WEED SEED OCCURRENCE IN RYEGRASS SEEDLOTS

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SUMMARY

Weed seeds are the major reason for perennial ryegrass (*Lolium perenne*) seed crops being downgraded or rejected from certification. An analysis was made of the occurrence of weed species in 1289 perennial ryegrass seedlots tested at the Official Seed Testing Station, Palmerston North. The most commonly occurring species were *Bromus mollis*, *Sherardia arvensis*, *Vulpia* spp., *Stellaria media*, *Poa annua* and *Capsella bursa-pastoris*. Results are compared with a 1984 survey and differences discussed. The percentage occurrence of seven specified undesirable weeds including *Avena fatua*, *Carduus nutans* and *Amsinckia calycina* is reported.

INTRODUCTION

Herbage seed produced in New Zealand has a farm gate value of about \$NZ40 million (Rolston *et al* 1988). The herbage seed industry supplies not only domestic requirements but also exports seed (14,000 t in 1987; 9,600 t in 1988) to more than 30 countries, the major markets being the European Economic Community (EEC), Australia and the USA. There are good prospects for expanding this export trade, but it will be possible only by maintaining high seed quality and competitive prices.

One of the main problems in herbage seed production is the ingress of weeds, particularly grass weeds. This has been recognised for many years. In 1912 Cockayne stated that "one of the most serious problems confronting the farmer of this Dominion is the adequate control of noxious weeds". He then exhorted farmers to sow pure seed explaining that most of the Dominion's weed problem came from imported impure seed. Four years later he described the occurrence of extraneous seeds in commercial samples of agricultural seed on the New Zealand market (Cockayne 1916). Soft brome (*Bromus hordeaceus*) and vulpia hair grass (*Vulpia* spp.) were extremely common contaminants, as were narrow-leaved plantain (*Plantago lanceolata*), Yorkshire fog (*Holcus lanatus*) and fathen (*Chenopodium album*).

Wild oats (*Avena fatua*), stinking mayweed (*Anthemis cotula*), rayless chamomile (*Matricaria matricarioides*) and ox-eye daisy (*Chrysanthemum leucanthemum*) were identified by Cocks (1969) as increasing problems in herbage seed production. Like Cockayne, his message was "sow clean seed".

Seed produced in New Zealand is subject to strict quality controls. The certification scheme run by the Ministry of Agriculture and Fisheries (MAF) ensures that any seed which meets certification standards is of high genetic and physical purity (Table 1). Weed seed within a seedlot has been the major reason for ryegrass seedlines being downgraded or rejected from certification in the past (Rolston *et al* 1985).

The survey reported here examines the extent and nature of weed seed contamination in 1989.

TABLE 1: Purity standards for perennial ryegrass.

	Basic seed	1st Generation
Minimum pure seed	99.0%	98.0%
Maximum other crop seed	0.3%	1.0%
Maximum weed seed	0.2%	0.5%

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METHOD

The frequency and type of weed seeds in perennial ryegrass seedlots were analysed in 1289 purity testing results issued by the Official Seed Testing Station in 1989. Results of this survey were compared with those from 1984 (Rolston *et al* 1985) and 1962 (Johnston 1962).

RESULTS AND DISCUSSION

Twenty-six of the weed species whose seeds occur frequently in ryegrass seedlots are listed in Table 2. The table shows the percentage of samples in which the seeds occurred during purity analysis (Young *et al* 1984) at the Official Seed Testing Station in 1989, 1984 and 1962. The data comes from isolated years and therefore does not necessarily reveal true trends. With that proviso, the fact that changes in occurrence of most weed species is small gives validity to the exercise.

In the 1989 survey, soft brome occurred in nearly 70% of all seedlots tested, while field madder, vulpia hairgrass, chickweed, annual poa and shepherd's purse each occurred in over 19%. The frequent occurrence of these seeds is a reflection not only of their being widespread in the field (Healy 1969; Webb *et al* 1988) but also of the fact

TABLE 2: Occurrence (%) of weed species in perennial ryegrass seedlots analysed at the Official Seed Testing Station in 1989¹ (1289 seedlots), 1984² (1445 seedlots) and 1962³.

