

Future Forage Systems Project

Oversowing – A brief literature review



Introduction

Oversowing is the only practicable way to improve or introduce new species into un-cultivable lands. Along with dry summers, soil fertility remains the greatest limitation to production in dry hill country (Suckling 1975; Chapman & Macfarlane 1985), and responses to applied P and N have been widely reported (Lambert et al. 1983; Lambert & Clark 1985). Historically oversowing was used to introduce grasses and clovers into land recently cleared of forest or scrub or improve high country tussock lands. With the advent of new pasture cultivars, oversowing has been used to introduce more species with higher yield and better feed value into existing pastures.

In situations where a sward already exists, successful oversowing requires careful preparation and post-oversowing management as well as cooperation from the weather as seedling establishment success is often very low (Charlton 1977). Treading of oversown seed into pastures and the use of herbicides to suppress the resident sward can aid the establishment and survival of seedlings (Charlton & Henderson, 1985, Sithamparanathan et al, 1986). These methods have been demonstrated as having benefits when applied to paddock scale oversowing in summer dry steep hill

country (Macfarlane, M. J. 1985, Macfarlane, Bonish, 1986) and moist hill country (Barker & Zhang, 1988, Chapman & Campbell, 1986, Barker et al, 1988).

The sward density must be controlled (i.e reduce competition) during the early phase of seedling establishment and grazing pre- and post-oversowing is critical. . The application of low rate of a broad spectrum herbicide as a sward suppressant assists in controlled density but it is not a substitute for poor or no pre or post oversowing grazing management.

Following oversowing, seedlings must compete against a number of factors including: desiccation, attack by insects and fungi, and smothering by resident plants (Chapman 1986). In moist environments, seedling completion can easily become a significant problem and in dry environments, seedling death from desiccation is likely.

Trials at Whatawhata Hill Country Research Station, highlighted the roles of sward control and treading to ensure establishment of a range of seeds oversown into easy hill country. A low rate of paraquat (250 g ai/ha in just 60 litres of water per ha) was capable of acting as a suppressant to check resident sward growth for a useful period following over-sowing. Establishment increased linearly with treading intensity at sowing, however maximum establishment was achieved with extreme treading intensities that could not be realised in hill farming practice (Shithamparanthan et al, 1986, Macfarlane & Bonish). The establishment of seed oversown into unimproved steep hill country using low rates of herbicide to suppress, rather than remove the existing sward has seldom been assessed. Lowering the amount of water per hectare used to apply a herbicide may significantly reduce establishment costs. Reducing the water rate from 200 to 60 l/ha can produce application savings with only a small decrease in herbicide effectiveness (Macfarlane, 1987). Savings can be made by choice of herbicide, the use of penetrants, application method and water rate.

Pre-oversowing preparation

The area to be oversown will required a change in management for almost a year before returning to 'normal' farm management. This plan must include:

- The area selected and how it will be integrated into the current farming system
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- Consider that there are other ways of improving animal productivity e.g. more fertiliser and increasing stocking rate, subdivision or an integrated approach to farm management e.g. "controlled grazing systems" approach.
- Arrange fertiliser, species/cultivars and any legume seed inoculation
- Preparation including hard grazing of the area pre-oversowing and the application of a pre-oversowing sward suppressant
- Post oversowing treading with a significant number of stock for 24-48 hours
- Intensive monitoring
- More frequent but short post-oversowing grazing to control competition
- Careful grazing over the first summer to ensure that plants are not grazed out
- Where applicable, manage annual clovers for seed set in first year

Area selection: It is easy to oversow to large an area which makes pre and post oversowing management difficult. If paddocks are too large to be satisfactorily managed, they may require subdivision before oversowing. Trial oversowing in a representative 5-10 ha paddock will provides

valuable experience before carrying out a large scale operation.

Evaluate other alternatives: Oversowing must be seen as an option along with other strategies as trials at Ballantre (moist hill country) showed that in general, yield responses were greatest from added fertiliser, intermediate from new introduced pasture grasses, and least from changes in summer management (Baker, 1993).

