POSTER SUMMARIES

Control of Common Chickweed (*Stellaria media (L) Vill.,*) in Autumn-Sown Ryegrass/White Clover Leys

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Introduction

The increase in arable cropping has encouraged direct sowing of grass/white clover swards in late summer rather than undersowing cereals. Common chickweed (*Stellaria media L*) has proved a major weed problem in these leys. Trials have been undertaken at the Edinburgh School of Agriculture since 1982 to compare the relative safety to white clover and perennial ryegrass of products currently recommended for chickweed control in the autumn and early spring, and the level of control of the weed achieved.

Method

Herbicides common to 3 sites were mecoprop salt (2.5 kg a.i./ha), linuron (0.26 kg a.i./ha), linuron + 2,4–DB + MCPA (0.9 kg a.i./ha; Alistell, Farm Protection) and bentazone + MCPB + MCPA (2.4 kg a.i./ha; Acumen, BASF) plus cyanazine (0.5 kg a.i./ha; Fortrol, Shell). These were applied to one site sown autumn 1982, and 2 sites sown autumn 1983. Applications were made October/November and March/April the following year. Treatments were applied by Azo knapsack sprayer, in 200l/ha vol., through T-jet 8003 nozzles.

Results

Chickweed Control

There was little difference in chickweed control of any product between autumn and spring spraying. Linuron gave marginally the best chickweed control, followed by mecoprop, bentazone + MCPB + MCPA plus cyanazine then linuron + 2,4–DB + MCPA. Control of all products was generally good and not dependent on ground cover of chickweed.

Clover Tolerance

Autumn-sprayed mecoprop, linuron and bentazone + MCPB + MCPA plus cyanazine, damaged clover severely at all sites. Linuron + 2,4–DB + MCPA was safer in 2 of the trials.

Spring-sprayed mecoprop and linuron were damaging in 1984, but less so in 1983. At one site in 1984, the clover was still very small (2–3 leaf) in the spring, and all the herbicides killed out the clover. However, at the other site where the clover was 4–5 leaf, linuron + 2,4–DB + MCPA showed good safety, and bentazone + MCPB + MCPA plus cyanazine some safety.

Ryegrass Tolerance

All treatments reduced grass yield following autumn 1983 treatments at both sites. But yields increased at the one site treated autumn 1982. This may reflect the severe winter conditions of 1983–84. Spring treatments at one site in 1984 (that with the lowest chickweed content) reduced yield, mecoprop having a severely damaging effect. At the other sites with high chickweed populations, grass yields improved, and bentazone + MCPB + MCPA plus cyanazine gave 20% yield improvements.

Conclusions

It is evident that although the chickweed control of all these products is adequate to good, they lack consistency in clover and grass tolerance, apart from the consistent lack of safety of mecoprop.

There is some indication that both autumn sown grass and clover are more tolerant of spring treatment than autumn treatment with herbicides, without detriment to chickweed control and final crop yield. Further work is being undertaken to examine whether there are alternative treatments which show improved grass and clover safety, whilst maintaining the level of chickweed control currently available.

Pot Experiments to Assess Herbicides for Selective Control of Established Thistle (*Cirsium arvense*) in Perennial Ryegrass

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ABSTRACT

In two outdoor pot trials in 1982 and 1983, herbicides were examined for their potential to control well established Cirsium arvense *in perennial ryegrass. Neither clopyralid, triclopyr, fluroxypyr nor bentazone were sufficiently active when applied alone. Mixtures of clopyralid with either triclopyr or bentazone were very effective, as was a mixture of clopyralid, triclopyr and fluroxypyr. Ryegrass was tolerant.*

Introduction

Creeping thistle (*C. arvense*) is still a major grassland weed (Peel & Hopkins 1980) so herbicides are examined each year on established thistle raised in pots. The work has shown that mixtures are usually more likely to be effective than single herbicides.

Materials and Methods

Root fragments of *C. arvense* were raised initially in the glasshouse in 10 cm pots in a sandy loam soil with added nutrients in the autumn of 1981 and 1982. In March, plants were transferred to 25 cm pots outdoors and sprayed on 3 and 5 June 1982 and 1983 respectively by a laboratory sprayer. Doses applied were:– clopyralid, 0.3 kg/ha, triclopyr 0.75 (1982) or 3.0 kg/ha (1983), fluroxypyr 1.0 (1982) or 0.75 kg-ha (1983), bentazone 2.0 (1982) or 3.0 kg/ha (1983). Mixtures of these were applied, usually in 2 treatments consisting of full and half doses of each component. There were 8–10 shoots 50–60 cm high, with roots 12–30 cm long at spraying. Ryegrass (cv. S23) plants were well tillered when sprayed on 8 July 1982, having been raised from 10 seeds sown 0.25 cm deep in 19 cm pots in

April 1982. Shoots were harvested to ground level on 3 and 8 August 1982 and 1983 respectively for *C. arvense* and 13 September 1982 for perennial ryegrass. Pots were left until 18 October 1982 and 1983 (*C. arvense*) and 1 December 1982 (perennial ryegrass) when shoots were again harvested.

Results

Although clopyralid, triclopyr and fluroxypyr caused a severe epinasty of *C. arvense,* plants recovered. Triclopyr was the most active, 3.0 kg/ha causing reductions in regrowth of shoot weight of 53% in 1983. Bentazone was also initially severe, but plants recovered well. Mixtures of clopyralid with either triclopyr or bentazone were much more active, higher doses reducing shoot fresh weight at regrowth by 61 to 96%. A mixture of clopyralid, triclopyr and fluroxypyr was similarly very active. Ryegrass was unaffected by any of these treatments.

Discussion

These results confirm earlier work, that bentazone and pyridyl acid herbicides, though insufficiently active on thistle when applied alone, can give increased levels of control in certain mixtures and are well tolerated by ryegrass. More work is needed to find optimum ratios of herbicides used in these mixtures for this and other broad-leaved species. It is unfortunate that clovers are sensitive to these herbicides.

References

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Optimising the Control of Perennial Broad-leaved and Woody Weeds in Established Grassland with Broadshot* using conventional and novel applicators

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Introduction

Traditionally agrochemical manufacturers have formulated grassland herbicides for the control of specific weeds. Shell Chemicals Agricultural Division identified that an opportunity existed for one herbicide which would offer grassland farmers economic control of docks, nettles, thistles, other perennial broad-leaved weeds and *woody* weeds.

Understandably farmers were also demanding specific and easy to understand recommendations for use of herbicides through conventional sprayers, knapsack sprayers and ropewick applicators.

