CONTROL OF *RHYNCHOSPORIUM* SCALD OF BARLEY BY SEED AND FOLIAR FUNGICIDES

J. EDMUND SHERIDAN and DAVID K. NENDICK

*Botany Department, Victoria University of Wellington
P.O. Box 600, Wellington*

SUMMARY

New and registered C¹⁴-demethylation inhibiting (DMI) fungicides were evaluated for control of scald of barley in the Wairarapa district of the North Island, New Zealand, in 1987-88. As a seed treatment cyproconazole with carboxin and thiram gave control equal to triadimenol on the cvs Kym, Goldmaker and Zephyr whereas myclobutanil showed no activity against scald at the rates used. Foliar applications of DMI's gave less control than previously reported possibly suggesting a shift in fungicide sensitivity of the local pathogen population. Best control was obtained with propiconazole, prochloraz and terbuconazole. Triadimenol and flutriafol gave little or no control at label rates.

INTRODUCTION

Good control of scald (*Rhynchosporium secalis*) in New Zealand barley crops has been achieved with seed treatments containing triadimenol and the disease has become less troublesome in recent years (Grbavac 1987; Sheridan and Nendick 1988). Where an attack has occurred the application of one or two sprays of propiconazole or prochloraz have given excellent control in the very susceptible cvs Triumph and Goldmarker (Sheridan *et al* 1985). No reports of field resistance of *R. secalis* to DMI fungicides have been made although overseas laboratory tests have identified some isolates of the pathogen with reduced sensitivity to triadimenol (Hollomon pers. comm.). This paper reports on seed treatment trials carried out in the autumn and spring of 1987, and foliar spray trials carried out in the spring of 1987 to evaluate DMI fungicides for control of scald in New Zealand barley crops.

MATERIALS AND METHODS

Seed Treatment Trials

Treatments and the rates of application and cultivars used are in Tables 1 and 2. For powder formulations the appropriate amount of the product was placed on to 200 g of barley seed contained in a 500 ml round bottomed flask on a mechanical wrist-action shaker. Shaking was commenced and 2 ml of distilled water was added drop by drop. The flask was stoppered and shaking continued for 10 minutes. For liquid formulations dilutions were made as follows: imazalil - 3.57 ml of 70% imazalil base was added to 400 ml of ethanol in a measuring cylinder followed by 100 ml distilled water; carboxin + thiram - 25 ml of 'Vitaflo 200' was added to 75 ml of distilled water in a measuring cylinder. After thorough mixing 2 ml of the dilution was added drop by drop to the seeds while shaking. For the mixtures with carboxin + thiram, cyproconazole and myclobutanil powders were placed on to the seeds and 2 ml of the carboxin + thiram dilution added drop by drop while shaking. Flasks were kept stoppered for 7 days to allow for vapour action, if any.

Autumn seed treatment trials were hand sown in 5 m rows, 35 g seed per row, at Carterton on 8 April and Gladstone on 14 May 1987. Spring seed treatment trials were sown on 26 September 1987 at Gladstone. Treatments were randomised in blocks and there were five replicates.

To ensure a high level of inoculum in the spring sown trial, leaves of the cv

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Triumph (collected from the Autumn trial) infected with *R. secalis* were spread over seedlings of the cvs Zephyr and Kym 2 weeks after sowing.

Foliar Spray Trial

Seed of the barley cv Fleet was sown at 150 kg/ha at Gladstone in the spring of 1987. Following emergence plots (20 x 2 m) were marked out separated by a 1 m strip made by rotary hoeing. Treatments were randomised in blocks and there were four replicates. Fungicides (Table 3) were applied on 7 and 19 December 1987 (at Feekes G.S. 10.5 and 10.5.4 respectively) using a knapsack sprayer at 200 kPa fitted with three Allman 'O' nozzles and applying 300 litres/ha. Inoculum was provided by washing spores of *R. secalis* from leaves of cv Zephyr collected from the autumn trial and applying with a watering can to two replicates of each treatment on 19 November 1987.

Disease Assessment

Disease assessment began at GS.1 and continued at intervals to GS 11.1. Disease severity was assessed visually on a 0-4 scale up to GS 10 where 4 represented the maximum level of disease in the trial. Thereafter the percent of leaf area infected was recorded for 10 tillers, taken at random, in each row (seed treatment trial) or plot (foliar spray trial).

RESULTS AND DISCUSSION

Seed Treatment Trials

Best control of *Rhynchosporium* scald was given by the treatments containing triadimenol (Tables 1 and 2) or cyproconazole combined with carboxin and thiram at 20 g/100 kg seed (Table 2). Control achieved with triadimenol in earlier trials was much better than in 1987 (Sheridan *et al* 1985). Cyproconazole applied as a foliar spray has been reported to have good activity against scald in overseas trials (Gisi *et al* 1986). In our trials some phytotoxicity was observed with cyproconazole seed treatments but plots soon recovered. At the lower rates of 5 and 10 g/100 kg seed cyproconazole alone or in combination with carboxin+thiram was less effective in controlling scald. Flutriafol treatments were less effective than triadimenol. Myclobutanil (see Orpin *et al* 1986) gave no control of scald at up to 20 g/100 kg seed.

TABLE 1: The effect of seed treatments on the control of scald: Autumn 1987.

