Weed seeds in white clover and ryegrass seedlots: an aspect of seed quality

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Abstract

New Zealand herbage seed is exported around the globe. Quality control is effected by the New zealand Seed Certification Scheme; computerised records of certified crops enabled establishment of a weed seed contamination database. Surveying of the database in 1993 and 1994 revealed the main problem weeds in white clover (*Trifolium repens*) seed crops to be field madder (*Sherardia arvensis*) and chickweed (*Stellaria media*), while those in ryegrass (*Lolium perenne*) seed crops are soft brome (*Bromus mollis*) and vulpia hair grass (*Vulpia sp.*). Identification of problem weeds has enabled advice to be given to the industry on targeting weeds during appropriate parts of the crop rotation, and modifying cultivation and harvesting.

Additional key words: *Certification, contamination, database, harvesting, herbicide resistance,* Lolium perenne, *purity,* Trifolium repens, *weed seeds.*

Introduction

New Zealand herbage seed is exported to more than forty countries, the major markets being Australia, the European Community and the United States. This export trade generates NZ $40 million a year. There is potential for expansion overseas but only if New Zealand maintains or improves seed quality.

Weed seed contamination is an important aspect of seed quality and can restrict the export potential of the seed. The New Zealand Seed Certification Scheme, run by the Ministry of Agriculture and Fisheries (MAFQual), ensures that any seed which meets certification standards is of high genetic and physical purity. Minimum pure seed for first generation seed is 97 % for white clover and 98 % for ryegrass, with only 0.5 % weed seed allowed in either crop. For basic seed, the requirements are even more stringent (Table 1). Eliminating weeds in a crop is important not only for certification and quality standards, but also because weed competition and harvesting difficulties can reduce yields in the seed crop. The computerised database, maintained by the Official Seed Testing Station, has enabled weed seed contamination in clover and ryegrass seedlots to be surveyed, thus allowing problem weeds to be identified and monitored over time. Note that the data presented in the following sections refer to the percentage of seedlots containing contaminants. These contaminants amount to less than 0.5 % of any individual seedlot (otherwise it fails certification).

Materials and methods

Seed contamination results of white clover (1715 seedlots in 1993; 934 in 1994) and ryegrass (2537 in 1993; 1563 in 1994) sent to the Official Seed Testing Station were surveyed. Results were compared with data from previous years where available.

Table 1. Purity standards for basic and first generation white clover and ryegrass seedlots.

	white clover	ryegrass
Basic		
Minimum pure seed (%))	99.0	99.0
Maximum other crop seed (%)	0.3	0.3
Maximum weed seed (%)	0.2	0.2
First Generation		
Minimum pure seed (%))	97.0	98.0
Maximum other crop seed (%)	0.5	0.3
Maximum weed seed (%)	0.2	0.2

Results and Discussion

Field madder (*Sherardia arvensis*) and chickweed (*Stellaria media*) were the major contaminants in white clover (Table 2), occurring in about 60 % of all seedlots tested in 1993. Fathen (*Chenopodium album*), and scarlet pimpernel (*Anagallis arvensis*) occurred in 47 % and sheep's sorrel (*Rumex acetosella*) in 37 % of seedlots tested. Comparison with a past survey in 1989 (Rowarth *et al.* 1990a) indicated an encouraging reduction in field madder contamination (from 84 %) and a similar reduction in sheep's sorrel (from 53 % of the samples contaminated to 37 %). However, comparison also revealed a marked increase in five species which were not recorded in 1989 as they were considered to be insignificant (present in amounts less than 0.2 % contamination). These were narrow-leaved plantain (*Plantago lanceolata*), clustered clover (*Trifolium glomeratum*), spurrey (*Spergula arvensis*), striated clover

Table 2. Proportion (%) of white clover seedlots containing weed seed contaminants (by species) analysed at the Official Seed Testing Station, Palmerston North.