A series of replicated trials and farmer applied evaluations were conducted in the period 1982–1984 to evaluate the efficacy of a formulated mixture of dicamba, triclopyr and 2,4–D ester.

Results – Precis

Mean Percentage Weed Control – REPLICATED TRIALS AND F.A.Es.
300 l/ha using 110/02 jets (3month assessment)
CONVENTIONAL AND KNAPSACK

Broadshot	Docks	Nettles	Thistles	Dand.	Butterc.	Daisy	Hawkb.	Yarrow	Sorrel
5 l/ha	97	–	82	97	94	100	–	75	100
3 l/ha	–	99	–	89	90	50	100	–	85

Mean Percentage Weed Control – ROPE-WICK APPLICATORS
Dilution of Broadshot* to water 1:3/2 passes (3 months assessment)

Ropewick Applicator	Nettles	Docks	Thistle
Vicon Wedge-Wik (Porter Manuf. Co.)	100 small clumps 50 large clumps	–	Checked
Hand-held Mini-Weedwiper‡	90	90	60
Side-Swipe	95	86	78

Mean Percentage Woody Weed Control – KNAPSACK SPRAYER APPLICATION – FINE COVER ALL FOLIAGE – (12 month assessment)

	10 ml/l water	20 ml/l water	60 ml/l water
Bramble	98	–	–
Coppice, var. sp.	–	93	–
Gorse	–	92	–
Japanese Knotweed	–	–	95

Conclusions

This unique Shell formulation of triclopyr, dicamba and 2,4–D ester has shown in trials in 1982–1984 to be a most effective herbicide for the control of perennial broad-leaved and woody weeds.

Indeed the recommendations for this product in one and five litre packs are wide-ranging and include the definition of recommended jets and water volumes for use with conventional sprayers, knapsack sprayers and rope-wick applicators.

*Broadshot is a Shell Trademark
‡Weedwiper is a Hortichem Trademark

Biological Control of Bracken

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Biological control of weeds is widely practised. Julien (1982) lists attempts at biological weed control on a world basis; Schroeder (1983) provides recent outline of the process, and CIBC (1978) gives details of the safety measures necessary to ensure that introduced control agents will be host specific to the target weed. Extensive programmes in Canada, USA and Australia have, at relatively little cost, brought a wide selection of troublesome weeds under permanent control. However, there have been no serious attempts to adopt this procedure in the UK.

Bracken (*Pteridium aquilinum* L.) is an increasingly important weed in Great Britain, particularly in upland areas; biological control merits consideration to solve this problem. Bracken occurs where habitats are suitable on all continents except Antarctica. Studies have shown that the associated phytophagous species, and the type of feeding damage they do, varies from continent to continent. Thus, in Great Britain, 27 insect species are regularly found feeding on bracken, but none cause significant damage and most are kept rare by their natural enemies. The bracken fauna of Africa, New Guinea and Australia include species which feed differently from the UK species and can be quite damaging to the bracken.

Several such species occur in South Africa in the Katburg Mountains and one of these, '*Parthenodes angularis*', has been selected for the first phase of a programme to assess the possibilities for biological control of bracken which is being funded by the Agriculture & Food Research Council. The larvae of this pyralid moth bore in the rachis of backen fronds, stunting or aborting the frond. They can have a significant effect in their natural habitat in spite of being attacked by native parasitic wasps. Studies have just started at the UK quarantine unit of the Commonwealth Institute of Biological Control at Silwood Park, in conjunction with Prof. C.V. Moran at Rhodes University, to screen this moth for host specificity to bracken. Should it prove host specific, only then will consideration be given to its introduction to the UK.

References

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Changes in Weed Species in the Swards of Meadows and Pastures used According to the Level of Nitrogen Fertilization

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In Poland there are about 2 m ha of meadows and reclaimed pastures utilized in the majority by the method of complete cultivation. In spite of a great area of meadows and pastures intensively used, we possess many areas where the presence of a great quantity of herbs and weeds decreases their yields, their use and fodder quality. Also, with a high level of nitrogen fertilization, we often meet the domination of nitrophilous weeds.

The present work took into account the results of long-term geobotanical studies and experimental investigations carried out in the years 1962–1984 on the area of West Poland. In the synthesis, about 600 floristic photos were analysed which were taken in the swards of meadows and pastures used in the last decades. Changes of species in the swards were indicated, both in the natural swards and in those cultivated over the years. The swards of newly established meadows were analysed in response to different levels of nitrogen fertilization. It has been demonstrated that low and medium nitrogen fertilization favours the development of many herbs and weeds. A high nitrogen fertilization impoverishes the swards of meadows and pastures but it can evoke a population explosion of some weeds and herbs like *Agropyron repens, Achillea millefolium, Veronica chamaedrys, Potentilla anserina, Plantago media,* (and *P. major*), *Capsella bursa-pastoris, Glechome hederacea.* In special habitat conditions, with limited oxygen in the soil, there occur also *Deschampsia caespitosa* and *Juncus effusus.*

Weeds with a wide ecological amplitude require still further studies of their reaction to different ecological factors, and different aspects of the anthropogenic factor.

Control of Cow Parsley (*Anthriscus sylvestris*) in Yorkshire Dales Meadows

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Background

Cow Parsley (*Anthriscus sylvestris*) is commonly found in the Yorkshire Dales where the traditional management encourages its spread. Such management is tight grazing, usually by sheep, throughout winter until early May, when the fields are shut up for hay or silage. This allows the plant to flower and set seeds which germinate in January/February, often in the bare patches created by tight grazing.

The Problem

The above management can allow the weed to become dominant and the fleshy stems slow the drying rate of cut swards and in addition the weed is believed to be potentially poisonous. Control can be effected by pioneer cropping and then reseeding to a long term sward but this is expensive and means the land is out of production, so control by herbicide is preferable.

ADAS Herbicide Trials 1974–83

(1) Herbicides applied before or at flowering in 1974 caused dieback but no reduction when assessed a year later.

(2) A similar trial in 1979 highlighted the potential of dichlorprop which gave up to 75% control.

(3) A trial laid down in 1982 compared 3 rates of dichlorprop (2.8, 5.6, 8.4 kg a.i./ha) which when applied at early flowering in June and assessed a year

later gave 88, 90 and 92% control respectively. Disappointing results were experienced with a selective application technique using a 50–50 mixture of Roundup and water and product DPX 4189 applied at 2.5 kg/ha although giving 90% control had an adverse effect on the grass.

