring as a block which has been spelled at least all winter. Its chance to make growth and reseed may be sacrificed for one season in rotation. This block, and its fellows in the rotation, must be one of the earliest blocks away in the spring so that relatively-high concentrations of stock can be run here for two to three weeks (after early shearing if practised) until the main spring/summer blocks come away. If these spring/summer blocks now make use of the improved country of easier slope and the better shady faces (Class VI land under the capability classification), the winter country can be spelled and the ewes set-stocked on them through weaning. Problem blocks, as mentioned earlier, could be suitable for the wethers before they are pushed out further in the early autumn.

It is difficult to estimate the number of lower summer blocks that could be needed under this system. Here the necessity for control of growth by mob stocking at times should be the consideration that must be weighed against financial restriction.

Autumn grazing further utilises either the back-lying or rank blocks, or more commonly, what is usually known as the summer country, the higher-altitude lands.

In case the writer is accused of impracticable idealism,
it should be stated that ideals are here regarded as precepts to be implemented when reality permits.

**Density of Fencing**

Where possible, the increased production from the improvement of a block should be made to pay for any necessary further fencing. It is not essential that all of a block should be improved or that a new fence should be erected to tightly enclose an improved area. While this is desirable, it is not always practicable. Finance available for seed and fertiliser may permit development of a lesser area than it is really feasible to fence off separately. In fact, it has been suggested that fencing should never be planned for greater density than will be needed to handle the size of flock envisaged at full development stage. The value of temporary (perhaps electric) fencing in the early stages of an improvement programme while stock numbers are being built up to larger single class mobs (e.g. more two-tooth ewes) should be considered.

However, the necessity for sward control of improved areas and, in drier regions, the need to spell for plant establishment and regeneration must be remembered and a sufficient proportion of a block (in the writer's opinion, at least one-half) should be treated at the one time so that a good degree of control of grazing intensity can be practised.

Where, for instance, only part or all of the shady aspect of a sunny and shady face block is treated, then that shady aspect will need to be fenced off from the sunny face or no control on either area can be exercised. But within the shady face itself, there is no real need to fence off strictly the actual part improved so long as it is a sufficiently large part of the total.

The principle should always be followed of first improving to the full the areas which are naturally of highest fertility, the better to have them pay for the improvement of the other. Besides, the advantages of increasing the fertility of poorer areas by stock transference of manure and seed from adjacent improved areas of higher fertility should be remembered. For instance, a case could well be made for improving thoroughly only the better soil strips of a block of mixed good and poor soils such as is found on the glacial outwash plains of the Mackenzie basin, or similarly for improving only the more responsive lower two-thirds of a plain hill face. Tight fencing of the improved area is not needed.

**Conclusion**

Since the size of flock which will bring a fair average return to the owner in practice determines the minimum
size of a property, block size must first of all be suited to the numbers and management of the different classes within the flock. But further than this, sound planning of block limits will enable better year-round utilisation of all the areas available for grazing on the run. While keeping in mind that the pattern of subdivision should be held within reasonable limits to minimise capital outlay and servicing costs, the subdivision of a property to allow periodic spelling or the close grazing of vegetation is an essential part of any policy of sward improvement. Again, it is suggested that, wherever possible, blocks should comprise only single classes of land. The aim must be to break the property into practicable blocks so that through better management the grazing value of the sward is continually being improved and, within the limits of climatic variation, the stock have sufficient feed available at all times of the year.

BURDOCK

The following note has been sent by a runholder in North Otago:

"The plant first appeared on our farm some 12 years ago in the sheep yards. Initially the weed was controlled in this area by grubbing all seedlings as they appeared. However at some stage a plant went to seed in an adjacent paddock and plants spread over roughly 40 acres.

We have found that grubbing is not a satisfactory control measure unless the complete crown and most of the taproot are removed. Some years ago an old-time shearer was here and saw some plants. He said that he had been told by a Canterbury runholder that burdock could be killed by placing a small piece of rocksalt on the rosette seedling.

We tried this and had great success, the plants dying in 48 hours. That was in the days when we were getting the old red English rocksalt. When the white German rocksalt came on the market we found that it would not kill even the smallest of seedlings. I still have a small supply of the English salt and have managed to hold the outbreak to the same sites where the original seedlings appeared from the first adult plant to seed.

