YIELD RESPONSES IN CEREALS TREATED WITH PIRIMICARB FOR ROSE-GRAIN APHID CONTROL

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SUMMARY

Insecticide trials at Lincoln showed significant yield increases in spring oats and barley treated with pirimicarb for the control of rose-grain aphid (*Metopolophium dirhodum*) at the flag-leaf sheath extension stage of plant growth. Treatment at mid-heading gave no increase in yields, but increased kernel size in spring barley. Results of an unreplicated trial near Kirwee were consistent with the above. Winter wheat treated at the same growth stages showed no yield responses to treatment.

INTRODUCTION

Significant yield responses to the control of rose-grain aphid were found in winter wheat and oats at Lincoln in the 1983-84 season. No yield response to insecticide was found in barley (Stufkens and Farrell 1984) This paper reports further trials carried out at Lincoln during the 1984-85 season, in which pirimicarb was applied to cereals at two plant growth stages. The use of action thresholds (aphid counts), employed for spray timing in 1983-84, was discarded in view of the rapid increase in aphid numbers early in the infestation period (Stufkens and Farrell, unpublished).

METHODS

Lincoln

Areas of the following cereals were drilled for autumn sown (29 May) and spring sown (6 September) trials: Rongotea wheat, Omihi oats, Illia (autumn) and Triumph (spring) barley. Nitrogen fertiliser (130 kg/ha) was applied as urea granules broadcast in split applications at early tillering and pseudostem-erect stages of growth. For stripe rust control, triadimeton (Bayleton 25 W.P.) was sprayed onto wheat on 3-4 occasions in the spring.

Pirimicarb (Pirimor 50) was applied at a rate of 125 g ai/ha, using a controlled droplet boom sprayer, at the flag leaf sheath extension stage (growth stage (GS) 41 -Zadoks *et al* 1974), at mid-heading (GS 55), or at both stages (Table 1). Control plots were untreated. Six replicates of plots 4 × 7.5 m (30 m^2) were used for each treatment.

TABLE 1: Dates of pirimicarb application to wheat (w), oats (o) and barley (b) at two growth stages (Zadoks *et al* 1974); Lincoln 1984.

Growth stage	Date of application			
	Autumn-sown		Spring-sown	
41	25/10 w b	1/11 o	19/11 w b o	
55	3/11 b 13/11 w	19/11 o	27/11 w b	6/12 o

Rose-grain aphids were counted on 10 randomly-selected samples of 10 tillers taken from unsprayed treatments at weekly intervals between 1 November and 14 December. Samples were taken from sprayed plots during the period 2-6 weeks after treatment. Values for aphid-days (Stufkens and Farrell 1984) were calculated from areas under curves of aphid numbers. Crop growth stage was recorded weekly from emergence until maturity.

Header yields were taken from a central 6 m × 1.8 m (10.8 m^2) strip in each plot at harvest. Sub-samples were taken for estimation of kernel weight and grading, using standard screens of slot width 2.4 mm (A6) and 2.8 mm (A7).

Courtenay

An unreplicated insecticide trial was carried out at Courtenay, near Kirwee. Magnum spring barley was drilled in a 2 ha paddock on 26th September. One half of the paddock was treated with pirimicarb at 125 g ai/ha on 6 December. Aphid numbers/ten tillers were recorded on 20 November and 4, 20 December. Header yields were taken from two strips 3 × 220 m (660 m²) in each of the sprayed and unsprayed areas. Subsamples were taken for estimation of kernel weight and grading, but as the crop was feed barley, one screen of 2.6 mm slot width (A6½) was used for grading.

RESULTS

Lincoln

Autumn-sown barley and oats were severely damaged by a gale, and the spring wheat block was destroyed by fire before harvest. Yields from these trials are therefore not presented.

Numbers of rose-grain aphids recorded in the Lincoln trials increased rapidly during November to peaks of 115/tiller (spring barley), 240/tiller (spring oats) and 22/tiller (autumn-sown wheat — i.e. winter wheat) at *ca* GS 53. Aphid numbers declined thereafter to < 5/tiller at GS 67-73.

Table 2 shows that winter wheat yelds were not significantly affected by insecticide treatments, which reduced the aphid burden by up to 390 aphid days. The proportion of kernels passing through an A6 screen (8.5%) and 1000 kernel weight (45 g) did not vary significantly between treatments.

