THE EFFECTS OF TWO SEED TREATMENTS ON DOWNY MILDEW AND ROOT ROT OF GARDEN PEAS

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SUMMARY

Two pea seed treatment mixtures were tested for ability to control downy mildew and root rot complex of garden peas grown through to seed in Canterbury. One mixture (metalaxyl + captan) gave superior control of downy mildew, while the other (fosetyl-Al + thiram + thiabendazole) performed better against root rot fungi. Neither mixture alone increased yield, but each contributed in different ways to an overall mean yield increase brought about by the use of seed treatments.

Keywords: Peas, seed treatment, fungicides, downy mildew, root rots

INTRODUCTION

Control of both downy mildew of peas (*Pisum sativum* L.), caused by *Peronospora viciae* (Berk.) Caspary, and root rots, caused by a complex of fungi, is through the use of crop hygiene, rotation and seed treatment (Hagedorn 1984; Ashby *et al* 1987; Scott 1987). All of the pathogens causing these diseases over-winter in the soil, and control measures are either designed to reduce inoculum in the soil, or protect seedlings from infection.

The use of systemic fungicides as seed treatments to protect peas from downy mildew infection, has been reported by Miller and Walley (1981), and is now widely used in both the pea processing and pea seed industries. However, the fungicides used have a narrow spectrum of activity, affecting only fungi in the order Peronosporales (especially genera in the families Peronosporaceae and Pythiaceae).

Root rots of peas, on the other hand, are caused not only by fungi in the order Peronosporales, but also in the Ascomycotina and Deuteromycotina. Mixtures of fungicides have been tested for the control of a broader range of pathogens in peas (Salter and Smith 1986) and this paper reports on trials to compare and test for registration purposes, two of these mixtures of fungicides. Systemic fungicides are combined with broader range ones to provide control of both downy mildew and root rots.

METHODS

Pea seed (cv. 'Bolero') treated with the fungicides in Table 1 were sown at the rate of 200 kg/ha into border irrigated plots at the Winchmore Irrigation Research Station on 26 September, 1989. The area had been in peas 3 years earlier, and pea straw from a downy mildew-infected crop was incorporated into the soil 1 week prior to sowing. The plots measured 8 x 3 m. Four replicates, one per border strip, were used and these were irrigated twice (6 November and 1 December; soil moisture above 16%).

TABLE 1: Seed treatments

Product	Rate	Active ingredients of fungicides	Abbreviation
Aliette Super	2.9 g/kg	(52.8% fosetyl-aluminium; 17.2% thiram; 12.9% thiabendazole)	F-Al+Th+Tbz
Apron C 70SD	2.0 g/kg	(35% metalaxyl; 35% captan)	Mx+Cpt
Nil			

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Seedling emergence counts were made 21 days after sowing; the number of plants in eight x 1 m rows per plot were counted and converted to plants/m². Disease assessments were carried out 34 and 49 days after sowing. Fifty plants were sampled in a transect across each plot and returned to the laboratory for assessment. Downy mildew at the first assessment was measured as the total leaf area of the plant affected estimated from a standard leaf area diagram. At the second assessment, the disease was assessed as the number of nodes up the plant that were infected. Root rots were assessed on the same plants at the same sampling times using a 0 to 4 scale (Fig. 1), and converted to a 0 to 100 disease index (DI) using the following formula:

$$DI = \frac{\sum (\text{Class} \times \text{No. in class})}{\text{No. of plants assessed} \times \text{No. of disease classes (4)}} \times 100$$

This calculation took into account both incidence and severity of the root rotting. At 49 days after sowing, plant tops were dried and weighed and isolations to water agar were taken from typical root rot areas of selected plants. Fungi were sub-cultured to potato dextrose agar for identification by colony characteristics and microscopic examination.

All assessments from this time onwards were taken on only three replicates, since the fourth replicate was deemed to be atypical to the rest of the trial because of weed growth and lack of plant vigour. The number of pods per plant was assessed 112 days after sowing, on 40 plants per plot. Yield measurements were done on the same day by taking two 1.25 m wide swaths through each plot with a Hege plot header. Thousand seed weights are expressed at a common moisture content of 14%. All results were subjected to statistical analysis.

Fig 1. Root rot disease assessment key for peas

RESULTS AND DISCUSSION

There were no differences in the number of seedlings that established 3 weeks after planting (Table 2). This indicates that damping off diseases were of no importance in the trial, even though the plots were in peas 3 years earlier and had pea straw incorporated before sowing.

TABLE 2: Mean number of seedlings emerged 21 days after sowing and dry weight of plants 49 days after sowing.

