FILLING UP SPACES BY SURFACE SEEDING

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Summary

Despite a gradual swing to selective herbicides for barley grass (*Hordeum murinum*) control, many situations still demand surface reseeding in an attempt to discourage reinfestation or other weed ingress. The techniques of oversowing, overdrilling and direct drilling are reviewed and the functional requirements of machines listed. Post-drilling covering is suggested as being important, particularly when sowing into pugged surface conditions and under a moisture stress. Because of the widely spaced areas and remoteness of many barley grass infestations, farmers may be forced into adopting makeshift reseeding techniques with inadequate machinery where contractors are uneconomic or impractical.

INTRODUCTION

IN CONSIDERING the question of how or with what to reseed barley grass (*Hordeum murinum*) areas, it must first be appreciated that this is an area of investigation which has occupied the time of relatively few workers to date. Nevertheless, it is probable that many of the critical considerations involved in these specific situations are little different from the more general criteria on which most surface seeding recommendations are based.

The question itself of whether or not it is advisable to overdrill or surface-seed treated areas, hinges around the degree of eradication of the total vegetation achieved and/or the selectivity of herbicides used. With less selective chemicals there can be little point in eliminating the weed and pasture unless some effort is made to repopulate the area with a vigorous forage species which will compete strongly with reintroduced or reseeding barley grass. Truly selective chemicals which will take out only the unwanted species may well obviate the need to consider reseeding, although often the resident species has been reduced in density or vigour by competition from a heavy infestation of barley grass and may thus still benefit from post-treatment seed application. Further consideration of this managerial decision, however, is beyond the scope of this review and has been covered in part by Palmer and Williams (1970). Suffice it to assume that, where reseeding is to be considered, it should be undertaken only with a keen appreciation of the fundamental requirements of germinating seed in a sometimes marginal environment.

It should be pointed out also that it is not intended to review situations where barley grass has become a general infestation requiring ploughing and complete reseeding of a pasture under clean seedbed conditions. Comments on pertinent considerations in this eventuality were given by Baker (1969).

METHODOLOGY

Three possible methods of introducing a desirable pasture or forage species must be considered. These are:

- (1) Oversowing—broadcasting seed *on to* the ground surface with or without competition suppression by chemical or mechanical means.
- (2) Overdrilling—mechanical placement of seed in discrete rows *into* otherwise physically undisturbed soil.
- (3) Direct drilling—overdrilling where the surface vegetation has been suppressed by herbicide application.

Of the three listed, it is becoming increasingly apparent that direct drilling offers the most promise and recent work has indicated that considerable gains can be made by this method.

Nevertheless, there will always remain areas and situations where both oversowing and overdrilling will be required, if not wholly desired.

OVERSOWING

Many of the annoying and propagating infestations of barley grass occur under overhanging trees where passage of machinery is difficult. In this case, oversowing may be the only reseeding technique possible. Every effort should be made to maximize the chance of establishment of the introduced species. This may range from spraying and/or stock concentration both before and for a short time after seeding, to the use of inoculated or pelleted seed (During, *et al.*, 1963). Even under ideal conditions, however, oversowing will seldom approach either of the more precise methods of mechanical introduction as far as establishment is concerned (Cross and Glenday, 1956).

OVERDRILLING

Overdrilling has been suggested in the past as a means of introducing vigorously competitive species into otherwise barley grass dominant areas or swards. To be successful, such a technique presupposes that competition has previously been reduced to a minimum either by stock where possible, or by close cutting with a suitable mower. One favourable characteristic of barley grass in this respect is that its earliest positive identification is often at the green seed stage in autumn. Fortunately, autumn overdrilling benefits from better moisture conditions and weakened competition (especially from clovers) at this time of the year. Further competition removal must nevertheless be provided by the overdrilling machine during the seeding operation at least to the extent of $\frac{3}{4}$ in. either side of the introduced seed. The functional requirements of a successful overdrilling machine were listed by M. W. Cross (unpublished data).

The drilling machine should leave a plant-free track 1½ in. to 2 in. wide and of uniform shallow depth through all types of vegetative cover and soil conditions.

It should open the furrow continuously from one end of the field to the other with individual mounted coulters.

It should distribute the seed and fertilizer uniformly along the furrow at the required rates and deal with a wide range of seeds.

Loose or standing surface vegetation and roots or stones should not cause blockages or damage.

If possible, the seed should be covered with soil and the machine should have a reasonably high working speed.

At the present stage of development, no currently available machine in New Zealand has successfully mastered the somewhat contradictory requirements of removing competition in a 1½ to 2 in. wide strip and placing the seed in a desirably shaped groove or furrow suitable for germination under arduous conditions. Perhaps the most satisfactory machines to date employ a dished disc operating at a slightly negative tilt angle and a 15° disc angle, or alternatively hoe coulter drills which provide a degree of "bursting" in such a manner that the heaved up sides of the groove do not readily fall back over the seed and "heal" giving continued competition from the resident species.