Conclusion

Satisfactory control can be achieved by an application of dichlorprop at 2.8 kg a.i./ha at early flowering at an approximate cost of £10/ha, but eradication may only be achieved by a second spray the following year and a switch from hay to silage or grazing to prevent seed set of the few remaining plants.

Establishment and Seed Production of Common Ragwort (*Senecio jacobaea* L.) and the Spread of Hoary Ragwort (*Senecio erucifolius* L.)

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1. ESTABLISHMENT OF *S. jacobaea* in gaps in a ryegrass sward

In a field experiment, 10 achenes were sown/gap of 5, 10 and 15 cm in diam. in each of 5 blocks in March (Watt 1984). Two levels of nitrogen (N) fertilizer were applied (25 or 200 kg/ha). The herbicide propyzamide (P) was sprayed at 0.4 kg a.i./ha in March (to reduce grass competition). The sward was cut monthly.

Most seedlings established when both propyzamide and high nitrogen had been applied (N × P *). In June, seedlings were thinned to leave one per gap. The number of leaves on these plants in October was greater with propyzamide (***), especially if also with high nitrogen (N × P ***) or in a large gap (Size × P ***).

2. SEED PRODUCTION OF *S. jacobaea* on an experimental site and on 2 natural sites

Achenes of *S. jacobaea* are of two types, ray and disc. Disc achenes are: variable in number, lighter (with a thinner pericarp) and hairy. They have a pappus and are released soon after maturity. This makes them well fitted for wind dispersal and the colonization of new sites. In contrast, ray achenes are better fitted for establishment in the gap left by the parent rosette (McEvoy 1984).

Capitula were collected from plants on 3 sites near Oxford. Plants from the ex-arable site had the least sward competition and the most and heaviest disc achenes. Those from the grazed site had fewer, lighter disc achenes and the least number of ray achenes. If they were dropped early this could be a possible mechanism for re-establishment in a competitive environment. The plants from the experimental, cut sward had the fewest, lightest achenes per capitulum because drought had halted their development.

3. *Senecio erucifolius* – recent spread on verges

Masses of flowering ragwort have become a common sight on roadside verges in recent years. In southern England, it is often *S. erucifolius*. This is a poisonous perennial and so if it could establish and reproduce in a sward it could pose a problem like *S. jacobaea*. To investigate this, achenes of both species were sown, 10 per gap of 10 cm diam., in October in boxes of ryegrass and in four grassland fields. The seedlings were counted in January.

In boxes *S. erucifolius* established best (78.7 *v.* 68.4%, ***), whereas, in the field, *S. jacobaea* was best (19.5 *v.* 12.5%, ***). Both species established better in the 2 sheep-grazed fields (21.7%) than in the 2 cattle-grazed fields (10.2%) (***), probably because seedlings were killed by cattle hooves. In one sheep field, achenes were also sown on molehills and in areas of old cowpats.

Both species established better on cowpats (27.5%) and artificial gaps (22%) than on molehills (10%) which were hazardous sites (***).

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Control of Chickweed in Autumn-sown Grassland

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A perennial ryegrass ley, sown in August 1982 and heavily infested with common chickweed (*Stellaria media*), was treated with various herbicides in September 1982, November 1982 (only ethofumesate) or May 1983. Dry matter yields of grass and chickweed were measured at the first silage cut in June 1983. All tretments which gave good chickweed control (see Table) substantially increased grass yield. Linuron (0.25 kg a.i./ha) performed similarly to established commercial treatments such as autumn-applied benazolin + 2,4–DB + MCPA, winter-applied ethofumesate and spring-applied mecoprop.

A second trial was conducted in 1983–84 to measure chickweed control by linuron at different rates and by linuron + 2,4–DB + MCPA, this time on a newly sown clover-rich sward. Because of wildfowl damage this trial was not taken to yield, but chickweed and clover ground cover were estimated in early May and mid-June 1984. Linuron at 0.25 kg a.i./ha was again very effective in reducing chickweed and was no more damaging to clover than benazolin + 2,4–DB + MCPA if applied in autumn. At 0.125 kg a.i.-ha linuron gave inadequate control of chickweed, while at 0.5 kg a.i.-ha clover damage was increased. Linuron + 2,4–DB + MCPA, whether applied in autumn or spring, was as damaging to clover as spring-applied mecoprop. There was evidence of inhibition of grass growth by linuron + 2,4–DB + MCPA and by linuron alone at 0.5 kg a.i./ha.

	1982/83 Trial d.m. yield(t/ha) June 1983		1983/84 Trial % reduction in ground cover			
			May 1984		June 1984	
	chweed	grass	chweed	clover	chweed	clover
Untreated	1.11	4.11				
s.e.		±0.13				
Applied autumn/winter						
Benazolin + 2,4–DB + MCPA(a)7 1/ha	0.28	5.50	78	37	29	0
Bentazone + MCPB + MCPA(b)5 1/ha	0.83	5.08	–	–	–	–
Linuron 0.125 kg a.i./ha	–	–	78	23	42	45
Linuron 0.25 kg a.i./ha	0.13	5.44	98	43	78	10
Linuron 0.5 kg a.i./ha	–	–	99	53	100	40
Linuron + 2,4–DB + MCPA(c)3.5 1/ha	–	–	100	63	100	55
Ethofumesate 1.0 kg a.i./ha	0.00	5.69	–	–	–	–
Applied spring						
Benazolin + 2,4–DB + MCPA(a)7 1/ha	0.06	5.57	–	–	64	40
Bentazone + MCPB + MCPA(b)5 1/ha	0.27	5.10	–	–	–	–
Linuron 0.125 kg a.i./ha	–	–	–	–	60	55
Linuron 0.25 kg a.i./ha	0.18	6.08	–	–	84	72
Linuron 0.5 kg a.i./ha	–	–	–	–	93	75
Linuron + 2,4–DB + MCPA(c)3.5 1/ha	–	–	–	–	29	60
Mecoprop 2.5 kg a.i./ha	0.00	5.22	–	–	100	57
s.e.		±0.28				

(a) 'Legumex extra'; (b) 'Acumen'; (c) 'Alistell'

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Mixture B, a Surfactant Additive for Improving Bracken Control by Herbicides

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Mixture B, a blend of non-ionic wetters, improves the effects of leaf-applied herbicides against forest weeds such as *Rhododendron ponticum*, heather and tussock grass (Tabbush & Sale 1984; Clipsham 1984). It assists the retention and spreading of spray droplets and markedly increases the rate of entry of herbicides into leaves. In studies with radioactively labelled hexazinone and glyphosate, rates of uptake by *Rhododendron ponticum* leaves were increased more than 50-fold (Clipsham 1984).

