SEED TREATMENTS FOR CONTROL OF NET BLOTCH OF BARLEY

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SUMMARY

The registered seed treatment containing triadimenol + fuberidazole gave good control of net blotch (*Pyrenophora teres* con. stat. *Drechslera teres*) on the cv Zephyr, but not on the newer cvs Triumph, Mata, Kym, Koru and Magnum. The other two registered seed treatments containing carboxin + thiram and carbendazim + mancozeb respectively, generally gave good control on all cultivars tested. Effective new seed treatments were imazalil alone or in combination with furmecycloz or triadimenol and prochloraz alone or in combination with carboxin.

INTRODUCTION

Net blotch of barley is caused by the fungus *Pyrenophora teres* and usually occurs as the anamorphosis (imperfect state) *Drechslera teres*. It is a common disease of barley in temperate, humid regions of the world and can cause considerable damage (Shipton *et al* 1973). The disease reached epidemic proportions in New Zealand in 1976-77 with yield losses of over 20% following the withdrawal of organo-mercury seed treatments (Sheridan and Grbavac 1979). The introduction of the new systemic mixtures 20% carboxin + 20% thiram (Vitaflo 200) and 15% carbendazim + 60% mancozeb (Granosan 200) in 1977 and 15% triadimenol + 2% fuberidazole (Baytan F17) in 1979 led to a dramatic reduction in net blotch incidence and severity and net blotch was no longer regarded as a serious threat to barley grain production (Hampton 1980). In the past two seasons, however, net blotch intensity has increased in the lower half of the North Island culminating in an epidemic in the Manawatu/Wanganui districts in 1982-83 (Sheridan and Grbavac 1983). Currently all seed lines from these districts are infected and levels in some are extremely high. This appears to be due to failure of the most widely used seed treatment, triadimenol + fuberidazole, to control net blotch on some of the newer cultivars (Sheridan and Grbavac 1982a). The present paper reports on trials in the spring and autumn of 1982-83 to investigate the effectiveness of registered and new experimental seed treatments on these cultivars. An organo-mercury seed treatment and the cv Zephyr were used as standards.

MATERIALS AND METHODS

Treatments with the rates of application and cultivars used are set out in the accompanying tables. Field trials were on land which did not have a barley crop in the previous season. For hand-sown spring trials a representative sample of barley seed consisting of 250 g was shaken with the appropriate amount of fungicide and 2.5 ml of sterile distilled water in a stoppered 500 ml conical flask on a mechanical shaker for 15 minutes. The water was omitted from the organo-mercury and untreated checks.

Imazalil (R 23979) and prochloraz were immiscible with water and were made up in ethanol. 7.14 ml of the 70% concentrate of imazalil was added to 800 ml of ethanol (absolute for laboratory and concrete mixer treatments; denatured with 0.25% tertiary butanol for mist-o-matic treatments) followed by the addition of 200 ml water (distilled for laboratory treatments; tap water for concrete mixer and mist-o-matic treatments). This was sufficient to treat 100 kg seed and contained 5 g ai imazalil. In the laboratory, 2.5 ml of the dilution was added slowly to the 250 g seed while shaking. The prochloraz, used for laboratory treatments only, was prepared similarly using the correct amount of product. For autumn trials 200 g of seed was treated with the appropriate amount of product.

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There were two types of field trial; hand-sown and tractor sown. In the former, laboratory treated seeds were sown by hand in 5 m drills (35 g of seed in spring, 30 g autumn) and the treatments were replicated and completely randomised. In tractor sown trials concrete mixer or mist-o-matic treated seeds were sown with normal farm equipment. Plots were 80 m x 2.5 m (concrete mixer) or 175 x 16 m (mist-o-matic). The treatments were replicated and completely randomised. The normal fertilizer application was made.

Disease assessment began at Feekes G.S. 1 (Zadoks 10) to determine the primary seed-borne infection and continued at intervals to G.S. 11.1 (Zadoks 77).

In hand-sown trials all diseased and healthy seedlings were counted while in tractor sown trials four lots of 25 plants or tillers were assessed. Disease severity was assessed on 10 tillers taken at random along a diagonal in each plot. Plots were harvested using normal farm combines.

