SEED TREATMENT AND FOLIAR SPRAY CONTROL STRATEGIES FOR DISEASE CONTROL IN WINTER WHEAT, CV KOPARA.

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SUMMARY

Speckled leaf blotch (*Mycosphaerella graminicola*) and stripe rust (*Puccinia striiformis*) reduced yield in winter sown wheat, cv Kopara, by 17%. Detailed analysis of the major yield components showed that yield potential was affected at several growth stages both prior to and post anthesis. A combination of seed treatment and a late spray at Growth stage 16, 24 (5 - 6 leaf stage, tillering), proved to be the best strategy to prevent yield loss, with a triadimenol/triadimefon combination being more effective, especially against stripe rust, than thiabendazole.

INTRODUCTION

Speckled leaf blotch (*M. graminicola* imperfect state *Septoria tritici*) has been shown to cause substantial yield losses, especially in winter sown wheat (Sanderson 1978; Thomson *et al* 1981). The disease reduced yield potential by reducing the number of florets formed per ear, increasing floret loss prior to anthesis and reducing individual grain weight (Gaunt and Thomson 1982; Thomson and Gaunt 1982). It was concluded that infection at early crop growth stages was an important factor in the cause of yield reductions and that seed treatment with an effective chemical in combination with foliar sprays may be an appropriate control strategy for this disease.

This paper reports on a field trial designed to test the optimal timing of foliar sprays in combination with seed treatments for control of speckled leaf blotch. In view of the recent arrival of stripe rust in New Zealand, treatment combinations were included to control the anticipated development of this disease in the crop.

METHODS

The widely grown cultivar Kopara was selected for the trial on the basis of its known susceptibility to speckled leaf blotch, and partial resistance to strip rust (G.M. Wright pers comm). Treatment plots were sown on 28 May 1981, using a precision cone seeder, with untreated seed or seed treated with either triadimenol or thiabendazole. The plots were treated with foliar sprays during the crop growth cycle in various combinations as shown in Table 1. Triazole (triadimefon) and MBC fungicides (thiabendazole) have known activity against speckled leaf blotch and stripe rust. The timing of the foliar sprays was based on previous knowledge of epidemic and apical development. Each treatment plot (12 x 6 m) was surrounded by a 0.5 m access path and separated from adjacent plots by a 1.5 m untreated buffer zone of Kopara wheat. Each of the four replicate blocks were separated by a buffer zone (3 m) which was also untreated. Fungicide sprays were applied to the plots using a 6 m boom with hollow-cone nozzles (D2.25), applying 300 litres/ha at 400 kpa.

At early stages of the epidemic, disease incidence was assessed at weekly intervals to determine the degree of protection by seed treatment. Subsequent to the application of the first foliar sprays, disease severity was assessed weekly for all treatments as the mean area of "disease" (speckled leaf blotch, stripe rust and natural senescence combined) on those leaves still bearing some green leaf area in the most effective treatment. This disease index, though having no absolute value, was an effective indicator of the relative efficacy of the treatments (see Lim and Gaunt 1981).

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At crop maturity, ten 0.1m² quadrat samples were removed from the central strip of each plot for detailed analysis of the major yield components. A central 1.5 m strip was then harvested mechanically to determine the header yield.

TABLE 1. Design of field trial sown 28 May 1981 at Lincoln College.

Treatment Code	Seed Treatment	Date G.S.	13 Aug. 14	Foliar spray 17 Sept. 15	1 Oct. 16
	triadimenol			triadimefon	
B	+		—	—	—
BS1B	+		+	—	—
BS2B	+		—	+	—
BS3B	+		—	—	+
OS1BS2B	—		+	+	—
OS2B	—		—	+	—
OS2BS3B	—		—	+	+
	thiabendazole			thiabendazole	
T	+		—	—	—
TS1T	+		+	—	—
TS2T	+		—	+	—
TS3T	+		—	—	+
OS1TS2T	—		+	+	—
OS2T	—		—	+	—
OS2TS3T	—		—	+	+
O	—		—	—	—

Plot size 12 x 6m

Replicate 4 (randomised block)

* i.e. 4, 5 + 6 leaves present on main stem.

RESULTS AND DISCUSSION

The first symptoms of both speckled leaf blotch and stripe rust were observed on the main stem leaves at early tillering (G.S. 23,30, Zadoks *et al* 1974). Primary infection by both diseases was reduced significantly by seed treatment (Table 2). The two fungicides had similar effects on speckled leaf blotch infection but triadimenol was more effective in preventing infection by strip rust, though thiabendazole did also reduce the level of the disease significantly relative to the nil treated plants.

TABLE 2. Percentage disease incidence of speckled leaf blotch and stripe rust.

Seed Treatment and (rate/100kg)	Speckled leaf blotch*				Stripe Rust*				
	7 Sept	14 Sept	21 Sept	28 Sept	7 Sept	14 Sept	21 Sept	28 Sept	
	Days after sowing	102	109	116	123	102	109	116	123
	G.S.	23	24	24	30	23	24	24	30
Triadimenol (15g)	8 a	14 ab	33 a	58 a	1 a	5 a	14 a	23 a	
Thiabendazole (115g)	5 a	12 a	33 a	44 a	3 a	20 b	35 b	48 b	
Nil	16 b	20 b	55 a	78 b	7 a	29 c	48 b	68 c	
CV%	36	21	35	17	89	18	30	25	

* Disease incidence was determined by examining 10 plants sampled randomly from each plot. Values are means of 4 replicates, each replicate consisting of 4 plots (triadimenol and thiabendazole) or 7 plots (nil treatment).