During 1983, commercial formulations of glyphosate, assulam and fosamine-ammonium were applied with and without Mixture B to bracken at Woodstock, Oxon, and Bagtor, Devon. Randomised block experimental designs with 4 replicates were used. Plot size was 2.5 × 6 m and spray volume 250 l/ha. At Woodstock, bracken in a woodland clearing, 1.75 m tall, was treated on 7.8.83 in dry sunny weather. At Bagtor, relatively short (0.5 m) bracken on open moorland at 1100 ft altitude was sprayed under cold showery conditions on 10.9.83, when the fronds had started to senesce.

At Woodstock, Mixture B markedly increased frond injury by glyphosate in the season of treatment. There was a similar but less evident effect at Bagtor. The main assessment at both sites was counts of emerged fronds in the season after treatment:–

No. of fronds/m^2 in 1984

Herbicide treatment	Woodstock		Bagtor	
	no additive	2% 'B'	no additive	2% 'B'
0.75 kg a.i./ha glyphosate	27.8	3.5**	21.3	12.7
1.5 kg a.i./ha glyphosate	9.5	4.3	9.2	6.0
2 kg a.i./ha asulam	5.3	1.2*	11.3	6.7
4 kg a.i./ha asulam	2.2	3.0	5.3	5.7
2.4 kg a.i./ha fosamine – NH_4	19.3	14.7	33.7	19.3
4.8 kg a.i./ha fosamine – NH_4	7.7	5.3	25.5	10.2**
Control	45.3		50.0	

* Effect of additive significant at 5% level of probability
** Effect of additive significant at 1% level of probability

It will be seen that at Woodstock, Mixture B significantly increased the effects of low doses of glyphosate and asulam. At Bagtor where the overall level of control was poorer, Mixture B improved the activity of fosamine-ammonium.

This work was commissioned by High Trees Agriculture Ltd, who have given permission to publish these results.

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The Tolerance of Four Forage Legumes to Several Herbicides

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Most legumes are very susceptible to weed competition especially during establishment. It is essential to control weeds at the earliest opportunity. Several mixtures are recommended for broad-leaved weed control in leys containing clovers but no herbicide, apart from 2,4–DB and dinoseb-amine, is recommended for use on both red and white clover, lucerne and sainfoin. A field trial was set up to evaluate the tolerance of these four legumes to five herbicide treatments.

The 4 legumes were sown by hand into a conventionally prepared seedbed on 23 August 1983. All 4 legumes were sprayed at the 2–3 trifoliate leaf stage. The experiment, including unsprayed plots, was designed with spraying as main plots split for the four species and replicated three times.

The assessments included visual scores of herbicide damage and herbage dry weight, recorded in early June the following year (Table 1).

Table 1: Effect of herbicide treatments on herbage harvested from 4 legumes on 8 June (DM, kg ha^{-1}, as % of unsprayed)

Herbicide (kg a.i. ha^{-1})	White clover	Red clover	Lucerne	Sainfoin
Unsprayed	100	100	100	100
2,4–DB (2.1)	108	102	150	104
2,4–DB (4.2)	81	95	180	80
Dinoseb-amine (1.66)	178	123	114	111
Dinoseb-amine (3.32)	154	144	185	101
Benazolin + 2,4–DB + MCPA (0.2 + 1.6 + 0.3)	65	114	120	151
Benazolin + 2,4–DB + MCPA (0.4 + 3.2 + 0.6)	101	89	45	64
Bentazone + MCPB + MCPA (1.0 + 1.0 + 0.4)	79	105	25	71
Bentazone + MCPB + MCPA (2.0 + 2.0 + 0.8)	56	65	7	62
Linuron + 2,4–DB + MCPA (0.1 + 0.8 + 0.1)	63	90	21	25
Linuron + 2,4–DB + MCPA (0.2 + 1.6 + 0.2)	53	77	17	16

This work indicates that both 2,4–DB and dinoseb-amine can be used with safety on all 4 forage legumes, with double dosing of dinoseb being particularly safe. Of the 3 mixtures, the benazolin based compound was the least damaging, appearing 'safe' on 3 species at the low dose, although there is still some concern with white clover; there was also quite severe initial scorching on lucerne. The bentazone and linuron mixtures caused substantial damage to all legumes, except red clover, with lucerne being particularly sensitive. Overlapping (i.e. double dosing) with these 2 mixtures would be extremely damaging.

Grass Weed Control in Seed Crops

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Grass Weed Control in Seed Crops of Perennial Ryegrass

Nortron (ethofumesate) is approved for use in perennial ryegrass seed crops at 7 l/ha pre-emergent and 10 l/ha post-emergent. Whilst these treatments often give good control of meadowgrass and blackgrass, control of winter wheat volunteers in an autumn seed bed following a cereal crop is often poor. Better control of volunteer cereals and other grass weeds can be achieved by using Nortron in combination with TCA.

Sequential applications of 5 kg/ha of TCA at ryegrass tillering, followed 3 weeks later by 5 l/ha of Nortron, has given better and cheaper control of weed grasses at £40/ha (£17.20/acre). This practice is now in common usage by British seed growers sowing their perennial ryegrass crops at a seed rate of 9–13.5 kg/ha and is also practised in Holland.

The combined treatment, however, often results in a growth check and crop scorch during the winter, but provided treatment is completed before Christmas the crop recovers and subsequent seed yields are enhanced. The purity of the harvested seed is also of a higher quality.

Observations on farm crops of Royal perennial ryegrass and seed yield trials have indicated that this variety is more susceptible to damage from Nortron/TCA combinations. The variety Lidura, however, appeared to be particularly tolerant. Despite the apparent damage to Royal in trials, the surviving plants recovered and gave satisfactory seed yields at harvest.

Grass Weed Control in Seed Crops of Red Fescue, Red and White Clover

Trial and farmer experience on red fescue have indicated potential success of using Clout (alloxydim-sodium), Checkmate (sethoxydim) and Fusilade (fluazifop-butyl) to control important grass weeds such as perennial ryegrass, blackgrass, wild oats, rough meadow-grass and volunteer cereals.

Clout, Checkmate and Fusilade are applied at the 2–3 leaf stage of the red fescue. Annual meadow-grass is not controlled by these herbicides but timely application of Tribunil (methabenzthiazuron) should control this weed.

Limited experience in trials and on farms has also indicated that these herbicides can be used successfully in red and white clover seed crops to control or suppress grass weeds.