Treatment and rate g ai/100 kg seed	% Control					
	Carterton Site*		Gladstone site**			
	cv Triumph GS2	GS6	cv Zephyr GS5	GS10.5	cv Kym GS5	GS10.5
triadimenol + imazalil ¹ 15 + 5	81	32	50	9	62	39
triadimenol + SAS 9244 + TBZ ² 7.5 + 1.4 + 1.4	-	-	50	35	62	53
flutriafol + imazalil ³ 5 + 5	0	16	17	0	25	37
flutriafol + imazalil 10 + 10	44	11	-	-	-	-
imazalil ⁴ 5	0	5	0	0	0	9
carboxin + thiram ⁵ 50 + 50	-	-	0	0	0	0
disease incidence in untreated	3.2%	-	-	-	-	-
disease severity in untreated	-	3.8 ^t	1.2 ^t	18% ^{tt}	1.6 ^t	8% ^{tt}

*Feekes GS 2 = 23 May 1987
6 = 15 July 1987

**Feekes GS 5 = 7 August 1987
10.5 = 10 October 1987

^t Visual assessment on a 0-4 scale

^{tt} mean % diseased area of the top 2 leaves.

¹ Baytan IM. ² Experimental product. ³ Vincit. ⁴ Fungazil. ⁵ Vitaflo 200

TABLE 2: The effect of seed treatments on the control of scald: Spring 1987.

Treatment and rate g ai/100 kg seed	% Control					
	cv Zephyr*		cv Kym*		cv Goldmarker*	
	GS5	GS10.5.4	GS5	GS10.5.4	GS5	GS10.5.4
triadimenol + imazalil 15 + 5	56	30	69	33	100	41
cyproconazole ¹ 10	12	39	44	6	50	38
myclobutanil ² 10	0	0	0	0	0	0
carboxin + thiram ⁴ 50 × 50	0	4	0	3	50	21
carboxin + thiram + cyproconazole 50 + 50 + 5	0	17	6	12	50	10
carboxin + thiram + cyproconazole 50 + 50 + 10	25	26	31	9	100	31
carboxin + thiram + cyproconazole 50 + 50 + 20	44	52	37	33	100	48
carboxin + thiram + myclobutanil 50 + 50 + 10	0	0	6	0	50	0
carboxin + thiram + myclobutanil 50 + 50 + 20	0	0	0	6	0	7
disease severity in untreated	3.2 ^t	23% ^{tt}	3.2 ^t	33% ^{tt}	0.4 ^t	29% ^{tt}

*Feekes GS5 = 2 Nov. 1987
10.5.4 = 15 Dec. 1987

¹SAN 619F 10W. ²Systhane 40W.

^t visual assessment on a 0-4 scale

^{tt} mean % diseased area of top 3 leaves

Foliar Spray Trial

Best control of scald was achieved with propiconazole (Table 3). Prochloraz and terbuconazole gave equal control which was not significantly different from that of propiconazole. In overseas trials (Reinecke *et al* 1986) terbuconazole is reported to give better control than triadimenol. In our trials triadimenol and flutriafol gave little or no control.

TABLE 3: The effect of foliar sprays on per cent control of scald in cv. Fleet.

Treatment and rate g ai/ha	% control at GS 11.1 1987-88 cv Fleet	
	Top 3 leaves	Flag leaf
propiconazole ¹ 125	63a ⁺	92
prochloraz ² 450	37a	39
flutriafol ³ 125	0b	0
triadimenol ⁴ 125	0b	0
terbuconazole ⁵ 250	41a	28
Disease severity in the unsprayed ⁺⁺	17% ^b	4%

⁺ analysis on disease severity. A common letter denotes no significant difference at the 5% level.

⁺⁺ mean % diseased area.

¹ Tilt 250 EC. ² Sportak 45 EC. ³ Impact. ⁴ Cereous 250 EC. ⁵ Folicur 250 EC.

Foliar fungicides generally gave less control of scald than expected. In 1984-85 propiconazole gave 100% control on cvs Triumph and Goldmarker while triadimenol gave 99% control on the latter (Sheridan *et al* 1985). Control in 1987-88 on cv Fleet at the same growth stage was 63% and 0% respectively. Prochloraz also performed less well and terbuconazole gave control similar to prochloraz. The failure of flutriafol and

triadimenol needs further investigation. A possible explanation is the selection for, or development of, strains of pathogen with reduced sensitivity to triazole fungicides. Inoculum for our foliar spray trial was collected from plants previously exposed to DMI fungicides at the Gladstone trial site. Hollomon (1984; pers. comm.) working in England found that isolates from commercial crops obtained during 1986 showed a 5 to 10 fold decline in mean sensitivity to triadimenol. Some isolates were not controlled in glasshouse tests by triadimenol seed treatments applied at the recommended rate. There is a need to carry out further field and laboratory tests to determine if a shift in sensitivity of the New Zealand pathogen population has occurred.

ACKNOWLEDGEMENTS

Financial assistance from Ciba Geigy, ICI and Nufarm Ltd. is gratefully acknowledged. Assistance by technical staff of the Botany and Zoology Department of Victoria University is appreciated. Mary H. Sheridan carried out the statistical analyses. the statistical analyses.

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