Fertiliser requirement: No amount of oversowing will change soil fertility improve production. It is essential that the soil fertility can sustain the plants being introduced. At Ballantrae (moist hill country), fertiliser application alone was produced more dry matter than introducing new cultivars where soil fertility was not improved (Baker, 1993)

Species and cultivar selection: What is the role of the new sward? Choice of pasture species 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 should be considered. In a highly improved situation, grass introduction will be worthwhile. Where new or novel species are to be introduced, such as annual clovers or plantain, careful selection for plant type and ability to manage flowering date is essential.

Inoculation. Inoculation with the correct strain of rhizobia is essential when introducing a new clover into an area. Coated or pelleted seed normally has the correct inoculated added and must be kept cool and used within 20 days of being coated or pelleted. Bare seed may be inoculated by hand on the day of oversowing using a supplied commercial inoculant in a peat based product. It is important that unchlorinated water is used when added to the peat (follow the instructions on the packet). A clean concrete mixer is the best way to inoculate bulk seed.

Coating and pelleting. Commercial coated seed and seed pellets (typically larger than coated seed) can be made up of many layers of compounds to protect the inoculant rhizobia from sunlight, desiccation and acid soil conditions. Some products also incorporate fungicides and nematicides. The use of coated seeds has shown be beneficial, particularly in drier sites where seed coats enable more rapid moisture absorption (McWilliam et al 1970, Vartha & Clifford, 1973).

Fertiliser requirements: The area needs to have sufficient base fertility to sustain the introduced species. If required ensure a capital fertiliser application at or before oversowing. In general, yield responses were greatest from added fertiliser, intermediate from new introduced pasture grasses, and least from changes in summer management (Baker 1993).

Area preparation: Seedling survival from oversowing is affected by moisture (seed soil contact and weather conditions, particularly wind) and competition for space, light and moisture. It is important that as much bare ground as possible is made available to the oversown seeds and to remove excess herbage that will compete with the establishing seedlings. Seeds should fall on the soil surface and not within a thatch of vegetation. This is achieved by a planned approach to removing as much of the standing existing vegetation as possible by grazing (Table 1.) and through using herbicide to suppress or kill existing vegetation. In summer dry areas, consider spring application of herbicides followed by a summer fallow. This will enable time for stock to graze and further open up the sward and conserve moisture in preparation for autumn oversowing.

Table 1. Percentage of sown seed established 8 weeks post oversowing following different oversowing management (Chapman, 1985)

Pre oversowing management	Percentage seeds established		
	Lax grazed	Hard grazed	+ Glyphosate
White clover	9.5	52.4	
Perennial ryegrass	12.5	23.7	
Cocksfoot	9.3	28.0	

Application methods

There are a range of possible application methods.

- Helicopter - with seed bucket
- Helicopter – seed applied with fertiliser using fertiliser bucket
- Helicopter – with lime slurry plus seed
- Fixed wing aircraft - with seed spreader
- Fixed wing aircraft - seed applied with fertiliser

The aim is for even distribution of seed (and fertiliser if it is being applied at the same time). Charlton & Grant (1977) monitored seed and fertiliser distribution throughout an oversown block and found that when an unmodified fixed wing was used, 58% of the area received less than half the desired application rate. This meant that other areas were receiving 2-3 times the desired application rate. Recent trials at Castlepoint Station (Macfarlane, 2013) using helicopter applied seed and fertiliser found similar issues with distribution.