Research on grass suppression in a grass and clover crop is being actively pursued by the Welsh Plant Breeding Station. The National Seed Development Organisation have also successfully used Clout to suppress couchgrass in a white clover seed crop.

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Forage Bromes : High Yields but Weed Problems

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Grasslands Matua (*Bromus willdenowii*) was bred in New Zealand in the early 1970's. Extensive field trials at NIAB centres over the past 5 years have demonstrated that yields of Matua under conservation cutting are around 130% of S24 perennial ryegrass and are higher than those of the best Italian ryegrasses. The species also persists for at least three and up to six years; it has good digestibility and palatability.

NIAB is currently evaluating the agronomic potential of several varieties of *B. willdenowii* and other brome species (*B. sitchensis, B. carinatus*). Their introduction to commercial agriculture in farm trials has, however, highlighted some limitations, such as poor growth in waterlogged soil conditions and an upright open growth habit which can allow serious weed invasion at establishment especially after autumn sowing.

Following information from France, the main problem weeds, annual meadow grass and chickweed have been satisfactorily controlled by applying metoxuron (Dosaflo) at 3 kg a.i.-ha when forage bromes had at least 4 leaves. The brome varieties Matua, Bellegarde, Primabel, Cabro, Lubro, Una and Deborah appeared to be undamaged. Mecoprop at 2.5 kg a.i./ha successfully removed broad-leaved weeds in Matua, Bellegarde and Lubro. Forage bromes perform best on sandy soils so herbicide rates must be reduced to avoid damaging the brome crop.

NIAB has not at present undertaken systematic screening of potential herbicides, Nortron cannot be used to control grass weeds because it also kills bromes. In France, successful pre-emergence weed control is widely achieved with Neburon, this is unavailable in the UK. Mixtures of forage brome with perennial ryegrass or legumes are damaged by metoxuron and further work is needed to identify suitable herbicides for these mixtures.

A New System of Grassland Renovation with the help of Slurry Manure in The Netherlands

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Every year, about 125,000 ha of permanent grassland are 'resown' in the Netherlands, mainly due to weed-infestation of *Agropyron repens*. Resowing can either be done with or without soil cultivation (direct-seeding). The direct-seeding practice is done mainly in the spring in short mown grassland and must be considered as a maintenance practice in low couch-grass infestation situations only.

In cases of heavy couch-grass infestations, a complete cultivation should be carried out. In these situations the old sward can either be rotary-cultivated and/or ploughed or can be killed chemically with Roundup® (glyfosate: 1440 g a.i./ha). Subsequently the Roundup killed sward is resown with or without soil cultivation.

The best period for re-seeding under Dutch conditions, is July, August and beginning of September.

Good establishment of the new ley is dependent on climatic and biological factors. Every year initial development problems are encountered on about 5–10% of the area resown.

Promising results for improved grass-establishment have been achieved in trials with slurry manure, applied 5 d after Roundup treatment (on closely mown leys). Cattle-Slurry-manure is used at a rate of 30–40 m^3 ha.

Advantages of the Roundup, slurry-manure and direct drilling technique are:

Roundup®:

Excellent control of established weeds.

Mowing:
Easy mowing possible up to 5 d after Roundup® treatment.
No adverse effect on glyfosate translocation.

Slurry-manure:
Slurry adds additional moisture.
Less loss of moisture due to 'manure coating'.
Good coverage of stubble residues.
Better decay of stubble.
Additional fertilizer value.
Reduction of slug damage.
Reduction of frit-fly damage.
Reduction of weed infestation (*Poa annua* and *Stellaria media*), especially when combined with 5 1 Nortron/ha.

Sowing:
Better direct drilling in closely mown leys.
Relatively cheap direct drilling method.

Practical Pest and Weed Control in Grassland

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Three Dow molecules are used in grassland. Triclopyr and clopyralid for broad leaf weed control and chlorpyrifos for pest control in grassland.

Triclopyr is the active constituent in several commercially marketed products. It is absorbed by leaves, stems and roots and is readily translocated throughout the plant. On broad-leaved species, there is rapid contact action, with characteristic auxin-type responses such as browning of leaves and severe stem twisting and curling. *Urtica dioica* will show effects within 24 h; larger woody species will take longer.

Broad-leaved weeds are best controlled when growing actively, particularly in warm, moist conditions. Field development tests have shown excellent long term control of *Urtica dioica* and *Rumex* sp. Similarly, field tests have shown that regrowth of *Rubus fructicosus* and *Ulex* spp. is negligible twelve months after a single spraying. Field trials on all the major varieties of sown grasses showed no scorch or adverse effects.

Clopyralid is used extensively in grassland for the control of *Cirsium arvense*. For best control of *C. arvense* clopyralid should be applied when plants are actively growing, but before flowering spikes are 15 cm (6 in) high. If the grass has been cut for hay or silage the treatment should be delayed for 2–3 weeks until sufficient regrowth has occurred.

The 2 major pests of UK grassland are frit-fly (*Oscinella frit*) and leatherjackets (larvae of *Tipulidae*). Chemical control of *O. frit* in newly sown leys or in direct re-seeds is most frequently required in high risk areas, with susceptible varieties, and where cultural practices favour the pest. An ADAS warning system based on catches of flies in traps is also available in some areas, but this advice is primarily for cereal growers.

Chlorpyrifos, applied at 720 g/ha between the drilling and early emergence phases reduces plant tiller and yield losses. Recent results from the Grassland Research Institute were presented in the poster session.

All agriculturally important species of grass, whether old grassland or newly established swards, can be damaged by leatherjackes. There are no completely effective cultural methods of control. Extension services provide advice on risk of damage by sampling permanent grass fields in the autumn, and farmers are encouraged to inspect their own fields. Chlorpyrifos is applied at 720 g/ha when high larval populations are detected and when damage is first seen. Results from trials at the West of Scotland College of Agriculture were presented in the poster session.

An Apparatus for Extracting Frit-Fly Larvae from turf samples

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The only method at present in use for estimating populations of frit fly larvae is the labour-intensive and soul-destroying job of disecting every stem in turf samples. We have now attempted to develop a system which, although not quick, may prove easy and reliable.

The equipment used, which is already available at many advisory centres, is the Leatherjacket Extractor described in *Plant Pathology* (1974)23:14–16. The principle of operation is that 25 turf cores of 65 mm diam. and 50 mm depth, retained in their individual steel cutting cylinders, stand turf-surface downwards over dishes of cold water while heat is applied to their upward-facing soil bases. The temperature gradient so produced drives the leatherjackets down into the water where they are counted. This normally takes about 45 minutes, i.e. until the turf surface reaches 40°C.

