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Chapter 4

Establishing and managing improved plants in hill country

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INTRODUCTION

Legume introduction by oversowing steep hill country is accepted practice. Grass oversowing is less commonly attempted.

Why do farmers choose to oversow, and why is success of oversowing variable? In answering these questions we suggest how success of oversowing might be improved. We also consider the appropriateness of attempting to introduce improved plants to steep hill country, how to go about it, and how to make best use of introduced plants. In this paper, improved plants are taken to mean those cultivars on the National List of Acceptable Herbage Cultivars. In practice, seed of unimproved plants is commonly used. At least 50% of pasture seed mixtures sown in North Island hill country are "bush burn" mixtures, and much of the white clover sown is of permanent pasture origin.

WHY OVERSOW?

The reason oversowing, rather than a more reliable method, is used in hill country is the steep topography. Oversowing is generally carried out with one of three aims in mind:

1. *Pasture development* after clearance of scrub or bush. There is a clear requirement here for seed application, and the consequences of not doing so are obvious: slow pasture establishment from pasture remnants and from germination of buried seed, weed invasion, and a large time lag until full grazing capacity is reached.
2. *Pasture renovation* following damage to existing pastures by pest attack and/or drought, treading damage in "sacrifice" areas, or erosion. Damage can be visually dramatic. However, if this damage is not still obvious a few months later, oversowing could not have been expected to greatly hasten recovery. In this situation, money spent on reseeding may be better used in other ways e.g. to apply bag N, or to apply chemicals for pest control.
3. *Pasture improvement* to increase farm productivity. However, it is probable that good management itself rather than improved botanical composition of well-managed pastures, is the dommant influence on animai performance.

Benefits of introducing improved plants to existing hill pastures include (i) improved annual or seasonal production of herbage, (ii) better feeding value of herbage, that is more digestible feed, higher animal intake, or lowered levels of toxic compounds and (iii) better tolerance of grazing, trampling, pest attack, drought, or low fertility.

lmproved plants often display their advantages more clearly in one environment than in another. Plants tend to perform best in the environment in which they were developed or bred. High utilisation is often necessary if the advantages of improved plants are to be reflected in increased animal performance. In general, high utilisation means high stocking rate.

There is presently only one herbage cultivar on the national list which has been bred specifically for North Island moist and wet hill country, namely the recently released Tahora white clover. There have been no relevant, well-documented, trials that have shown that any of the potential advantages of oversowing North Island hill country with improved plants have been realised.

ALTERNATIVES TO OVERSOWING

Farmers oversow improved plants in order to improve animal productivity. During pasture development this goal is attained, at least in the initial period. However, pasture renovation and improvement will not necessarily increase animal production.

There are many proven ways of improving animal productivity other than by oversowing:

fertiliser application, increasing stocking rate, subdivision, use of genetically superior livestock, or an integrated approach to farm management e.g. MAF's "controlled grazing systems" approach.

If pasture composition change is desired, several of the above achieve this. Dramatic results can be achieved also by use of selective herbicides or high intensity strip-grazing with cattle.

Introduction of improved plants should not be viewed as a panacea, or a way of overcoming the inherent limitations of a particular hill farm, be they associated with climate, low soil fertility, or management.

THE PLACE OF IMPROVED PLANTS IN HILL COUNTRY

The foregoing paints a somewhat gloomy picture of cultivar use in steep hill country. However, this is designed to put the use of oversowing as a farm management tool into perspective. There are definite advantages to be gained in introducing improved plants into hill pastures:

1. Introduction of a new genetic base to the pasture means that a broader range of plants is present to exploit the multitude of different microsites present. This material may never have been present in early sowings, or may have succumbed during periods of inappropriate management.
2. Seed quality and purity are guaranteed when using certified seed.

PLANT INTRODUCTION

Once the decision to introduce improved plants to hill pastures has been made, what is the most effective way of achieving this? Attention should be paid to the following:

Cultivar selection

For pasture development or renovation, that is when oversowing into bare ground, a grass-legume mixture should be used.

For pasture improvement species choice is influenced by level of fertility. If pastures are essentially ***unimproved,*** introduction of improved plants is unlikely to be advantageous. If pastures are ***moderately improved,*** oversowing with legumes could 'be of advantage. In the ***high/y improved*** situation, grass as well as legume oversowing may be of value.

Scale of operation

It is often a mistake to oversow a large proportion of.a farm in one season. This is because it may not be possible to prepare a suitable seedbed, and give adequate post-sowing management, where these requirements impinge heavily on normal farm management procedures. If paddocks are too large to be satisfactorily treated, they should be subdivided before oversowing.

It is also advisable to delay major operations until the chosen technique has been tested on **a** small area of pasture, and has been seen to be effective.

Such a trial could consist of two l-5 ha areas, separately fenced, and representative of the topography and pasture type to be sown on a larger scale. Each area should receive ***identical*** treatment, as outlined below, with one exception — seed should not be sown on one area. The two areas should be closely observed weekly for about two months, and note taken of numbers of germinating seedlings. After 10-12 months both paddocks should be spelled for about a month, then pasture composition compared. Information gained in this way will assist in the decision to proceed on a larger scale, change the introduction procedure, or abandon the scheme.

