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Field trials of foliar sprays of 3,5-dichlorophenoxyacetic acid (3,5-D) against common scab on potatoes

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Summary

Foliar sprays of 3,5-dichlorophenoxyacetic acid (3,5-D) in June or early July decreased the incidence of common scab by about 30 % in four field trials on cv. Maris Piper and cv. Désirée; however, significant decreases in yield and in mean tuber weight were also common.

The effects of 3,5-D on potatoes resembled those of the growth retardant daminozide in some ways, but 3,5-D was not persistent enough to have a useful effect on scab in the field.

Introduction

Previous glasshouse work showed that foliar sprays of certain chlorophenoxyacetic acids greatly decreased the severity of common scab, caused by soil-borne *Streptomyces scabies* (McIntosh et al., 1981). 3,5-dichlorophenoxyacetic acid (3,5-D), a growth retardant in solanaceous plants (Firn & Wain, 1971; Taylor & Wain, 1978), was outstandingly effective among the compounds tested; it was more active against scab, in much smaller amounts, than daminozide and ethionine (McIntosh & Bateman, 1979; McIntosh & Burrell, 1980).

In this note results are reported of trials of 3,5-D against scab in the field.

Method

Three trials were done with cv. Maris Piper on sandy loam at Woburn Experimental Farm, Bedfordshire, and one with cv. Désirée on loamy sand at MAFF Gleadthorpe Experimental Husbandry Farm, Meden Vale, Nottinghamshire.

All trials were of randomised block design, each plot being a 3.75 or 4 m length of single row, separated from parallel plots by single unsprayed rows and from plots in the same row by 1-m paths. Freshly-made 0.05–0.2 g/l solutions of 3,5-D (McIntosh et al., 1981) were applied as high volume sprays from knapsack sprayers, once or several times in June or early July. On each occasion a few plants were lifted from discard rows to give an estimate of tuber size at spraying. After harvest by fork in September, the following measurements were made on the tubers from each plot: yield of total tubers; scab index (Large & Honey, 1955; Lapwood & Dyson, 1966) on a sample of 40 or 50 ware tubers; and mean weight per tuber, calculated from the scab assessment sample.

Table 1. Effects of 3,5-D foliar sprays (0.2 g/l) on incidence of common scab at harvest in field trials.

Year	Site	Cultivar	Spray dates (S)			Yield of tubers (t/ha)	Mean tuber wt (g)	Scab index
			7 June	11 June	19 June			
1978	Woburn	Maris Piper	S	-	-	38.8*	107*	10
			-	S	-	31.9***	95**	8*
			-	-	S	35.0**	83***	10
			-	S	S	22.0***	59***	5**
			-	-	-	45.3	138	15
1979	Woburn	Maris Piper	11 June	26 June	2 July			
			S	-	-	39.9	154	31*
			-	S	-	38.8	136*	19**
			-	-	S	39.7	135*	28*
			-	-	-	41.7	160	40
1981	Woburn	Maris Piper		14 June	22 June			
				S	S	38.9**	92***	13
				-	-	48.6	134	16
1981	Gleadthorpe	Désirée			19 June			
					S	40.8	102	12
					-	37.3	99	15

* Difference from unsprayed significant at $P < 0.05$.
** Difference from unsprayed significant at $P < 0.01$.
*** Difference from unsprayed significant at $P < 0.001$.

Results and discussion

Table 1 gives results from all single and repeated spray treatments with 3,5-D at 0.2 g/l in all four trials. In 1979 and 1981, lower concentrations were also used: 0.1 g/l sprays had roughly the same effects as 0.2 g/l, but 0.05 g/l sprays had no effects. Results from these treatments are not shown in the table.

The main conclusion is that, despite the encouraging results from glasshouse tests, 3,5-D foliar sprays did not give practical scab control. In the glasshouse, single 0.2 g/l sprays consistently decreased scab severity by about 85 %, and decreased yield by about 8 %, with some tuber deformation (McIntosh et al., 1981). In the field, by contrast, the effects on scab were weaker, and crop injury more serious. The general effects can be seen from the approximate mean decreases from all the 0.2 g/l treatments: scab, 30 %; yield, 15 %; tuber weight, 20 %. Tuber distortion, like the effect on scab, was less than in the glasshouse.

In all trials with Maris Piper, plants sprayed with 3,5-D at 0.2 g/l became more compact than normal, with darker green leaves, within a week. These symptoms, which

were sometimes still noticeable a month later, resembled those caused by sprays of the growth retardant daminozide at about 5 g/l (Humphries & Dyson, 1967). Evidently the effect of the 3,5-D treatments could be damaging enough to limit tuber growth. Significant decreases in yield and tuber weight were common in Maris Piper in 1978 and 1981 at Woburn, even in the absence of significant effects on scab; in the other trials such losses were fewer, suggesting that they were partly dependent on local or seasonal conditions, or on cultivar.

3,5-D also resembled daminozide in other ways. Both are known to be translocated from leaves to tubers and other parts of plants after spraying and both prevented scab formation by altering tuber metabolism, 3,5-D being about 50 times more active than daminozide in the glasshouse (McIntosh & Bateman, 1979; McIntosh et al., 1981). However, the difference between effectiveness in the glasshouse and effectiveness in the field was much greater for 3,5-D than for daminozide (McIntosh, 1979). This may be related to the comparatively poor persistence of 3,5-D; with a half-life of 7–10 days in potatoes (Burrell, 1982), it was much less stable than daminozide in plants (Dicks, 1972; Dicks & Charles-Edwards, 1973; Thomas, 1974). In the glasshouse, with only one or two tubers per plant, the periods of tuber initiation and maximum sensitivity to infection by *S. scabies* (Lapwood, 1973) were limited to a few days; in the field they were spread over several weeks. Table 1 gives indications that the optimum time for single sprays was about mid-June when the mean tuber weight on the sampled plants was 0–6 g; however, the short-lived 3,5-D could clearly not continue to protect, as daminozide could, a series of young tubers.

Practical scab control by foliar sprays may be possible with other chemicals if they are as efficient as 3,5-D in the glasshouse, and as stable in plants as daminozide.

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