For the extraction of stem-boring larvae the procedure is modified as follows. The turf cores are forced back out of their cylinders, and soil and roots trimmed away to leave a depth of about 20 mm remaining in the cylinders. The heater is fitted with a switch by-passing the 45-min timer, and the simmerstat is turned down to produce a steady temperature of 30°C at the turf (i.e. lower) surface. In practice, after some hours the whole system of core, dish and water comes to within one or two degrees of this temperature. At the end of the process the contents of the dishes may be washed through appropriate sieves, but with careful handling of the cores the operation can be very clean and the catch may be examined directly.

Testing so far has shown that virtually complete extraction is achieved in 48 h. Early tests in the summer produced frit larvae of all instars. Good steady populations were hard to find in the Aberdeen area; the one used for these tests seemed thriving but then rapidly declined to a low level, while many predatory beetle larvae appeared in the samples (This coincided with the failure of a control trial in winter barley in the next field – after a promising start, damage ceased in the control plots). Further testing has been on a winter population of about $2000/m^2$; extraction proved marginally (but not significantly) more productive than dissection of stems.

The extraction system also brings out large numbers of other dipterous larvae, aphids, mites and free-living nematodes.

This note has described progress in limited preliminary testing. The results of full tests will be published when development of the method is complete.

A Comparison of Methods of Studying Root Feeding in Grassland Soils

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A rhizotron and radioisotopes have been used in amenity grassland at Bangor in an attempt to improve methods of quantifying root herbivory and its effects on root systems. The rhizotron has permitted observations of feeding ecology of soil invertebrates and provided a check on the efficiency of soil coring and heat extraction for estimating animal populations.

Many taxa have been shown to be omnivorous, or, to take both living and dead (detrital) plant or animal material. Wireworms are both carnivorous and herbivorous; slugs and earthworms take live and dead roots; *Campodea* (Diplura) feeds on live roots and both living and dead animals. Observations on soil *in situ* indicate that several animal taxa that are not usually extracted from cores by heat either because their populations are highly aggregated or because of the depth at which they live are quite common. Examples are slugs (4 species), *Campodea,* centipedes, millipedes and dipteran and coleopteran larvae. It is not possible to derive density data from rhizotron observations, but effects of grazing on the root system can be quantified.

Studies using isotopes (134 Cs) allow estimates of the quantity of root eaten by individual animals but not of how the loss of that much root affects the plant. Unfortunately, in our study, so few animals ate radioactive roots that we could not produce any replicated data. Using isotopes in the field it was not possible to separate animals feeding on myccorhizal hyphae from those feeding on roots.

An experiment using insecticide to exclude chafer grubs (*Phyllopertha horticola*) from turf showed a major difference in chafer numbers and foliage production between treated and untreated but no differences in root biomass.

These results have important consequences for the interpretation of studies on root feeding in grassland. The respiration/consumption model used in IBP projects (French 1979; Persson & Lohm 1979) depend on knowing the biomass and trophic level of the animals. Our observations have shown that several taxa take food from up to three trophic levels and the importance of each type in the diet depends on availability. This coupled with the inadequacies of sampling techniques must occasion careful reappraisal of published data. As an extreme case *Campodea* is rare in heat extracted samples and is always listed as a carnivore (e.g. Greenslade & Greenslade 1983) but in this study they were commonly observed with the rhizotron and were omnivorous.

Another common technique used to quantify root feeding is to apply insecticide to some plots and to suggest that the difference in foliage production between treated and untreated plots is a result of the decline in the numbers of target pest(s) (e.g. Clements *et al,* 1982; Blackshaw 1984), but the lack of a response to the control of a root feeder reported here suggests more complex interactions.

The methodology for studying the impact of root herbivory on grassland plants is at best flawed. This is an area of major importance in grassland studies as it affects our estimations of both direct crop losses and element cycling, especially nitrogen. Existing data on root herbivory in grassland must be interpreted with caution.

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Nematode Problems of Grassland Associated with the Plant-parasitic Nematode *Longidorus elongatus*

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Longidorus elongatus is the most widely distributed longidorid nematode in the British Isles, is common in Western Europe and has been recorded from North America, India and New Zealand. It is a migratory plant-parasitic nematode which can transmit raspberry ringspot virus to raspberry and strawberry and tomato black ring virus to potato. However, most populations are virus free and the damage they do is confined to that caused by the nematode directly feeding on the plant root. *L. elongatus* has been shown to feed on over 60 plant species, severe damage being reported on strawberry, sugar beet, carrot and ryegrass. *L. elongatus* has a long life cycle and its annual rate of multiplication is low consequently high populations are usually only found associated with perennial crops which are good hosts for the nematode e.g. strawberry and grass.

Studies on the feeding of *L. elongatus* on ryegrass has shown that it feeds exclusively at the root-tip which swells to form a gall. The gall is fed upon for 10–12 d before it collapses and becomes necrotic. In the initial stages of gall formation hypertrophy occurs and the cells contain enlarged nucleic and nucleoli, a greater proportion of cytoplasm and increased concentrations of protein. Hyperplasia follows with many cells having enlarged amoeboid shaped nuclei and nucleoli. These cells are fed upon and are eventually emptied by the nematode.

Large numbers of *L. elongatus* can depress grass yields. Systemic insecticides/nematicides e.g. aldicarb have been shown to have a transient beneficial effect on the establishment of grass/clover swards while the effect of fumigant nematicides e.g. dichloropropene was more persistent. However, although the effect of the fumigant nematicides on nematode numbers could still be detected after 5 years the beneficial effect on grass yields was lost after 1–2 years because of the detrimental effect the chemicals had in reducing the clover content of the sward. The decrease in clover in treated plots may have been due to increased competition from grass or a reduction in the symbiotic rhizobium required by the clover.

The present cost of nematicides is probably too high for the majority of farmers to be able to justify their routine use on grassland but new formulations and methods of applying the chemicals may change this situation. Future control measures which are environmentally more acceptable may include the breeding of resistant/tolerant varieties of the use of naturally occurring nematode pathogens e.g nematophagous fungi.

