Growth-promoting effects of some biocides on grass

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Summary

Single application in spring or split application for each cut of O,O-diethyl O-2-pyrazinyl phosphorothioate on grass-clover swards over a 2-year period increased the grass yield with 15 %. The population density of free-living root nematodes was highly reduced, but this could not account for the yield increase. Application of O-2,4-dichlorophenyl O,O-diethyl phosphorothioate was much less effective on yield increase and nematode reduction.

Introduction

In pot experiments white clover could be kept growing vigorously for several months, and growth of diseased clover considerably improved, by the application of 'Nemafos' (25 % emulsifiable concentrate (e.c.) of O,O-diethyl O-2-pyrazinyl phosphorothioate) or 'V-C 13 Nemacide' (75 % e.c. of O-2,4-dichlorophenyl O,O-diethyl phosphorothioate) (Ennik and Kort, 1966).

The same active compounds were tested in other formulations in field experiments on grass-clover swards. The results are briefly reported in this paper.

Experiments and discussion

The above-mentioned active compounds were tested in five field experiments on grass-clover swards in 1966, four of these were continued in 1967. The formulations were 'Nemafos' 46 % e.c. and 'AAvlitox', a wettable powder with 20 % O-2,4-dichlorophenyl O,O-diethyl phosphorothioate. The experiments were situated on sandy soils (pH-KCl varying from 4.1–5.5 and organic matter content from 3.7–4.6) with the following treatments in triplicate: (1) control; (2) single application of 16 ml/m² Nemafos (46 %) in spring; (3) split application of 8 ml/m² Nemafos for each cut except for the last one in 1967 (= 24–32 ml per year); (4) single application of 40 g/m² AAvlitox (20 %) in spring; (5) split application of 20 g/m² AAvlitox for each cut except for the last one in 1967 (= 60–80 g per year). The plots were 8 × 2.5 m². Four marked areas of 0.88 m² each were treated per plot, the chemicals being applied with a watering can in 4 l water per sub-plot (= 4.5 l/m²). The control sub-plots received 4 l tap water. In 1966 only 3 fields with a low clover content received nitrogen at the rate of 25 kg N/ha. In 1967 all fields were fertilized with 50 kg N/ha applied in two dressings. The total yield of the 4 sub-plots per replicate was weighed and sampled

GROWTH-PROMOTING EFFECTS OF SOME BIOCIDES ON GRASS

Table 1 Grass and clover yields per cut in g dry matter/m² (untreated plots) or in % of untreated. Averages of 5 experiments in 1966 and of 4 experiments in 1967

Year	Cut	g d.m./m ² Yield in of untreated plots		Yield in % of the yield of untreated plots							
				Nemafoz				AAvlitox			
				16 ml/m ² in spring		8 ml/m ² each cut		40 g/m ² in spring		20 g/m ² each cut	
				grass	clover	grass	clover	grass	clover	grass	clover
1966	1st	267	81	102	91	105	99	103	100	105	100
	2nd	122	61	138	84	133	98	107	102	122	90
	3rd	186	55	116	107	126	105	103	93	103	104
	4th	90	21	110	124	129	114	110	95	102	114
	year total	665	218	114	96	119	102	105	98	107	99
1967	1st	312	12	112	100	113	117	107	100	110	92
	2nd	177	23	114	143	114	165	101	113	107	148
	3rd	176	31	118	74	118	94	94	84	104	68
	4th	92	7	115	86	129	100	100	71	101	57
	year total	757	73	114	101	116	121	102	95	107	96

to determine the dry matter yields of grass and clover separately. Each year 3 or 4 cuts were obtained.

Especially in the Nemafoz plots the grass occasionally suffered from yellow or brown tips due to phytotoxicity, but this did not seem to have affected growth. The average yields per cut of grass and clover are shown in Table 1. The yields of the untreated plots are given in grams of dry matter per m², those of the treated plots are expressed as percent of the untreated ones.

In the first cut in 1966 the yields were hardly affected, but in subsequent cuts the grass yield was considerably higher on the treated plots, especially on the Nemafoz plots. An increase in yield of a similar order occurred in 1967. For Nemafoz, the effect averaged 15% of the control. In both years there was no significant difference between the effects of the split and single applications. In this respect the results of the experiments to be discussed below were similar. The increase in grass yield on the Nemafoz plots did not result in a decrease in clover yield. With Nemafoz in split application in 1967, the clover yield was even higher than on the untreated plots, indicating that also the growth of clover was improved to some extent by the Nemafoz treatment.

Nematode counts, made in October 1966 in the 0–5 cm soil layer, showed that the number of free-living root nematodes had been reduced to a low level by Nemafoz but less so by AAvlitox (Table 2), without much difference between single and split applications. The number of saprophagous nematodes was also considerably reduced by Nemafoz and more so by split application.

Averaged over all experiments, Nemafoz caused the greater increase in yield and the greater fall in nematodes, compared to AAvlitox. The size of both effects was independent of the frequency of application. This distinct relation between the extent of nematode death and size of yield increase may suggest that the yield response has been caused by the death of parasitic nematodes. However, the between-experiment

Table 2 Number of free-living root nematodes (comprising the genera *Pratylenchus*, *Paratylenchus*, *Tylenchorhynchus*, *Rotylenchus*, *Heterodera*, *Meloidogyne*, *Trichodorus* and other *Tylenchida*) and saprophagous nematodes per 100 ml of soil in October 1966. Averages of 5 experiments

	Untreated	Nemafos		AAvlitox	
		16 ml/m ² in spring	8 ml/m ² each cut	40 g/m ² in spring	20 g/m ² each cut
Root nematodes	2563	138	84	1278	1408
Saprophagous nematodes	2003	1228	261	1672	2332

variability in population density of the different nematode genera, either separately or in combination, did not parallel the variability in yield increments. Moreover, the nematode numbers were rather low in some experiments and probably below the critical level for damage. It is likely, therefore, that the yield increasing effect is at least partly attributable to factors other than the death of nematodes. Similar unexplained growth responses have been observed by other workers with other chemicals on other crops (Martin, 1966).

In two other field experiments, different application rates of Nemafos 46% (2½, 5, 7½ and 10 ml/m² for each cut or 15 ml/m² in spring) and AAvlitox 20% (7½, 15, 22½ and 30 g/m² for each cut or 40 g/m² in spring) were compared in 1966 and 1967. Application of both compounds, and more in particular of Nemafos, resulted in an increase in grass in one experiment, whereas in the other the increase was mainly in clover. In both experiments the increment appeared to be independent of time and rates of application, the lowest rate being as effective as the highest. The reduction in nematodes examined in April 1967, prior to the first treatment in that year, ran quite parallel to the yield increment: Nemafos was more effective than AAvlitox and the reduction was the same for all application rates and methods. However, the nematode numbers in the untreated plots were very low in both experiments and not likely to cause plant damage. Nor could they account for the difference in reaction of grass and clover on both fields.

Field experiments have shown that an increase in available nitrogen is a common effect of biocide application. Pot experiments indicated that under certain conditions treatment with chemicals may promote root growth (Ennik, 1966) or reduce water consumption. Additional research is needed to clarify whether and to what extent these phenomena are involved in the growth response.

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