I go over the area twice during the spring and summer and put salt on any seedlings. I give the area a thorough inspection before stocking in the autumn when the burrs would be ripe enough to transfer to wool, and any plants found are cut out and burned.

This programme has definitely stopped the spread of the weed and I hope within a year or two should mean its elimination."
BRIER

In Review No. 3 September, 1962, Mr R. J. Lee of Cardrona contributed some interesting experiences on the control of brier. He has been good enough to bring this information up to date.

“Looking back over the work of eight summers and autumns the following points are prominent:

On a block of country that was done in the 1956-59 period by dozer, pulling, grubbing and hormoning, and grubbing again in 1961, we were alarmed at the work required again this year to deal with young briers showing up, in places to over 4,000 plants per acre, and much of it where there is a dense sward of grasses.

Work this year since January has been mainly grubbing as the following figures show: Grubbing £486, pulling with tractor £10, hormoning with diesel and concentrate 2-4-5T at 1 to 60 £35/14/7.

Economics were the deciding factor in the methods adopted as shown below.

On land that had been done two years previously, in follow-up work a man can grub from 140 to over 500 bushes per hour according to density. At 250 per hour and £3 per day the cost is 3/- per 100 bushes. Hormoning with knapsack sprayer, a man uses approximately three gallons an hour, and a gallon does from 55 to 70 bushes; at one of hormone to 60 of diesel it cost 10/8 per 100 bushes.

At 1 to 160 the cost is 8/4 per 100 bushes.

Most of our country was not suitable for hormoning on account of tussock and other growth making it very difficult to get satisfactory coverage of the crowns.

I did some work last year commencing in May, and repeated every month till November doing one area at 1 to 60 and another at 1 to 160 each month, and as far as I can see there is no difference in the results, all being satisfactory.

(A scientific man made the remark that I probably would have had similar results if I had treated some with one part hormone to 500 diesel.)

On a block that was lightly stocked last year, there is evidence of numerous small briers coming away.

There is much evidence throughout Central Otago, taking the long-term view, that it is in the national interest to keep this country heavily stocked till such time as an economic method of control comes to light.

It is a rather ironical situation in this age, when science has made such progress in many directions, that
the methods of 50 years ago are the most economic in controlling a noxious weed which is hindering production of meat and wool on our tussock country, the production from which is so vital to our standard of living.”

**SUBSIDIES FOR HIGH-COUNTRY IMPROVEMENT**

In Review No. 2, February 1962, we published particulars of soil conservation subsidies which were available for improvement work. The Soil Conservation and Rivers Control Council has recently approved modifications of certain subsidies with the aim of assisting runholders to provide equivalent off-site grazing to compensate for de-stocking eroded land.

The scheme envisages the development of equivalent grazing of stable country to make more practicable the de-stocking of critically eroded lands, used in conjunction with the Council’s scheme of meeting the full cost of fencing off certain Class VIII land which will be retired. It should make Conservation Run Plans more attractive propositions.

Subsidy is available up to £1 for £1 on the cost of materials only—fertilisers and seed—but consideration will be given to subsidies on other practices such as the initial cost of installing irrigation where this is desirable for the increasing of grazing capacity.

Each case will be considered by the Council on its merits having regard to the severity and extent of the problem, the length of the period for which the de-stocked area will be closed, and the facilities for equivalent off-site grazing.

Runholders granted subsidies under this proposal will be responsible for the proper preparation of the land prior to sowing, prudent management during establishment, and follow-up maintenance topdressing as deemed necessary.

Before subsidies under the new provisions will be granted, the runholder must be operating a Conservation Run Plan or must agree to undertake such a Plan. Initially, this scheme will operate for three years when it will be reviewed by the Council.

The decision of the Council followed a recommendation from the New Zealand Catchments Boards’ Association which was strongly supported by the Institute.

Runholders interested in obtaining benefit from this new subsidy provision should apply in the first instance to the local Catchment Board or, in the case of the Waitaki Valley, to the Waitaki Catchment Commission.
TUSSOCK GRASSLANDS AND MOUNTAIN LANDS INSTITUTE

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