EFFECT OF SLOW-RELEASE SEED TREATMENTS FOR CONTROL OF ROOT MAGGOTS, Delia radicum (L.) and D. floralis (Fallén), IN CANOLA IN ALBERTA

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ABSTRACT

Experimental slow-release formulations of Amaze (oftanol, isofenphos) and Counter (terbufos) as seed treatments of canola were tested during 1992 for control of root maggots at two sites in Alberta. The efficacy of these treatments in reducing the level of serious root damage caused by maggot feeding and secondary foot rot was estimated at 42% for Brassica rapa and 39% for B. napus varieties. Significant yield increases were obtained in rapa at both sites (9.4% at Ellerslie, 12.1% at Westlock) and in napus at Westlock (17.8%).

INTRODUCTION

This paper presents highlights from a report entitled "Intervarietal Comparison of Chemical Seed Treatments for Root Maggot Control in Canola" (Griffiths 1993). That report followed up the results of a previous study entitled "Economic Assessment of Cabbage Maggot Damage in Canola in Alberta" (Griffiths 1991), in which it was demonstrated that in parts of Alberta with midsummer peak of precipitation major yield losses could be caused in canola by root maggot attack and secondary fusarial foot rot. The rapa variety Tobin was highly susceptible to such losses, while the napus variety Alto appeared less susceptible at least on chernozemic soil. During 1992 work with the two most promising chemical controls (Amaze and Counter) was extended to additional varieties at two rates of application. The formulations used were experimental, designed to prolong release of the active ingredient into the main period of maggot hatching (June 15 to July 7 approx.).

EXPERIMENTAL DESIGN AND METHODS

Seed was sown in plots of $6m^2$, trimmed shortly before harvest to $2m^2$ in order to avoid edge effects. Eight blocs (each containing 11 or 12 plots in random sequence) were sown for each canola species at each site. Some rapa data for Westlock had to be rejected on account of root competition from a shelterbelt. There were five seed treatments: 1, Amaze as seed coating at 24 ml/kg, 2, the same at 48 ml/kg, 3, Counter granules in 1:1 mixture by volume, 4, the same in 2:1 mixture, 5, untreated for maggot control. The following four varieties were tested with all five treatments: Horizon and Parkland (rapa), Excel and Legend (napus); additionally untreated plots of Tobin (rapa), Alto and Celebra (napus) were included. The formulations of Amaze and Counter tested included a plastic intended to prolong release of the active ingredient into the period of maggot hatching.

The two study sites were located on the Ellerslie section of the University of Alberta Farm (immediately south of Edmonton) and in SE19-58-26-W4 (near Pickardville south of Westlock).

Seed was sown on May 8 at a rate equivalent to about 2 kg/ha, which gave a mean seedling density at Ellerslie of 120 plants/sq.m. for napus and 105 plants/sq.m. for rapa, and at Westlock of 80 plants/sq.m. for napus and 120 plants/sq.m. for rapa. Root ratings using a six-point rating system were conducted twice, on plants immediately outside the plots to be harvested during the period of maggot infestation (July 10-15) and on harvested plants on the day of harvest.

RESULTS

(1) Level of Maggot Infestation (Table 1)

All chemical treatments for maggot control achieved significant (in χ^2 test of 2x2 table) reductions in the level of serious root damage during the period of maggot feeding (first set of root ratings). By harvest time the level of serious root damage in untreated plots further increased (and remained significantly higher than in treated plots) in the case of rapa at Ellerslie and in both species at Westlock. The data for napus at Ellerslie is less conclusive, showing no increase in the level of damage in untreated plots between the first set of ratings and harvest. This is consistent with the yield data (only napus at Ellerslie failing to show a significant yield increase in response to seed treatment for maggot control). Significant mortality (category 5) was noted only in rapa varieties at Westlock (about 10% of plants in untreated plots).

The level of serious root damage was generally higher (both in untreated and treated plots) in rapa than in napus, rising to 80% (Ellerslie) and 87% (Westlock) of plants in untreated rapa plots but only to 49% (Ellerslie) and 62% (Westlock) in untreated napus plots. The average reduction in the level of serious root damage achieved by the seed treatments was 42% in the case of rapa and 39% in the case of napus. These values may be considered estimates of treatment efficacy.