In the plots with triadimenol seed treatment only, disease severity was reduced at G.S. 30, but thereafter there were no significant differences relative to nil treated plants. Thiabendazole seed treatment alone had no effect on disease severity from G.S. 30 onwards. When triadimenol treated plots were further treated with triadimefon foliar sprays, the greatest additional control relative to the triadimenol treated plots was observed with a spray applied at the 6 leaf stage; earlier sprays had little additional effect on diseases. Two sprays applied at the 5 and 6 leaf stages, to plots which were not treated with triadimenol, had a similar but no greater effect on diseases than the triadimenol plus 6 leaf spray treatment.

Thiabendazole sprays had less effect on disease than triadimenol, mostly because of a lower efficacy against stripe rust (Chan, unpublished). However, there were some consistent reductions in overall disease levels, as in the effect of the 5 leaf stage spray on disease at anthesis.

The effects on yield were generally low and non significant, probably due to an overall depression of yield by the low soil water availability during the exceptionally dry summer in this season. Yields were lower than in similar trials conducted in previous years and this could have resulted in a masking of treatment effects. Despite this, some consistent yield responses are worthy of mention.

Triadimenol seed treatment appeared to reduce yield in the trial, possibly due to an effect on apical development which was shown by the reduced number of grain per ear at harvest. However, similar effects have not usually been seen in other trial results. Overall the triazole fungicide treatments had a greater effect on yield than thiabendazole, reflecting the better control of disease (especially stripe rust). The major effect on yield (17% yield loss prevented by treatment) was due to effects on grain number per ear, with little effect on grain weight nor the combined component ear number per unit area. Yield responses were lower and more variable with thiabendazole treatments.

On the assumption that yield differences were depressed by the drought situation (cf. yield of 6 t/ha or more in previous trials), it is evident from disease assessments that seed treatment in combination with a single foliar spray was as effective in controlling

TABLE 3. Disease severity from stem elongation to grain filling.

Treatment	Mean disease severity* on bottom 6 leaves at G.S. 30	Mean disease severity* on top 4 leaves at G.S. 63	Mean disease severity* on top 4 leaves at G.S. 80
B	56 bc	62 d	71 bcd
BS1B	51 ab	62 d	72 cd
BS2B	45 a	66 d	76 d
BS3B	62 cd	50 abc	60 a
OS1BS2B	50 ab	59 bcd	68 abcd
OS2B	51 ab	60 bcd	72 cd
OS2BS3B	66 de	48 a	60 a
T	72 e	61 d	69 abcd
TS1T	67 de	61 cd	67 abc
TS2T	71 e	50 abc	63 ab
TS3T	72 e	61 cd	64 abc
OS1TS2T	70 e	58 abcd	62 ab
OS2T	71 e	50 ab	63 ab
OS2TS3T	61 cd	59 bcd	66 abc
O	71 e	60 bcd	68 abcd
CV %	7	11	8

* Disease Severity was assessed, with the aid of standard area diagrams, as the percentage non-green leaf area. The main contributors to this variable were speckled leaf blotch, stripe rust and natural senescence.

disease as two foliar sprays in the absence of seed treatment. The former treatment is more cost effective and may be tentatively recommended for this cultivar in Canterbury. The single spray can be applied at the 5 to 6 leaf stage without risk of an increase of disease prior to this time due to partial protection from seed treatment. In 1981 there was stripe rust inoculum pressure on Kopara crops from crops of more susceptible cultivars (e.g. Rongotea and Hilgendorf). One may predict that the recommended treatment would be more effective if inoculum pressure can be decreased by more effective control of disease on susceptible cultivars or by a trend away from their usage in the future.

TABLE 4. Effect of speckled leaf blotch and stripe rust on yield and yield components.

Treatment	QUADRANT SAMPLE					HEADER YIELD (t ha-1)
	Yield (t ha-1)	Plants /m ²	Ears/ plant	Grains /ear	1000 grain wgt (g)	
B	3.8 c	197 a	2.5 b	24.7 c	31.6 a	3.3 b
BS1B	4.8 abc	198 a	2.7 ab	31.2ab	28.9 b	3.8 b
BS2B	4.6 abc	215 a	2.5 b	28.5 abc	29.9 ab	4.5 a
BS3B	4.9 ab	179 a	2.6 ab	34.1 a	31.1 ab	4.6 a
OS1BS2B	5.4 a	221a	2.6 b	32.5 ab	30.2 ab	4.2 a
OS2B	5.0 ab	186 a	3.1 a	30.4 abc	28.9 b	4.3 a
OS2BS3B	4.9 ab	196 a	2.5 b	31.5 ab	31.8 a	4.2 a
T	4.3 abc	206 a	2.7 ab	26.6 bc	30.0 ab	4.0 ab
TS1T	4.7 abc	214 a	2.8 ab	26.8 bc	29.8 ab	4.1 a
TS2T	4.7 abc	214 a	2.5 b	29.6 abc	30.3 ab	4.1 a
TS3T	4.3 abc	190 a	2.8 ab	26.7 bc	30.6 ab	4.5 a
OS1TS2T	4.2 bc	203 a	2.6 b	27.0 bc	30.6 ab	4.1 a
OS2T	4.7 abc	203 a	2.5 b	30.3 abc	30.6 ab	4.4 a
OS2TS3T	4.9 ab	224 a	2.4 b	29.8 abc	30.6 ab	4.1 a
O	4.6 abc	200 a	2.7 ab	29.0 abc	30.0 ab	3.8 ab
CV %	14.4	15	11.1	12.4	5.3	11.5

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