Botanical name	Year 1989 [1]	1993 [2]	1994 [3]
Sherardia arvensis	84.4	61.9	67.0
Stellaria media	65.9	62.9	58.9
Chenopodium album	53.8	47.2	49.0
Rumex acetosella	53.0	36.4	37.1
Anagallis arvensis	43.0	47.5	47.2
Sisymbrium officinale	13.8	14.1	14.2
Silene gallica	11.9	14.6	18.2
Polygonum aviculare	9.7	16.3	10.2
Viola sp.	9.5	9.8	14.0
Cerastium sp.	2.6	2.2	1.3
Anthoxanthum odoratum	2.6	4.4	3.0
Barbarea sp.	1.5	0.5	0.5
Capsella bursa-pastoris	0.6	1.6	1.5
Amaranthus sp.	0.2	0.6	0.3
Plantago lanceolata	0.2	20.5	16.9
Trifolium glomeratum	0.2	20.9	13.5
Rumex sp.	*[4]	19.5	14.4
Spergula arvensis	*	18.9	14.0
Trifolium striatum	*	4.3	3.9

[1] Data from 537 white clover seedlots
[2] Data from 1715 white clover seedlots
[3] Data from 934 white clover seedlots
[4] * under 0.2 % in 1989

(*Trifolium striatum*) and docks (*Rumex* spp.). Narrow-leaved plantain and clustered clover were formerly a problem, which was solved with the use of phenoxy-compounds such as MCPB and 2,4-D Hi ester. Increase in prevalence suggests that the development of herbicide resistance is a possibility; any species that increases markedly within a short time span should be monitored.

Analysing the clustered clover data further revealed that prevalence in the industry standard, Grasslands Huia, was much lower in 1993 (14.4 %) than for 'other cultivars' (30.5 %) many of which are imported for multiplication for overseas requirements. In 1994 the difference was not so dramatic (11.1 % in Huia and 18.4 % in 'other' cultivars) but was still considerable. It is possible that the clustered clover is being imported in the seedlots, but it is more likely that the cultivation practices used for the multiplications are the cause of the problem. The overseas cultivars are usually autumn-sown for harvesting the following summer, in contrast to Huia which is spring-sown for harvesting 15 months later. This means that Huia can have herbicide application to remove weeds such as clustered clover when the overseas cultivars are still too small for spraying. This discovery has enabled recommendations to be made to the seed industry.

The most prevalent contaminants in ryegrass seedlots (Table 3) were the grass weeds soft brome (*Bromus mollis*), vulpia hair grass (*Vulpia sp.*) and annual poa (*Poa annua*). Soft brome decreased slightly since the first survey in 1962 (Rowarth *et al.*, 1990b), but was still present in over 70 % of the samples. Vulpia hair grass had decreased from 70 % in 1984 to 50 %. The low contamination in 1989 probably reflects the drought conditions experienced in that year. Annual poa contaminated about 40 % of seedlots but contamination was markedly less in 1989 (a drought year). It is possible that in that year the poa had seeded before ryegrass harvest and the drought prevented a second generation. Chickweed (*Stellaria media*) and field madder were the worst non-grass contaminants. Chickweed has consistently appeared in around 25 % of seedlots since 1989, a reduction from 35 % in 1984. Field madder was generally present in 20 - 30 % of the samples; the increase to 36 % in 1994 could be related to the wet season and consequent late harvest that Canterbury experienced. Speedwell (*Veronica* sp.) and field pansy are of concern in that they have increased in prevalence markedly over the past few years. In 1984 field pansy was noted as being on the increase - prevalence has increased almost three-fold since then. Equally, speedwell did not rate a mention in 1989, but was present in 24 % of seedlots in 1994. Mouse-eared chickweed (*Cerastium* sp.) showed marked annual fluctuations; wet years enhanced contamination whereas drought conditions (1988/89) reduced contamination markedly. As with the white clover results, it is possible that the increases seen in prevalence of some of these weed species indicates an increase in herbicide resistance, or that continued use of one herbicide is changing the weed flora to species not readily controlled by that herbicide.

