PROPICONAZOLE — A NEW SYSTEMIC FUNGICIDE FOR DISEASE CONTROL IN CEREALS

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SUMMARY

Applications of the new triazole fungicide propiconazole were as effective as triadimefon in controlling stripe rust (*Puccinia striiformis*) in four cultivars of wheat. In four out of five trials two applications of propiconazole (each of 125 g/ha), 3 to 4 weeks apart, during periods of considerable disease pressure, prevented yield losses of from 21-40%. A single application to the susceptible cultivar Takahe prevented yield losses of 23-26%. There was no difference between 125 and 250 g/ha. Single applications of fungicide controlled leaf rust (*Puccinia hordei*) on barley, but because of low disease severity did not result in yield differences over untreated.

INTRODUCTION

Propiconazole, previously coded CGA 64250, is a new broad spectrum fungicide belonging to a chemical class of highly active triazole fungicides described by Staub *et al* (1979), as having systemic protective and curative properties.

Chemistry

1-[2-(2,4-dichlorophenyl)-4-propyl-1, 3-dioxolan-2-yl methyl]-1,2,4-triazole.

Toxicology

The acute oral LD₅₀ to rats is 1517 mg/kg. It causes minimal eye and slight skin irritation when tested on rabbits. It is moderately toxic to fish, but of low toxicity to birds.

Mode of action

The mode of action of propiconazole is described as ergosterol biosynthesis inhibition. In general the main effect is on secondary haustoria with no effect on spore germination at normal rates. It is a systemic fungicide absorbed by all green plant parts with translaminar movement in the leaf.

Biological activity

At low concentrations, propiconazole controls a wide range of ascomycetes, basidiomycetes and deuteromycetes. This paper describes the effectiveness of the compound against two of the airborne diseases of cereals, stripe rust of wheat, and leaf rust of barley.

METHODS

There were eight plot trials located in Southland (five wheat), and Canterbury (one wheat, two barley). The treatments were applied in 225-300 litres water/ha using a small plot sprayer at 200 to 300 kPa. Plots were 3 x 8 to 10 m in Southland and 5 x 20 m in Canterbury, all in randomised blocks with treatments replicated 4 to 5 times. Both the propiconazole and triadimefon treatments were emulsifiable concentrate formulations containing 250 g/litre. Visual assessments were made 3 to 4 weeks after each spraying. The percentage area of the upper three leaves infected with stripe rust from 10 tillers per plot were determined by comparison with a set of standard area diagrams. For yield purposes, either 4 to 5 m² quadrats/plot in Southland, or a 1.5 m swath in Canterbury, were taken from each plot, threshed, and the resultant grain weighed. All grain yields are expressed at 15% moisture content.

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The early applications (E) in the Southland trials were made at growth stage E31, and the later (L) ones at E60-65 for trial 3 and E69 for the remainder, according to the EDP code of Eucarpia (Zadoks *et al* 1974). The first applications were made when the disease had infected from 1 to 5% of the top leaf.

RESULTS AND DISCUSSION

Southland: The cool (8-14°C) and showery weather conditions prevailing during and subsequent to the first spray applications, were conducive to continuing infection pressure from stripe rust. The rapid increase of the disease in untreated wheat crops is seen in Table 1. Under these conditions, a single application of fungicide gave no more than 4 weeks control with a double rate of 250 g/ha propiconazole little better. However, as Table 2 shows one application did give increases in yield though significance was only achieved in two trials, both of which were on the susceptible cultivar Takahe. A second application continued to provide very good stripe rust control and this resulted in significant increases in grain yields over untreated.

TABLE 1: Southland wheat trials

Trial No:	Assessment dates	Treatments	(g/ha)	% Flag leaf area rust infected									
				1		2		3		4		5	
				7/1	3/2	6/1	2/2	7/1	3/2	7/1	3/2	7/1	2/2
propiconazole	125 E			16	52	2.6	88	21	71	25	100		76
propiconazole	250 E			7	45	1.3	67	21	72	13	98		76
propiconazole	125 E + L			6	29	2.7	23	26	57	22	71		31
triadimefon	125 E			8	38	2.1	94	28	69	23	94		69
triadimefon	125 E + L			4	32	2.9	19	29	54	21	73		26
untreated				22	54	4.9	88	64	86	75	95		73

Spraying dates: early (E) 2-3 Dec. 1981, and late (L) 6-7 Jan. 1982.