Seedbed preparation

The environment of a seed introduced to a hill pasture is hostile. Desiccation, consumption by predators, attack by fungi, and smothering by resident plants are likely fates of seedlings. Where resident pasture is absent, as during pasture development or renovation, these perils are lesser in magnitude. Where the area to be oversown has been root-raked, driving stock across it can consolidate a loose seedbed and improve moisture relations of sown seed.

In drier hill country desiccation is most likely to be a serious problem, and in wetter hill country competition from resident pasture plants will be of greater importance. Seedbed preparation should proceed with this in mind.

When oversowing into existing pasture, good seed/soil contact is essential; hard grazing prior to sowing allows better penetration of seed to the soil surface. Where a dense turf mat is present, as is often the case, driving a mob of sheep and/or cattle back and forth across a hillside which has been previously hard-grazed can result in formation of an excellent seedbed, especially if the soil is moist at the time. Seed bed preparation can commence the previous winter with intensive mob-stocking, or pasture could be spelled then cattle-grazed over the summer. These treatments reduce pasture density and hence reduce competition between resident plants and introduced seedlings.

Slowly developing seedlings such as Wana cocksfoot are susceptible to competition from

resident vegetation, so pre-sowing herbicide application (paraquat or glyphosate) will improve chances of successful introduction.

Seeding rate

Seed rates should be higher than those used on flat land, and where conditions are particularly severe (e.g. poor seedbed conditions) then even higher rates should be used. Establishment is commonly only achieved by 10% of the sown seeds, so it is false economy to cut back seed rates.

It is difficult to specify exact seeding rates, as many other factors influence successful seedling establishment. Rates given here are higher than those commonly employed in practice: white clover 5 kg/ha, lotus 3 kg/ha, red clover 6 kg/ha, subterranean clover 5 kg/ha, ryegrass 30 kg/ha, cocksfoot 12 kg/ha. Note that these are bare seed weights, and if coated seed is used rate of coated seed sown should be twice that of bare seed.

Seed coating

The major advantage of using coated legume seed is increased *Rhizobium* inoculant survival. Inoculation of seed used in pasture development may be advantageous. There is no need to inoculate white, red or subterranean clover seed used for pasture renovation or improvement in steep hill country, as rhizobia are already present in the soil. Unless resident lotus is present in significant amounts, lotus seed must be inoculated. Only recently coated legume seed should be used, as *Rhizobium* survival decreases with time.

There is little information on effects of coating grass seed, in hill country. It may improve establishment, but it may be more effective to use the same money to apply more bare seed.

Timing of seed application

Temperature and moisture are very important environmental factors which make results of oversowing unreliable.

In summer-dry hill country, spring oversowing is very unreliable, and much greater success will be achieved with autumn sowing. However, if winters are severe, delay in oversowing beyond early May can result in poor establishment as a result of low temperature damage.

In summer-wet hill country, spring oversowing can give better results than sowing in autumn, especially if cold winters are experienced. It should be remembered that even in summer-wet country, aspect and slope variability lead to dry microsites and poor conditions for establishment and survival. Subterranean clover is a winter annual, and must be sown sometime during autumn — early winter.

Method of seed application

Oversowing is the only practical method, and this is normally achieved by helicopter or aeroplane. Although helicopters are potentially more accurate, skilled pilots achieve good results with either method. Seed spreaders are essential on fixed-wing aircraft. The seed should be applied to the entire area in two halves, each half being applied in different directions. Unfortunately, aerial application is often characterised by poor seed distribution, and the most satisfactory seed distribution is by hand, or hand-operated spinner. Although tedious, hand methods ensure that seed is present in all favourable growth sites, and combines nicely with other sowing requirements if used in conjunction with strip-grazing. Seed can be sown by hand while animals are grazing each break, ensuring pasture removal, turf destruction, and post-sowing treading to bury seed.

Post-sowing management

Treading the sown area with stock straight after sowing buries some of the seed and improves establishment.

Post-sowing management should prevent seedlings being smothered by resident vegetation. The aim is to not severely damage establishing plants, yet to allow light to penetrate to them. This encourages individual seedling to develop a high number of stolons and tillers.

Oversowing should be followed, for at least 12 months, by relatively tight set stocking e.g. maintenance of about 1000 kg DM/ha herbage mass, or by frequent on-off grazings e.g. pre-grazing herbage mass of 1300 kg DM/ha and post-grazing residual of 800 kg DM/ha. These management recommendations are not rigid, but oversown paddocks should receive *special* treatment. Thus, oversown areas can not be included in the normal winter rotation for ewes, or set-stocked at usual stocking rates from May to February. Such practices could greatly reduce chances of successful cultivar introduction.