Common name	Botanical name	Occurrence (%)		
		1989	1984	1962
soft brome	<i>Bromus hordeaceus</i>	67.3	76.7	85-90
field madder	<i>Sherardia arvensis</i>	29.5	29.1	20-25
vulpia hairgrass	<i>Vulpia</i> spp.	28.5	40.5	70-75
chickweed	<i>Stellaria media</i>	26.1	35.1	— ⁴
annual poa	<i>Poa annua</i>	22.4	39.9	—
shepherd's purse	<i>Capsella bursa-pastoris</i>	19.1	16.8	—
wireweed	<i>Polygonum aviculare</i>	10.2	3.2	—
field pansy	<i>Viola arvensis</i>	10.2	11.2	—
sweet grass	<i>Glyceria</i> spp.	7.0 ⁵	13.7	—
sheep's sorrel	<i>Rumex acetosella</i>	6.9	10.0	25-30
hedge mustard	<i>Sisymbrium officinale</i>	6.4	5.1	—
straited clover	<i>Trifolium striatum</i>	5.6	14.5	5-10
sweet vernal	<i>Anthoxanthum odoratum</i>	4.6	10.7	20-25
mouse-ear chickweed	<i>Cerastium</i> spp.	4.5	27.7	10-15
storksbill	<i>Erodium</i> spp.	4.2	<3.0	10
docks	<i>Rumex</i> spp.	3.8	5.6	10-15
fathen	<i>Chenopodium album</i>	3.7	<3.0	—
lesser canary grass	<i>Phalaris minor</i>	3.3	12.2	—
clustered clover	<i>Trifolium glomeratum</i>	2.5	3.0	—
nipplewort	<i>Lapsana communis</i>	2.5	3.0	—
hawkbit	<i>Leontodon taraxacoides</i>	1.7	4.8	—
narrow-leaved plantain	<i>Plantago lanceolata</i>	1.7	4.8	25-30
tall oat grass	<i>Arrhenatherum elatius</i>	0.8	<3.0	—
prickly sow thistle	<i>Sonchus asper</i>	0.5	<3.0	—
willow weed	<i>Polygonum persicaria</i>	0.5	<3.0	—
creeping buttercup	<i>Ranunculus repens</i>	0.3	<3.0	—

¹ Data from original tests of officially sampled seedlots of Droughtmaster, Ellett, Grasslands Nui, Grasslands Ruanui, Yatsyn and uncertified perennial ryegrass.

² Data from Rolston *et al* (1985).

³ Data from Johnston (1962).

⁴ — not available.

⁵ 43% of the seedlots in which *Glyceria* spp. seeds were found were grown in the Manawatu district.

that many of the seeds have physical characteristics similar to ryegrass seeds which makes it very difficult to remove them from a seed line without incurring heavy losses of good seed (Hartley 1969). This is particularly the case with seeds of grass weeds such as soft brome or vulpia hairgrass and is exacerbated when hard threshing at harvest has caused breakage of awns and/or hairs (Young and Hampton 1987; O'Neill 1990).

However, grass weed contamination (particularly that of soft brome, vulpia hair grass and annual poa) has decreased considerably since 1962 (Table 2). Some broadleaved weeds have also decreased markedly in the last 4 years, e.g., chickweed, mouse-ear chickweed, narrow-leaved plantain and striated clover.

Improvements are associated with reduced amounts of second generation seed being entered for certification and the removal (on 1.1.87) of the "permanent pasture" grade from certification. The permanent-pasture certification was based solely on laboratory tests for perenniality (i.e., for ryegrass, the ultra-violet fluorescent test (Scott 1984)). There were no field requirements, which meant that farmers did not have to meet standards of weed control (or isolation distances) at this stage. Thus they were able to enter crops for certification at harvest, i.e., they were able to "catch-crop". Furthermore, seed crops failing to meet standards set for First and Second Generation were often entered for the permanent-pasture grade. The removal of the permanent-pasture grade has meant that seed production has moved away from "catch-croppers" to specialist growers, resulting in improved paddock selection and increased inputs (both of time and chemicals).

Field pansy and nipplewort were identified in 1985 (Rolston *et al*) as potential problems for seed growers. However, the current survey does not show any increase in contamination by these species since 1984. From the present survey the weeds that are causing problems, or have the potential to do so, appear to be chickweed, wireweed, storksbill, shepherd's purse and fathen, all of which are broadleaved weeds. As most, if not all, perennial ryegrass seed crops are sprayed for broadleaved weeds, the failure to control these species suggests herbicide resistance may be developing or that continued use of MCPA is changing the weed flora to species not readily controlled by MCPA. Control of these species may require the use of higher priced herbicides such as bentazone, or mixtures to replace MCPA and MCPB.

Only seven chemicals are registered or have label claim for weed control in ryegrass seed crops (Table 3); three are for controlling broadleaf seedlings, two are for wild oats, one for annual grasses and one for storksbill and mayweeds. In practice, farmers use a wide range of herbicides including many that have registrations for either pastures or cereals (Rolston *et al* 1985). More research is necessary to establish which chemicals are useful in ryegrass seed production, and a large, multi-company herbicide screening trial involving DSIR, MAF and AGCARM (Agricultural Chemicals and Animal Remedies Manufacturers of New Zealand) was started in autumn 1990.