The Effect of Fonofos Insecticide on the Establishment of Ryegrass

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Five trials in 1983–84 and 3 trials in 1984–85 evaluated the effects of fonofos insecticide in newly sown crops of Italian ryegrass. Seed (variety RvP) was treated with a microencapsulated formulation of fonofos and sown in small plot replicated trials alongside untreated seed. Comparisons were also made with plots sprayed with microencapsulated fonofos before sowing or with chlorpyrifos after sowing. Seven of the trials were sown in the autumn following the desiccation or ploughing of a previous crop of grass. One trial was sown in the autumn following the harvest of winter barley.

Fonofos seed treatment and both the sprays reduced the percentage of plants attacked by larvae of frit fly (*Oscinella* spp.) and increased numbers of healthy plants and crop vigour. Over 8 trials these treatments increased the mean number of healthy plants by 21%. Herbage yield was determined in the spring at 2 trial sites and all treatments increased the yield of dry matter. The mean yield increase for all treatments in these trials was 36%. Increases in grass establishment were particularly large at sites where grass was resown into an old sward desiccated by paraquat.

The microencapsulated fonofos seed treatment was overall as effective as the insecticide sprays in improving the establishment of these crops. Seed treatments also offer a more convenient method of application and a more economical use of the active ingredient.

A Distribution Study of Bibionid Larvae in Grassland

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Of the 20 British species of Bibionidae, *Bibio johannis* L. and *Dilophus febrilis* L. predominate in managed grassland and are often reported as being associated with pasture damage in early spring or late summer.

A study was made from November 1984 to March 1985 of the distribution of bibionid larvae in a grassland site. Larvae were sampled by wet-sieving soil cores of 10 cm diam. Preliminary sampling throughout the field revealed that the larvae were only found alongside hedgerows and around a telegraph pole in the centre of the field.

Ten fortnightly samples were collected from an array of points alongside a hedgerow and it was found that the number of larvae taken was not uniform with respect to both distance along and away from the hedgerow. Larvae of both species were higly aggregated over the twenty week sampling period ($2.97 \leqslant s/\surd \times \leqslant 12.52$ and $0 \leqslant s/\surd \times \leqslant 12.95$ for *B. johannis* and *D. febrilis* respectively). Samples were collected up to 26 m from the hedgerow, but the greatest number of larvae were found at 6 m, within the shelter zone of the hedgerow.

Soil cores (144) were collected from 6 concentric circles at distances up to 18 m from the telegraph pole. It was found that larvae were more likely to occur in soil cores taken 6 m from the pole.

This study has shown that bibionid larvae did not occur evenly throughout the site but were found in highly contagious aggregations. The distribution alongside the hedgerow was such as to suggest classic shelter effects. However, the similar distribution found around the telegraph pole suggests that larval occurrence may reflect behavioural habits with both the hedgerow and the pole acting as mating-swarm markers.

Association of Slugs with *Sclerotinia trifoliorum* on White Clover

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Slugs which had been allowed to fed on sclerotia or apothecia of *Sclerotinia trifoliorum* were transferred to agar plates for 24 h. Sclerotia of *S. trifoliorum* developed on the plates after 3 weeks at 10°C. More sclerotia ($P<0.001$) were produced by *Arion fasciatus* and *A. subfuscus* than by *Deroceras reticulatum*. The transfer of excreta without slugs also produced infection. Transfer of the same slugs to other agar plates for a second 24 h period did not produce infection.

D. reticulatum which had been similarly fed also transmitted the disease to *Trifolium repens* (cv. S 100), although less efficiently than by direct inoculation. There was some indication that previous feeding by uninfected slugs, which were then removed, predisposed the plants to direct infection. Where the slugs were allowed to remain on the plants after inoculation the level of visible infection was reduced. This was attributed to a feeding preference of the slugs for diseased to healthy plant tissue.

It was concluded that slugs of either genus were potential vectors of *S. trifoliorum*. As the agar plate tests did not allow normal field behaviour it was not certain the *Arion* species were the more probable vectors. The feeding preference for diseased tissue could not be assumed to reduce the effect of the disease, but only the visible symptoms.

Leatherjackets in the West of Scotland

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In south-west Scotland losses due to leatherjackets in intensively managed grassland, whether for early grazing or silage, are commonplace and often considerable. To identify risk years and to provide timely forecasts of probable damage, a leatherjacket survey of grass fields is carried out each year in early winter. For survey purposes leatherjacket assessment is conducted in the laboratory by a heat extraction process.

While the College has adequate facilities to carry out the above survey, it has insufficient resources to meet the potential advisory demand from large numbers of farmers seeking advice on the leatherjacket status of particular fields. To overcome this difficulty, recent attempts have been made to introduce and publicise a DIY sampling kit suitable for on-site use by farmers. The DIY method employed to date uses a modified St. Ives Fluid, a liquid expellent which, when poured on the soil surface, brings grubs to the surface for collection. More recently, for a variety of reasons, a range of novel DIY methods has been investigated; some of these show promise.

Concurrent with the above work, the efficacy of candidate leatherjacket insecticides has been tested on grassland and the economic threshold for the best of these, chlorpyrifos spray, has been established. Further, it has been demonstrated that chlorpyrifos spray gives a greater yield benefit when applied early (November, December or January) than when applied later (March or April). Presently the effect on yield of chlorpyrifos spray when combined with different rates of nitrogen application is being studied under a range of leatherjacket population densities.

Improved Grassland Establishment by the Control of Frit Fly (*Oscinella frit*) with Cypermethrin and Permethrin Applications

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Objectives

1. To improve sward establishment in direct drilled grass trials by the control of frit fly with permethrin ('Ambush') and cypermethrin ('Ambush' C) applied at plant emergence.
2. To compare the efficacy of permethrin and cypermethrin with standard foliar insecticides and an experimental seed treatment.
3. To examine the control with cypermethrin of frit fly attack in grass plots established by minimum cultivation, ploughing and direct drilling.

Table 1:

	Plants/m at establishment (direct drilled)			
Trial No.	1 Weston-s-Mare 12.11.79	2 Brixham 30.10.79	3 Crewkerne 4.11.79	4 Tavistock 5.11.79
Permethrin 50 g a.i./ha	61	21	32	50
Experimental seed treatment	60	36	42	73
Untreated	35	7	30	24

Table 2

	Plants/m^2 at establishment (direct drilled)			
Trial No.	5 Tockingham 6.11.80	6 Corston 17.10.80	7 Barton St David 27.10.82	8 Langport 20.10.82
Cypermethrin 25 g a.i./ha	286	769	162	517
Permethrin 50 g a.i./ha	243	781	–	–
Chlorpyriphos 672 g a.i./ha	–	781	149	554
Bendiocarb 500 g a.i./ha	–	–	163	469
Experimental seed treatment	377	949	–	–
Untreated	178	571	126	285

Table 3: Comparisons of plant reduction at establishment (Nov 1983 Pitney)

(visual score)

Cultivation	Dynadrive	Plough	Direct drill
Cypermethrin 25 g a.i./ha	0	0	0
Untreated	10	0	60

Conclusions

1. Cypermethrin and permethrin applied at plant emergence controlled frit fly attack and improved plant establishment from 7 to 200% (mean 67%) compared with untreated.
2. The insecticide foliar sprays were not as effective as an experimental seed treatment in controlling frit fly and improving plant establishment.
3. Cypermethrin was equally effective as chlorpyriphos and bendiocarb in improving grass plant establishment by the control of frit fly attack.
4. Cypermethrin application at emergence moderately improved plant establishment in minimum cultivation plots and greatly improved establishment in direct drilled plots.