In all cases except lotus, moderate to high grazing pressure and soil fertility status will favour persistence of the introduced cultivars, once satisfactory establishment (after at least one year) has been achieved. Lotus is slow to establish, so moderate to lax grazing pressure should be practised, and continued beyond the first year. Subterranean clover, which must reseed for continued survival, may disappear if rotationally grazed at infrequent

intervals during flowering in spring, because of removal of flowers. Under frequent grazing or set-stocking, subterranean clover flowers freely and sets seed. The other legume species can be spelled during their flowering periods, in order to build a reservoir of buried seed. Legumes produce 'hard seed' which remains viable in the soil for many years. However, the importance of buried seed in the life cycle of these perennial legumes is not certain.

Even with correct post-sowing management, established plants may subsequently disappear, Provided environmental catastrophes such as drought have not occurred, it is probable that the wrong cultivars were used in the given situation. The desirability of preliminary small-scale oversowing, before oversowing on a large scale, is again emphasised.

SUMMARY

Farmers and farmers' advisers should consider the following points before attempting introduction of improved plants to steep hill country:

1. Why is oversowing being considered?
2. Given satisfactory plant establishment after oversowing, will the desired effect be achieved?
3. Are there (better) alternatives to introducing improved plants?
4. What are the most suitable cultivars? "A permanent pasture mix" is a pretty generalised thing to use when a lot of time and effort is to be spent on sowing and establishing it.
5. Time should be spent on preparing a seedbed, and seed placement should be accurate. Is the operation too big to allow this to be achieved?
6. A trial run on a small area in the preceding year is advisable.
7. Timing of seed application is critical.
8. Can the oversown area be correctly managed for at least 12 months?

FURTHER READING

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Discussion

PART II — NORTH ISLAND STEEP HILL COUNTRY

Q. *How does Yorkshire fog perform in hill country?*

A. Little information is available to date, but we do know that Yorkshire fog will grow in some of the hardest environments in hill country such as infertile, droughty and hard faces. It is not as dominant in hill country as browntop and may never be a major species, but it could fill a more useful niche in future. Yorkshire fog is present in pastures with a background of more lax grazing pressure. It tends to form a dense turf which is hard to convert into an improved pasture.

Grazing by goats at Ballantrae has produced a white clover-Yorkshire fog dominant hill pasture, quite an unusual combination of species.

Q. *How can the buried seed reservoir be used as an asset in hill country?*

A. Early work by Suckling showed the value of summer spelling to increase the buried seed level, especially of clovers. Recent studies at Ballantrae, however, indicate that mortality of buried clover seeds is quite high, with most dying off within the following year. It therefore seems important that seed produced by spelling during one summer is encouraged to grow the following autumn. In summer-dry regions, buried seed is vital for re-establishment after drought or pest attack, so management which encourages reseeding of herbage legumes is a good insurance policy for the farmer.

Research in the Wairarapa has indicated that in dryland hill pastures, reseeding of ryegrass can be important. About 10% of plants in such a pasture will have established from seeds dropped the previous autumn.

Q. *Has the range of subterranean clovers now available, and any local ecotypes, been evaluated?*

A. 3 years of data from a collaborative evaluation are now available on 9 subterranean clovers in 9 regions of New Zealand. Some newer cultivars seem suitable for some regions. Tallarook and Mount Barker still emerge as the best types for general use in New Zealand and are the basis of resident sub clover in our pastures. The prostrate, crown forming habit typical of Mount Barker is more desirable than some of the more upright, leggy Australian types which are grazed to extinction under New Zealand grazing management.

Q. *Is coating or inoculation of herbage seeds worthwhile in North Island hill country?*

A. Trials indicate no benefit from coating grass seed in North Island hill pasture. The one benefit of coated legume seed is maintenance of *Rhizobium* viability, but the only legume which needs inoculation in land which has been recent pasture is lotus. In developing pasture from bush, the use of inoculated and coated legume seed is recommended as the soils will be *Rhizobium* deficient.

Q. *You suggest that hill farmers do their own trials with oversowing clovers. Doesn't this suggest something wrong with advisory services?*

A. No. It will demonstrate to the farmer that in his case oversowing is or is not worthwhile. If it does not work then he should invest in other means of improvement such as using nitrogen fertiliser.

Q. *Work in Otago has indicated that higher fertiliser application and intensive rotational grazing improves pasture more than introduction of new species and cultivars.*

A. Remember that it is easy to develop hill pasture from a run-down state but not easy to improve pasture which has already been renovated by fertiliser application and grazing management. It is during this intensification phase that better genotypes can be effectively utilised — plants better than those already there.

Q. *What is the correct time for oversowing?*

A. During the day! Common sense is vital for oversowing success. Establish the seedling at a time when the next few months are favourable. With annual and perennial legumes, oversowing in autumn rather than spring is more successful in most North Island regions because moisture supply is more reliable and pests and pasture competition less. Specifying a particular month is not easy because of wide variation in onset of autumn rains and other factors.

Q. *Would the extra cost of using a herbicide to check existing pasture during oversowing be worthwhile?*

A. A grass such as cocksfoot must have herbicide treatment for establishment success.