TABLE 2: Southland wheat trials — Grain yields (t/ha) and 1000 grain weights (g).

Trial No:	Cultivar	Treatments and rate (g/ha)	1		2		4		5	
			Hilgendorf		Tiritea		Takahe		Takahe	
			t/ha	grains (g)	t/ha	grains (g)	t/ha	grains (g)	t/ha	grains (g)
propiconazole E	125		4.0	35	3.2 b	25 c	3.5 ab	36 b	3.3 b	26 b
propiconazole E	250		4.5	38	3.6 b	25 bc	3.3 b	36 b	3.8 ab	28 ab
propiconazole E + L	125		5.0	38	4.8 a	28 ab	4.0 a	38 a	3.9 ab	28 ab
triadimefon E	125		4.5	36	3.0 b	23 c	3.4 b	36 ab	3.4 b	28 ab
triadimefon E + L	125		4.4	38	5.0 a	29 a	3.4 b	36 b	4.3 a	29 a
untreated			3.7	35	2.9 b	22 a	2.7 c	33 c	2.30 c	25 b
CV %			22	9	19	9	11	3	16	10
			NS	NS						

The sporadic incidence of take-all (*Gaeumannomyces graminis*) in trial 1 gave rise to yield variability with consequently no significant differences between grain yields and weights. Trial 3 was not harvested due to severe lodging.

Canterbury: Table 3 indicates that although the initial application (E) of fungicides controlled the stripe rust present, subsequent disease pressure resulted in re-infection and no significant increases in yield. However, a repeat application (L) 3 weeks later, gave a significant level of disease control which resulted in significant yield increases.

TABLE 3: Canterbury Wheat Trial results.

Trial No: 6		% Stripe rust infection						1000
Assessment dates	Leaf 3		Leaf 2		Flag Leaf	Yield t/ha	Grain Wgt (g)	
Treatments (125 g/ha)	10/11	30/11	10/11	30/11	10/11			30/11
propiconazole E	36 ab	20 bc	20 a	24 b	8 a	22 ab	5.6 c	37 d
propiconazole E + L	8 c	8 c	3 b	9 c	2 b	16 bc	7.0 a	41 ab
propiconazole L	28 b	17 bc	5 b	11 c	3 b	14 c	6.4 b	39 bc
triadimefon E	37 ab	28 b	29 a	23 b	7 a	17 bc	5.7 c	39 cd
triadimefon E + L	10 c	10 c	5 b	10 c	4 b	13 c	6.4 b	41 a
untreated	45 a	43 a	27 a	30 a	8 a	26 a	5.5 c	38 bc
CV %	30	46	51	18	30	25	4	3

Cultivar: Rongotea

Spraying dates: early (E) 30.9.81; late (L) 20.10.81.

In the two trials on barley leaf rust was present on the upper leaves of Mata and Zephyr at the time of spraying (27 January and 30 January 1982 respectively). However, as there were very dry conditions prevailing in February, leaf rust failed to develop into a severe epidemic. Assessments of infected leaves showed a difference between treated and untreated, but this was not reflected in significant yield or grain weight differences.

CONCLUSIONS

The use of propiconazole at 125 g/ha was very effective in controlling stripe rust in wheat.

In general an application at the onset of the disease, with another 3 to 4 weeks later during periods of disease pressure, prevented significant yield losses (21 to 40%) from occurring.

A single application of propiconazole, when applied to the susceptible cutlvar Takahe, prevented significant yield losses (25%) due to stripe rust.

There was no significant difference between the 125 and 250 g/ha rates of propiconazole.

The results confirm those obtained in Europe by Urech (1979) and Speich and Urech (1980).

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