The importance of weed seed contamination in downgrading or rejection from certification of ryegrass seedlots can be seen in Table 4. Of the 12.2% of seedlots which were downgraded or rejected during laboratory examination, 8.5% (i.e., 70% of total

TABLE 3: Herbicides with label claim for use in ryegrass seed crops (Foley pers. comm.).

Common name	Product name	Product rate (litres/ha)	Comment
bentazone	Basagran	2-3	mayweeds, chamomiles, storksbill
2,4-DB	various	2.5-3.5	seedling broadleaf
dicamba	various	.35-.7	seedling broadleaf
difenzoquat	Avenge	5	wild oat
ethofumesate	Tramat	10	barley grass and annual grasses
L-flamprop-isopropyl	Commando	6	wild oats
MCPA	various	2-3	seedling broadleaf

TABLE 4: Reasons for downgrading or rejection from certification of perennial ryegrass seedlots at laboratory examination, Official Seed Testing Station, 1989 (1317 seedlots) and 1984 (1228 seedlots).

	Seedlots downgraded or rejected (%)	
	1989	1984
Excess smooth brome	1.9	2.2
Excess other species	0.8	1.6
Presence of wild oat	5.7	2.7
Total due to weeds	8.5	7.2
Total due to other reason*	3.7	1.6
Total	12.2	8.8

*Downgraded or rejected because seedlot failed to meet pure seed standard (because of inert matter).

changes) were due to weed seed contamination. About 50% of changes were due to wild oats and 16% were due to smooth brome. In contrast, in 1984 82% of all changes were due to weed seed contamination, 31% to wild oats and 25% to smooth brome.

The occurrence in ryegrass seedlots of weeds designated undesirable by the New Zealand Agricultural Merchants Federation and the Official Seed Testing Station (Scott 1980; Young 1984) is shown in Table 5. The presence of seed of wild oat, nodding thistle or yellow gromwell within a seedlot results in automatic rejection from certification. Wild oat is the main single cause of change in certification status of ryegrass seedlots (Table 4) and the relatively large increase in incidence of wild oat contamination since 1984 (Table 5) is a serious problem. The incidence of contamination with thistle seed appears to be decreasing as is the incidence of yellow gromwell (which has been regulated against only since 1985 after a dramatic increase in its appearance in the early 1980's, particularly in Canterbury). Control of these two species is due in part to increased farmer awareness, plus spot spraying with phenoxy herbicides.

Weed seed contamination has implications not only for internal certification requirements, but also for export potential. Several of the commonly occurring or designated undesirable weed seed contaminants are included in the list of prohibited or restricted weeds in the seed quarantine regulations of other countries, preventing export to those destinations. The EEC will not import ryegrass seed containing *any* wild oats or more than 20 dock seeds per 60 g; Canada and some states in the USA restrict entry of any seed containing plantain; several USA states, including Oregon, will not import seed containing annual poa; Australia prohibits the entry of any seed containing yellow gromwell, nodding thistle or Californian thistle.

TABLE 5: Occurrence (%) of specified undesirable weeds in officially sampled certified and uncertified perennial ryegrass seedlots analysed at the Official Seed Testing Station in 1989 (1465 seedlots) and 1984 (1646 seedlots).

Common name	Botanical name	Occurrence (%)	
		1989	1984
wild oat	<i>Avena fatua</i>	6.1	2.2
barley grass	<i>Hordeum murinum</i>	1.2	2.3
scotch thistle	<i>Cirsium vulgare</i>	0.6	3.0
winged thistle	<i>Carduus tenuiflorus</i>	0.5	1.2
Californian thistle	<i>Cirsium arvense</i>	0.3	0.9
nodding thistle	<i>Carduus nutans</i>	0.3	0.4
yellow gromwell	<i>Amsinckia calycina</i>	0.1	0.6

CONCLUSIONS

Results from the 1989 survey show that one in 12 perennial ryegrass seedlots submitted for laboratory examination as part of the certification scheme are downgraded or rejected because of failure to meet weed seed standards. These downgradings or rejections occur after all the expenses of producing and cleaning the seed have been incurred and can drastically affect the sale of, and financial returns on, these seedlots (Rolston *et al* 1985). Although the rejection/downgrading figure of one in 12 is slightly better than that of one in 10 for the previous survey (Rolston *et al* 1985), overseas restrictions on quality control are becoming increasingly tight and it will become more and more difficult to export contaminated seed. The full potential for expansion in overseas markets will not be reached unless New Zealand herbage seed producers keep their seed clean.

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