Treatment	No. plants / m ²	Dry weight/plant (g)
F-Al+Th+Tbz	107a‡	1.17a
Mx+Cpt	113a	1.03ab
Nil	119a	0.93b
LSD (5%)	18.7	0.24
Contrasts:		
Nil vs. Treated	ns	†
F+Al. vs Mx.	ns	ns

‡ Numbers followed by the same letter are not significantly different at P=0.05
 ns = P>0.10; † = P<0.10; * = P<0.05; ** = P<0.001.

TABLE 3: Percentage infection with downy mildew assessed on leaves, 34 days after sowing, and on nodes 49 days after sowing.

Treatment	Log ₁₀ (% leaf area affected)	(Back transformed values)	% of nodes infected
F-Al+Th+Tbz	1.002b	(10.0)	36.3ab
Mx+Cpt	0.350a	(2.2)	31.1a
nil	1.447b	(28.0)	47.4b
LSD(5%)	0.574		
Contrasts:			
Nil vs treated	**		*
F-Al. vs Mx.	*		ns

Downy mildew (DM) developed strongly in all the plots, and this was consistent with levels of the disease in many paddocks throughout the district in that season. The absolute level of DM on the leaves decreased in relation to amount of healthy tissue between the time of the two disease assessments (Table 3). Warm dry conditions and adequate soil moisture allowed plants to out-grow the disease which remained confined to lower leaves. It was thus more appropriate to determine percentage of nodes infected rather than leaf area affected at the second assessment. Both seed treatments gave reductions in DM at both assessment dates, but only for Mx+Cpt was the reduction statistically significant.

There was a significant (P<0.10) increase in the number of nodes per plant in the fungicide- treated versus the nil-treated plants at the second disease assessment; F-Al+Th+Tbz treated had 10.5, Mx+Cpt 10.3 and untreated 10.1 pods per plant.

TABLE 4: Root rot assessed as a disease index (DI) on a 0 - 100 scale, 34 and 49 days after sowing

Treatment	Log ₁₀ DI means			(Back transformations of means)		
	34 d	49 d	Mean	34 d	49 d	Mean
F-Al+Th+Tbz	0.806a	1.257a	1.121a	(6.4)	(18.1)	(13.2)
Mx+Cpt	1.047ab	1.471a	1.310ab	(11.1)	(29.6)	(20.4)
Nil	1.319b	1.558a	1.465b	(20.8)	(36.1)	(29.2)
LSD(5%)	0.280	0.266	0.219			
Contrasts:						
Nil vs Treated	*	†	*			
F-Al. vs Mx.	†	†	†			

The following pathogenic fungi were isolated from the root rots in the plants 49 days after sowing: *Fusarium solani* (Mart.) Sacc.; *Pythium ultimum* Trow; *Ascochyta* spp. (in order of decreasing frequency)

Seed treatments with both F-Al+Th+Tbz and Mx+Cpt gave decreases in root rot, caused mainly by *Fusarium solani*. Although F-Al+Th+Tbz gave the greatest reduction in root rot, this was not significantly lower than Mx+Cpt ($P < 0.05$) at either assessment date. At $P < 0.10$ confidence level, treatments were lower in root rot scores at both the first and the second assessments. Plant dry weights reflected the root rot scores (Table 2); the lowest disease rating (F-Al+Th+Tbz) gave the highest dry weight, and the highest rating (nil treatment), gave the lowest dry weight.

TABLE 5: Yield and yield components of peas determined 112 days after sowing.

Treatment	Pods/plant	1000 seed wt.(g)	Yield (t/ha)
F-Al+Th+Tbz	3.8a	202a	3.70a
Mx+Cpt	3.6a	203a	3.66a
Nil	3.3a	198a	3.16a
LSD (5%)	0.76	7.2	0.60
Contrasts:			
Nil v treated	ns	ns	*
F-Al vs. Mx.	ns	ns	ns

Thousand seed weights, pods per plant and yields were generally higher in the treated plots, but the increases were not statistically significant (Table 5).

However, when both treatments were analysed together and compared to untreated, there was a significant increase in yield.

CONCLUSIONS

In this trial site where DM and root rot incidence and severity were typical of many fields in Canterbury, one fungicide mixture, (Mx+Cpt) gave better control of DM, whereas the other (F-Al+Th+Tbz) gave better control of root rots. This latter result may reflect the extra activity of the MBC component in the mixture allowing it to control *Ascochyta* spp., against which it has specific activity (Bretag 1985).

Each fungicide mixture appeared to better contribute towards the control of a different spectrum of diseases to achieve small increases in yield. Pea yields are variable in Canterbury, and analysis of components of yield show that site selection, and seasonal climatic variation influence yield more than any other factor(s). (Wilson 1987). Moreover, the diseases controlled here are not major constraints to yield when growing conditions are satisfactory (Ashby *et al* 1987).

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