Weeds are a problem in seed production because of three main factors:

- they are widespread in the field
- they have survived herbicide treatment
- their seeds have physical characteristics which render them difficult to separate from the crop seed without engendering losses of the crop seed.

Table 3. Proportion (%) of perennial ryegrass seedlots containing weed seed analysed at the Official Seed Testing Station, Palmerston North.

Botanical name	Year 1989 [1]	1993 [2]	1994 [3]
Bromus mollis	67.3	77.1	76.7
Vulpia sp.	28.5	49.2	52.9
Poa annua	22.4	41.2	35.2
Stellaria media	26.1	26.2	24.7
Sherardia arvensis	29.5	22.7	35.8
Veronica sp.	*[4]	19.0	24.1
Viola sp.	10.2	17.5	28.6
Cerastium sp.	4.5	12.8	12.2
Capsella bursa-pastoris	19.1	12.7	14.9
Anthoxanthum odoratum	4.6	9.2	6.0
Polygonum aviculare	10.2	6.9	7.4
Cynosurus echinatus	*	6.8	6.7
Erodium cicutarium	4.2	6.8	6.5
Aphanes sp.	*	6.3	5.7
Glyceria sp.	7.0	5.5	4.0
Phalaris minor	3.3	5.4	7.8
Rumex sp.	3.8	5.1	8.2
Galium aparine	*	4.8	6.9
Brassica sp.	*	4.5	4.7
Avena fatua	6.1	3.7	2.4
Trifolium striatum	5.6	3.2	1.7
Juncus bufonius	*	3.1	1.2
Sisymbrium officinale	6.4	3.0	3.5
Erodium moschatum	*	2.9	4.0
Holcus lanatus	*	2.8	1.5
Lapsana communis	2.5	2.8	3.5
Plantago lanceolata	1.7	1.3	0.5
Lamium sp.	*	1.1	1.0
Agropyron repens	*	1.0	1.2
Alopecurus geniculatus	*	0.8	0.6
Briza minor	*	0.8	0.3
Anthemis arvensis	*	0.5	0.2

[1] Data from 1289 ryegrass seedlots
[2] Data from 2537 ryegrass seedlots
[3] Data from 1563 ryegrass seedlots
[4] * under 0.2 % in 1989

The database has established which weeds are surviving herbicide treatment. Working with the seed grower, scientists are able to give advice on chemicals to use in anticipation of the desired crop, i.e., problem weeds can be controlled in a part of the rotation where chemicals are available which will not affect the current crop. This requires forethought on the part of the seed grower. Simultaneously, the database has been used to inform chemical companies of problem weeds. This has resulted in several large-scale herbicide trials involving the chemical industry and AgResearch.

Physical similarity is a major factor in contamination of white clover by field madder and sheep's sorrel, and ryegrass by soft brome and hair grass. Examination of seedlots revealed that it was damaged seeds (i.e., field madder without its crown, sheeps' sorrel without its coat, and soft brome and hair grass without awns) that were causing the problem. Seed growers were advised to reduce thrashing in harvesting (and thus minimise damage); in the last two years, a reduction in contamination by these species has been evident.

Meeting the certification quality control standards takes time and money, but ensures that New Zealand seed is acceptable around the globe. Around 10 % of seedlots of white clover and ryegrass are rejected at the laboratory examination stage every year due to weed seed contamination. In the last few years the rejection percentage has not changed, but the amount of weed seed that has to be dressed out has increased. As farmers pay for seed dressing on the inboard weight, this is costing them money. Use of the database has not changed certified seed quality (which is established by the process of certification) but will assist growers of herbage seed in meeting those standards with less cost to themselves.

Conclusions

These surveys have enabled problem weeds to be identified, thus allowing them to be targeted at a stage in the crop rotation where herbicides that destroy the weed will not also destroy the crop. Advice on other management practices such as sowing date and harvesting has also been formulated. The surveys have also identified weeds which may be developing herbicide resistance; this can be tested before a major problem occurs. Thus the database is providing information that, used intelligently, will enable New Zealand herbage seed producers to maintain or improve seed quality at reduced cost to themselves.

References

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