Yield of spring oats was significantly increased in plots sprayed at GS 41, associated with a reduction of 3000 aphid days in the aphid burden, but treatment at GS 55 had no effect (Table 2).

TABLE 2: Grain yields (t/ha-above) and aphid-day values (below); Lincoln 1984-5.

Sprayed at GS: Crop	41	55	41 + 55	untreated	LSD	CV%
Spring barley	4.85	4.62	4.76*	4.27	0.47	8.5
	180	790	150	1350		
Spring oats	3.56*	3.28	3.45*	3.15	0.28	6.8
	310	2200	230	3250		
Winter wheat	6.47	6.37	6.30	6.08	n.s.	5.2
	30	310	30	420		

*P < 0.05 in comparison with untreated.

Spring barley yields were significantly increased by ca. 0.5 tonne (12%) in plots sprayed at GS 41, associated with a reduction of 1200 aphid-days, but as in spring oats, treatment at GS 55 had no effect (Table 2). Screenings through A6 mesh (12-13%) and 1000 kernel weight (43-44 g) did not vary significantly between barley treatments, but the proportion of large kernels retained by A7 mesh was significantly greater ($p < 0.05$) in plots sprayed at GS 55 (62-63%) than in unsprayed plots (55%).

TABLE 3: Grain yields (t/ha), % large kernels* and 1000 kernel weight (g): spring barley, Courtenay, 1984-5.

	Yield t/ha		Large kernels %		1000 kernel g	
Strip	Spray	untreated	Spray	untreated	Spray	untreated
1	6.23	5.42	40.8	30.7	38.5	34.9
2	6.31	5.37	43.5	26.5	38.5	34.4
Mean	6.27	5.40	42.2	28.6	38.5	34.7

*% kernels retained by A6½ (2.6 mm slot) screen

Courtenay

Rose-grain aphid numbers in the barley crop increased in late November to a peak >100/tiller, and declined during December. Pirimicarb treatment at GS 41 reduced the infestation by approximately 1000 aphid days in the sprayed half of the paddock.

Grain yields from the treated area were *ca.* 0.8 tonne (16%) greater than in the untreated half of the paddock. The proportion of kernels retained by the A6½ screen (42%-29%) and 1000 kernel weights (39-35 g) were also greater in the sprayed than in the unsprayed areas, respectively (Table 3). No significant conclusions can be drawn from this unreplicated trial, but the results are consistent with those from the Lincoln spring barley trial.

DISCUSSION

The results of the trials here are discussed in relation to those obtained at Lincoln in the previous season (Stufkens and Farrell 1984). Winter wheat supported relatively low rose-grain aphid populations (up to 10-20/tiller in both years). The yield response to pirimicarb application at GS 41 was significant in 1983-84, but not in the present work. We suggested (Stufkens and Farrell 1984) that the 1983-84 result should be treated with caution, in view of the slight aphid infestation. Further work is in progress to examine the effects of aphid control in wheat.

Spring oats supported relatively heavy aphid infestations (up to 110-240/tiller), and showed significant yield responses to pirimicarb treatment at GS 41 in both years. Oats may therefore be regarded as being regularly at risk from rose-grain aphid damage.

Spring barley supported moderate aphid numbers (up to 30/tiller) and showed no yield response to insecticide treatment in 1983-4, but was heavily infested with up to 115 aphids/tiller at both Lincoln and Courtenay in the 1984-5 season. Significant responses to spraying, in grain yield and kernel size, were found at Lincoln, and results at Courtenay were consistent with those at Lincoln.

Substantial aphid infestations were found on spring barley elsewhere in mid Canterbury during November and December 1984 (Stufkens and Farrell 1985). It is possible that yield losses due to rose-grain aphid damage were widespread.

The level of aphid infestation, and hence yield losses, varied between 1983-84 and 1984-85 seasons at Lincoln. We have suggested that the time of rose-grain aphid invasion of autumn sown crops varies between years, under the influence of winter climate (Stufkens and Farrell 1985), and that the level of peak aphid populations may vary with November weather (Stufkens and Farrell 1984). November weather in 1984 was relatively warm and dry, in comparison with 1983, and favoured a rapid rate of aphid increase, as observed during the present work. These data suggest that barley may be particularly subject to aphid damage varying in intensity from year to year under the influence of climate. Further work on loss of yield due to aphid damage in barley in is progress.

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