The Effect of Crown Rust (*Puccinia coronata*) on the Competitive Ability and Regrowth of Ryegrass

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Introduction

It is sometimes thought that leaf fungus diseases are of limited economic importance because of the ease with which infected material can be removed by cutting or hard grazing. Regrowth can thus start from scratch with no penalty due to prior infection.

Experiments on perennial and Italian ryegrasses have shown this is not necessarily so.

Method

Two perennial and two Italian ryegrass varieties were chosen for their resistance of susceptibility to crown rust (*Puccinia coronata*). They were:

1. Perennial ryegrass vars. Cropper (resistant) and Aurora (susceptible)
2. Italian ryegrass vars. Tribune (resistant) and RvP (susceptible)

In separate experiments, plants of each species were grown in 8 in. pots either as single variety monocultures or as 1:1 mixtures of both varieties, with 14 plants/pot. Each pot was marked so that the variety of every plant was known. Half the pots in each treatment were inoculated with crown rust uredospores 3 times at weekly intervals. The first of 4 harvests during the year was taken 6 weeks after the first rust inoculation. A fifth harvest of perennial ryegrass was taken the following spring.

Results

Rust infection reduced the dry matter yield of the susceptible variety of both ryegrass species not only at the first harvest, when herbage was infected, but also at harvests 2 and 3 when there was no disease. The time interval between harvests 1 and 3 was 11 weeks for perennial ryegrass and 8 weeks for Italian. There was no significant effect of rust on yield of mixtures of either species.

The contribution of the competing varieties to the yield of the mixtures was also assessed. Compared to their yields in healthy mixture, rust infection of mixtures reduced the contribution of Aurora and increased that of Cropper at every harvest, significantly for harvests 2–4. Under this treatment Cropper always yielded its most and Aurora its least. In Italian ryegrass, rust infection of mixtures reduced the contribution of RvP at harvests 1 and 2, but there was no consequential increase in the contribution of Tribune.

Conclusions

Infection by crown rust can reduce the yield of susceptible ryegrass varieties not only at the time of infection, but also subsequently by reducing regrowth. This is presumably due to reductions in reserves needed for regrowth. The competitive ability of susceptible varieties can also be reduced, to the advantage of the competing resistant variety. The differences in this respect shown by perennial and Italian ryegrasses may be due to the different tillering ability of the two species, the greater tillering capacity and prostrate growth habit of perennial ryegrass exerting a larger competitive pressure than Italian ryegrass.

Observations on Drechslera Leaf Spot on Lolium Perenne Affected by Cadmium

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In June 1981, in the Mendip region of Avon, England, several large chlorotic areas in a three year old ley of perennial ryegrass (*Lolium perenne* L.) were observed to be more heavily infected with *Drechslera* species than adjacent non-chlorotic regions of the sward. The chlorotic areas were associated with high levels of heavy metals in the soil as this area contained the remains of open cast mines. A study was therefore conducted to examine the possible relationship between susceptibility to disease (particularly *Drechslera* sp.) and the uptake of cadmium by ryegrass plants. Observations were made on plants in the field, on plants grown in solution culture and on simulated swards of ryegrass grown in soils, in the presence and absence of cadmium.

Results showed that the chlorotic patches in the sward were associated with high concentrations of Cd, Pb and Zn in the soil and that the ryegrass in these areas was severely affected by *Drechslera* leaf spot. When Cd at 10–25 $\mu g\ cm^{-3}$ was added to plants grown in solution culture, or in soil as simulated swards, levels of disease after inoculation were up to 10 times greater than on plants grown without the additional cadmium. Cadmium accumulated in root and shoot tissues and, in addition, decreased the uptake of potassium by the roots.

The increase in susceptibility of Cd-affected ryegrass plants may be the consequence of one or more of the deleterious effects that Cd is known to have on the physiology of the plant.

Clover Stem Rot (*Sclerotinia trifoliorum* Eriksson) and its Control with Vinclozolin in West Germany

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Red clover (*Trifolium pratense*) is of considerable importance in southern areas of West Germany where it is grown as a fodder crop. In the regions of Bavaria and Baden-Württemberg over 110,000 ha is currently produced and 70–80% of this area is commonly affected by *Sclerotinia trifoliorum*.

Historically the most serious disease of red clover in Europe, stem rot is believed to be a major cause of lack of persistency in both red and white clover. Estimates put the percentage plant losses as high as 20–40% in affected areas of W. Germany this spring. Because of this scale of plant loss farmers are beginning to replace red clover with maize at the expense of fodder quality and their crop rotation systems. There is also increasing concern over soil erosion.

Because of the importance of the problem a number of trials were carried out between 1980 and 1983 to investigate the effect of vinclozolin (known to be active against *Sclerotinia* species) on *S. trifoliorum* in red clover.

Treatments were applied to replicated, small plot trials when *Sclerotinia* apothecia were seen to germinate in the field. This varied from mid-October to late November for the years in question. Earlier work in other crops had suggested this to be an optimum timing.

Applications of 0.5 kg/ha a.i. vinclozolin at 26 sites on a total of 7 varieties reduced the incidence of *S. trifoliorum* from 76% in the control of 6% in treated plots, when observed in the spring. A significant yield increase of 263 dt/ha (35 dt/ha dry weight) was achieved from 3 mowings. No benefit was obtained from increased application rates.

Variety trials carried out on a number of commonly grown varieties showed all to be similar in their susceptibility to stem rot. All varieties showed significant yield increases when treated with fungicide.

Growers in areas of W. Germany susceptible to attack by *S. trifoliorum* would welcome any measures to increase the persistence of red clover leys. Although little vinclozolin is currently used to control stem rot, there is increasing interest in this possibility.

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