TABLE 1. Proportion of seriously damaged roots (26+% of main rootstock damaged and/or rotted) for each site and species

Brassica napus cvv. (Excel + Legend) (%)

	Ellerslie		Westlock	
	Jy 11	Au 20	Jy 15	Au 25
Amaze, low (n=100)	30	26	26	40
high (n=100)	15	20	22	34
Counter, low (n=100)	28	48	27	35
high (n=100)	25	40	16	29
Total treated (n=400)	24.5	33.5	22.75	34.5
Untreated (n=100)	54	49	46	62

Brassica rapa cvv. (Horizon + Parkland) (%)

	Ellerslie		Westlock	
	Jy 10	Au 8	Jy 12	Au 11
Amaze, low (n=100)	23	43	38	51
high (n=100)	25	41	36	38
Counter, low (n=100)	45	47	55	55
high (n=100)	29	57	45	57
Total treated (n=400)	30.5	47	43.5	50.25
Untreated (n=100)	72	80	72	87

(2) Plot Yields (Table 2)

Significant yield increases as a result of treating seed for maggot control were achieved in rapa varieties at both sites (9.4% at Ellerslie, 12.1% at Westlock) and in napus varieties at Westlock (17.8%). The small increase in napus varieties at Ellerslie is not significant. Within rapa varieties, untreated plots of Horizon gave higher yields than untreated plots of Parkland and Tobin ($p<0.1$). Within napus varieties, there were

no significant yield differences between untreated plots of the four varieties tested at Ellerslie but at Westlock Excel and Alto yielded more highly ($p<0.05$) in untreated plots than did Legend and Celebra. See Griffiths (1993) for a breakdown of the data.

No consistent rate response was demonstrated with higher and lower rates of application, nor were the effects of treating seed with Amaze or Counter significantly different.

TABLE 2. Mean plot yields for each site and species

	Ellerslie				Westlock				Site Difference
	g/2m^2	kg/ha	bu/ac	n	g/2m^2	kg/ha	bu/ac	n	
Brassica napus cvv.									
Treated	467.4 ± 8.1	2337	41.6	64	422.1 ±10.4	2111	37.6	64	+10.7% (- 9.7%) ($p<0.01$)
Untreated	463.2 ±11.7	2316	41.2	32	358.4 ±15.1	1792	31.9	32	+29.2% (-22.6%) ($p<0.001$)
Treatment Effect	+ 0.9% (- 0.9%) (ns)				+17.8% (-15.1%) ($p<0.01$)				
Brassica rapa cvv.									
Treated	380.9 ± 7.0	1905	33.9	64	408.6 ±10.1	2043	36.4	35	- 6.8% (+ 7.3%) ($p<0.05$)
Untreated	348.3 ± 8.5	1741	31.0	24	364.5 ±22.7	1822.5	32.4	10	- 4.4% (+ 4.7%) (ns)
Treatment Effect	+ 9.4% (- 8.6%) ($p<0.05$)				+12.1% (-10.8%) ($p<0.05$)				

(3) Seed Quality

No significant differences in seed quality (weight, oil content, protein content) were demonstrated to have resulted from maggot control. The effect of maggot damage appeared to be entirely quantitative.

DISCUSSION

Only about one-quarter of normal precipitation fell during June 1992, and July precipitation although much greater was still below average. So the 1992 data must underestimate the benefits obtainable in years of average or above average summer precipitation more favourable for root maggots and the *Fusarium* fungi which cause secondary foot rot. The need to replace existing seed treatments with slow-release formulations which will control maggots as well as flea beetles is sufficiently demonstrated.

The better resistance of *napus* to maggot damage inferred from earlier studies was confirmed at Ellerslie on chernozemic soil, but not at Westlock on grey-wooded soil.

The absence of significant rate responses suggests that under 1992 conditions the lower application rates already reduced damage to below an economic threshold.

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