DIRECT DRILLING

As many control measures centre around at least the partial suppression of barley grass with suitable herbicides, it is not unreasonable that direct drilling appears to offer a more complete competition removal combined with the benefits of mechanical placement of seed in the ground than does either oversowing or overdrilling. In short, the herbicide application removes the machine's mechanical obligation to suppress competition and thereby alters the first listed functional requirement to that of opening a narrow groove or furrow of uniform shallow depth through all types of vegetative cover and soil conditions. All other previously listed requirements apply equally as well to direct drilling machines as they do to overdrilling.

Machines have been developed for use specifically after chemical application, but the merits and demerits of their various coulter assemblies for seed placement will not be resolved until a great deal more investigation is undertaken into this aspect. Nevertheless successes have been obtained under a range of conditions.

B. P. O'Connor (unpublished data) made the following mean visual assessments of percentage establishment of direct drilled lucerne (*Medicago sativa*) and phalaris tuberosa (*Phalaris tuberosa*) following paraquat treatment of barley grass infestations in Hawke's Bay (Tables 1 and 2). All drilling was undertaken with narrow hoe coulters, preceded by vertical flat discs as displayed by a popular make of seed drill currently available in New Zealand.

With chemicals of extended soil residual life, the interval between spraying and drilling will, of course, be important. However, the permanency of the barley grass kill may also be increased with consequent improvement in establishment of the introduced species, provided the latter is reasonably tolerant to the chemical. For example, in the autumn 1970 observations reported above, a residual additive to the spray increased the observed percentage establishment of phalaris tuberosa to 70 to 80%, but gave no noticeable improvement to lucerne.

TABLE 1: EFFECT OF VEGETATION SUPPRESSION ON SURVIVAL OF INTRODUCED SPECIES

(Assessed two months after treatment in spring, 1969)

					Mean Percentage Establishment Paraquat Treated	Mean Percentage Establishment Unsprayed, but Drilled Control
Lucerne	....	....	....	....	20-30%	0%
Phalaris tuberosa	....	....	....	....	20-30%	0%

TABLE 2: EFFECT OF VEGETATION SUPPRESSION ON SURVIVAL OF INTRODUCED SPECIES

(Assessed six months after treatment in autumn 1970)

					Mean Percentage Establishment Paraquat Treated	Mean Percentage Establishment Unsprayed, but Drilled Control
Lucerne	....	....	....	....	20%	0%
Phalaris tuberosa	....	....	....	....	40%	0%

*H = Harrowed; UH = Unharrowed.

COVERING

As a significant proportion of barley grass infestations occur on camping areas in dry spots, it is not unreasonable to place special emphasis on the covering of seed as a means of discouraging desiccation or delayed germination of the introduced species. In addition, many of these camping areas become roughened through pugging during wet periods, making seed survival even more difficult, particularly in relation to the better adapted barley grass seed population.

A recent trial at Massey University (Table 3) under dry conditions, emphasized the benefit of covering using a simple but specially developed bar harrow to scuff the loosened soil arising from the passage of the drill and place it back in the grooves or furrows from whence it came (Baker, 1970). Such a harrow is not well adapted to covering seeds sown by drills leaving a discrete and relatively undisturbed seed groove. Difficulty in covering seed sown at shallow depths by such drills would suggest that they might be less applicable to barley grass reseeding than those producing appreciable soil disturbance. On the other hand, the latter action might also be expected to stimulate more weed seed germination than the former. Such thoughts, however, must remain somewhat speculative until further work on this aspect has been completed.

Although the above data were not obtained from a barley grass area and were from a short duration experiment only, the severe moisture stress at the time emphasized the benefit of adequate covering of the seed, particularly on previously pugged ground. Such a recommendation might reasonably be extended to apply to shallow sown species on any roughened area likely to be under a moisture stress.

TABLE 3: DIRECT DRILLED CHOUMOELLIER (*Brassica oleracea*)
EMERGENCE DENSITY

Plants per Square Foot

Ground Con- ditions	Sampling Date							
	3 wk post sowing		3½ wk post sowing		4½ wk post sowing		Means	
	H*	UH	H	UH	H	UH	H	UH
Rough sur- face (2-3 in. joor dæp 2.07 marks)	0.88	0.88	2.44	1.32	1.63	1.13	2.04aA	1.10bA
Reasonably smooth surface	1.19	0.76	1.88	1.74	1.38	1.01	1.48abA	1.14bA

*H = Harrowed; UH = Unharrowed.

On the other hand, a similar trial in December 1969, which experienced good rain soon after sowing, gave only a small and insignificant gain in favour of bar harrowing at the time of sowing. In each case narrow hoe coulter with preceding vertical flat discs were used to drill the seed.

GENERAL

Whatever the merits and demerits of the various surface-seeding techniques and machines, the problem is likely to be dictated by managerial considerations. While some of the better direct drilling machines are contractor owned and operated because of their complexity and cost, the nature and extent of barley grass infestations on many farms will preclude the economic use of contractors for reseeding. Thus many farmers will be forced into makeshift overdrilling and direct drilling techniques and machines, with a consequent lessening of the chances of overall success. Fencing, too, is difficult on ill-defined areas, so that adequate grazing management of reseeded areas is often impossible. Any surface seeding undertaken is "short cut" by necessity and design and is therefore less tolerant of sub-optimal conditions and techniques than is the case with conventional clean seedbed cultivation and resowing.

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