Seed and fertiliser distribution is dependent on the seed size and the fertiliser particle size. If a spinner is used, heavier particles and seeds are thrown further while with aircraft the heavier seeds and particles tend to fall closer to the aircraft (Gillingham, et al 1985). The use of GPS guidance can improve application. Actual distribution on the ground is affected by application technique as well as height above ground of the aircraft or bucket, the angle of the bucket and the influence of any cross wind. A small amount of cross wind will actually produce a better distribution than oversowing on a calm day. In conditions of little or no cross wind, it is extremely difficult to achieve satisfactory distribution of both seed and fertiliser at standard 12 metre track spacings. Overall distribution can be improved in still conditions by reducing flight track spacings and seed and fertiliser hopper flow rates. This will, however, result in increased application costs. Although individual seed and fertiliser components of oversowing mixes will segregate in conditions of moderate to high cross winds, this still results in very good overall paddock distribution, as long as accurate flight path spacings are maintained. (Table 2. Macfarlane et al, 1987). The placing of buckets or plastic pails within a block to collect seed and fertiliser will provide a measure as to the evenness of application.

Post oversowing treading

Heavy stocking of oversown areas increases the seed-soil contact and the amount of bare ground. Trials have shown that treading increased the amount of bare ground by 20%, disturbed more soil and vegetation and reduced the amount of seed visible on the surface by 15%. This increased initial establishment resulted in better establishment on steep slopes up to 6 months later (Chapman, 1986,

Macfarlane & Bonish, 1986). The effects are similar on both grasses and clovers (Sithamparanathan et al, 1986).

Table 2. Maximum and minimum deviations from the mean application rate (Mean = 100) and % of land receiving less than half target seed application rate, for paddock distributions modelled from single swath pattern of each seed type – seed and fertilizer mixed fixed wing aircraft applied (Macfarlane et al 1987)

	Distribution % of mean application rate			
	White Clover	Perennial ryegrass	Cocksfoot	Fertiliser
1.6 km/h cross wind				
Maximum	237	300	214	270
Minimum	22	0	4	4
% area receiving less than half application rate	42	55	38	60
8.6 km/h cross wind				
Maximum	158	140	136	163
Minimum	30	56	66	66
% area receiving less than half application rate	11	0	0	0
12.6 km/h cross wind				
Maximum	137	138	149	181
Minimum	56	64	77	48
% area receiving less than half application rate	0	0	0	0

Grazing management post-oversowing

Monitoring: Germinating seedlings in oversown areas should be observed weekly for three to four months for insect or slug damage.

Grazing: Post-sowing management must be aimed at preventing 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 seedlings to develop a high number of stolons and tillers. At Whatawhata a trial showed that failing to regularly graze post oversowing reduced the numbers of established white clover seedlings by more than half on easy and steep slopes (Table 3). To ensure that competition from resident plants is reduced, oversowing should be followed by relatively tight set stocking e.g. maintenance of about 1000 kg DM/ha herbage mass, or by frequent on-off grazings e.g. maximum pre-grazing herbage mass of 1200-1300 kg DM/ha and post-grazing residual of 700-800 kg DM/ha for at least 12 months. The effect of this is that post-oversowing rotations need to be nearly twice as frequent as the normal farm rotation. These management recommendations are not rigid, but oversown paddocks must receive special treatment. Thus, oversown areas cannot be included in the normal winter rotation for ewes, or set-stocked at usual stocking rates from May to February.

Table 3. Number of white clover stolon growing points at 12 weeks post oversowing with two grazing regimes (Macfarlane & Bonish, 1986)

	Regular grazings	Grazed every second rotation	Reduction stolon density
Easy slope	545	265	53.1%
Steep slope	497	231	54.6%

Summary and practical guidelines.

1. Hard grazing before oversowing is essential.
2. Spraying with a sward suppressant, e.g. glyphosate or paraquat:diquat (6:1), is necessary to maximise seedling establishment.
3. Reducing the water rate with herbicide will result savings to development costs, however this may result in slightly more completion from the existing sward on easier slopes.
4. Shepherding stock across slopes is a practical method of increasing soil disturbance, seed/soil contact and establishment.
5. Post-oversowing grazing management must maintain a low level of competition, graze at 1000-1200kg DM/ha to 700-800kg DM/ha. Such management should be maintained for 12 months.
6. Keep oversowing to an area that you can manage.

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