Management practices to ensure minimum contamination in seed crops when changing cultivars of perennial ryegrass (*Lolium perenne* L.)

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Abstract

Recommendations ensuring minimum contamination between perennial ryegrass (*Lolium perenne* L.) seed crops when changing cultivars are not available. A trial was established to investigate the management practices necessary to minimise contamination. When volunteer ryegrass plants were eradicated in spring, no further germination was noted, and no buried seed was found after two years. When volunteer plants were allowed to reseed, direct drilling appeared to reduce the volunteer ryegrasses more successfully in year one than conventional cultivation techniques. However, by the end of the second year it was apparent that the cultivation techniques were more effective than direct drilling. The results emphasise the necessity for good hygiene practices in ryegrass seed crops.

Additional keywords: *buried seed, direct drilling, cultivation*

Introduction

Seed purity has been of concern for many years (Rowarth *et al.*, 1993). The advent of high- and low-endophyte perennial ryegrasses (*Lolium perenne* L.), where the same cultivar can exist in both endophyte states, has provided a further emphasis for the importance of purity. Ryegrass plants and seeds of one cultivar with a high-endophyte status resemble those of the same cultivar with a low-endophyte status, but may have different end-uses. Similarly, seeds of different cultivars (of which there are 18 available in New Zealand at present) are often difficult to tell apart. Demand for different cultivars of ryegrass is increasing, but land available on which to grow ryegrass is not. The land available has generally been used for ryegrass seed production already, and there is concern that buried ryegrass seed may cause contamination within a new cultivar crop. The seed producer must be confident that cultivation practices provide complete control of volunteer ryegrass germination. Current MAF Qual regulations state that a paddock must not have been used to grow any other ryegrass during the previous two harvest seasons; this trial was established with the aim of identifying the cultural practices necessary prior to ryegrass cultivar change which will ensure zero contamination by the previous crop.

Materials and Methods

The trial site was at AgResearch Lincoln, Canterbury, on a Wakanui silt loam which had not grown ryegrass or been grazed by stock in the previous eight years. Buried seed was examined in ten soil cores per split-plot taken to 300 mm before the trial started and after the second harvest.

The trial was a split-plot, randomised block design with 6 replicates and a full plot size of 100 m^2. The treatments were two seed spreading rates (225 or 450 kg/ha) applied in January, reflecting the measured seed lost between and within windrows during the harvest of four paddocks of perennial ryegrass during December/January 1991/2 (Archie unpub. data); two endophyte levels (82 % or 7 % infection) and three cultivation practices (autumn direct drilling, winter cultivation or spring cultivation).

- Autumn direct drilling involved application of glyphosate (2 l/ha) plus Pulse plus Glufosinate-ammonium (6 l/ha) in early March. In late March simulated (i.e., no seed) direct drilling plus application of fertiliser occurred.
- Winter cultivation involved application of glyphosate (2 l/ha) plus Pulse in early May, ploughing in late May, two grubbing passes, harrowing and rolling in

early June plus simulated drilling and fertiliser application in late June.

- Spring cultivation involved grubbing in early March, ploughing in late March, two grubbing passes, harrowing and rolling in early September, and simulated drilling plus fertiliser in mid-September.

Half of each plot was sprayed with paraquat (2 l/ha) after scoring numbers of plants in September and October to allow sequential germination to be examined (data not presented). This split-plot treatment simulated total volunteer seedling control. Plant numbers on unsprayed half-plots were counted prior to imposing cultivation treatments (in twenty 0.25 cm quadrats per plot) and just before anthesis (late November) using ten 0.25 m^2 quadrats per plot. Seed yield was measured at the end of the first and second years in ten 0.25 m^2 quadrats per plot. This seed was returned to the area from which it had been harvested, except for the portion used for germination measurement (ISTA, 1993); unharvested seed was allowed to return to the soil as recontamination for year two. (The same practice was repeated after harvest in year two as the trial is being continued.)

Results and Discussion

No buried ryegrass seed was found in the trial plots before the trial started.

No significant differences were found between plant numbers and seed yields from high- and low-endophyte plots (data not presented).

Plant numbers before the cultivation and herbicide treatments were applied averaged 5328 m^2 and 10084 m^2 over all the plots for the low and high spreading rates respectively. This was a 50 % survival from the potential number of plants from the applied seed. Plant numbers in November in year one reflected spreading rate (Table 1) and there were significantly more plants on the winter- and spring-cultivated plots than on the autumn direct-drilled plots. Winter-cultivation treatments had a significantly greater yield than spring-cultivated treatments, which in turn yielded significantly more than autumn direct-drilled treatments. However, this could in part reflect the fact that all treatments were harvested at the same time, whereas the different treatments could have affected harvest date. Germination of this seed was 98 %.

In year two (Table 2) volunteer plant numbers just before anthesis were reduced in both the cultivation treatments, but had changed little in the autumn direct-drilled plots. Plant numbers were significantly greater in autumn direct-drilled plots than in conventionally-cultivated plots; this was reflected in significantly higher seed yield/m^2 in direct-drilled plots.

In the plots where all seedlings were sprayed out at intervals, no germination was noted after November in the first year. No plants were allowed to achieve maturity and set seed. After two years, buried seed sampling revealed no ryegrass seed contamination in the soil.

Table 1. Effect of cultivation treatment and quantity of seed spread on plant number and subsequent seed yield in year one.

Cultivation	Seed spreading rate (kg/ha)	Plants/m^2 20/11/92	Seed yield (g/plant)	Seed yield (g/m^2) 11/1/93
Autumn	450	7.7	0.34	2.6
	225	5.4	1.50	8.0
Winter	450	16.4	1.93	31.6
	225	8.3	2.10	17.2
Spring	450	17.8	0.79	14.1
	225	11.1	0.95	10.6
Significance		**	**	**

Table 2. Effect of cultivation treatment and quantity of seed falling from volunteer plants, on plant number and seed yield in year two.

Cultivation	Seed falling rate (kg/ha)	Plants/m^2 24/11/93	Seed yield (g/plant)	Seed yield (g/m^2) 12/1/94
Direct drill	26	8.8	2.30	20.2
	80	6.3	2.50	15.8
Winter	316	2.0	0.95	1.9
	172	1.4	0.79	1.1
Spring	141	3.8	1.10	4.2
	106	3.2	2.20	7.0
Significance		**	**	**

Conclusions

MAFQual requirements for first generation seed production allow only one ryegrass contaminant per 10 m x 1 m quadrat. These results show that although the

three cultivation and spray treatments reduced plant numbers and subsequent reinfection, none of them could result in a crop which could comply with MAFQual hygiene regulations within one year. The recontamination was sufficient to have the potential for 1000 plants/m^2 (10000 plants/quadrat). However, where volunteer seedling control was absolute, no germination occurred after November of the first year, and no buried seed was found in the soil after the second year.

Results from this trial emphasise the necessity for good crop hygiene. Potential problem plants should be controlled during the part of the rotation where herbicides are available that will not damage the current crop. In the case of ryegrass cultivar change, the availability of suitable herbicides is likely to be of more importance than the cultivation technique chosen.

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References

ISTA. 1993. International rules for seed testing. Supplement to *Seed Science and Technology* ***21***, 74-187

Rowarth, J.S., Rolston, M.P. and Johnson, A.A. 1993. Weed seed contamination: use of a seed testing database to identify processing limitations. *Proceedings of the International Grasslands Congress* ***17***, 1872-1874.