RESULTS

Registered seed treatments

In the spring hand-sown trials all three registered seed treatments gave good control of net blotch on the cv Zephyr. Triadimenol + fuberidazole gave 65% or less control on the cultivars Triumph, Mata, Koru and Magnum compared to 85% or more with carboxin + thiram and carbendazim + mancozeb (Table 1). In a repeat trial in the autumn using the same seed lines, except for Mata and Kym which were from the 1983 harvest, results were essentially the same (Table 1). Carboxin + thiram, however, performed less well on Mata and Kym. Increasing the rate of application by 50% did not markedly improve performance of triadimenol + fuberidazole on cvs Triumph and Mata (Table 2).

TABLE 1: The effect of seed treatments applied at normal rate on percent net blotch control in hand-sown field trials in the Wairarapa in spring 1982 and autumn 1983.

Treatment and rate ai/100 kg seed		Control as % of untreated					
		Zephyr	Triumph	Mata	Kym	Koru	Magnum
Spring 1982							
triadimenol + fuberidazole							
15 g + 2 g		95	64	0	0	31	60
carboxin + thiram							
50 g + 50 g		95	99	96	100	85	100
carbendazim + mancozeb							
30 g + 120 g		100	91	98	100	100	99
organo-mercury 2.2 g		100	100	100	100	100	100
untreated*	Diseased	54	51	23	1	21	18
	Emerged	732	696	722	645	768	720
Autumn 1983							
triadimenol + fuberidazole							
15 g + 2g		100	68	21	65	44	82
carboxin + thiram							
50 g + 50 g		97	100	66	70	100	100
organo-mercury 2.2 g		100	100	—	—	100	100
untreated*	Diseased	13**	20**	15***	6***	8**	5***
	Emerged	602	535	560	577	626	576

* Mean No. of diseased and emerged seedlings per row at Feekes G.S. 1 (Zadoks 10-12) and 18 days (spring) or 14 days (autumn) after sowing. Diseased averaged over 6(**) or 4(***) replicates and emerged averaged over 4 or 2 replicates respectively.

TABLE 2: The effect of seed treatments applied at normal rate and normal + 50% on percent net blotch control in hand-sown trials in the Wairarapa in the spring of 1982-83.

Treatment and rate ai/100 kg seed	Control as % of untreated	
	Triumph	Mata
triadimenol + fuberidazole 15 g + 2 g	43	0
22.5 g + 3 g	52	0
carboxin + thiram 50 g + 50g	96	94
75 g + 75 g	92	99
carbendazim + mancozeb 30 g + 120 g	79	89
45 g + 180 g	90	94
untreated* Diseased	57	22
Emerged	687	729

*Mean No. of diseased and emerged seedlings per row at Feekes G.S. 1 (Zadoks 10-12) and 18 days after sowing averaged over 5 replicates.

In tractor-sown trials where seed was treated in the mist-o-matic machine or concrete mixer triadimenol + fuberidazole gave unsatisfactory control on cvs Triumph and Mata at all sites (Table 3). Carboxin + thiram and imazalil gave good control on all cultivars and at all sites.

TABLE 3: The effect of seed treatments on percent net blotch control in tractor-sown trials in the spring of 1982-83.

Treatment and rate ai/100 kg seed	Control as % of untreated							
	North Is. Trials*				South Is. Trials**			
	Zephyr		Triumph		Triumph			
	Site 1 C	Site 1 C	Site 1 C	M	S.2 M	S.1 M	S.2 M	S.3 M
triadimenol + fuberidazole								
15 g + 2 g	98	54	47	34	62	25	32	53
carboxin + thiram								
50 g + 50g	91	97	95	94	96	91	74	77
imazalil 5 g	—	—	—	—	—	97	90	91
imazalil 10 g	100	100	100	94	98	100	93	94
untreated***	15.7	12.3	12.7	19.8	9.6	22.8	13.7	17.7

* Completely randomised trials with 3 reps for concrete mixer (C) and 5 reps for mist-o-matic (M) treated seed.

** Non-replicated large block trials.

*** % incidence of net blotch at Feekes G.S. 1 to 2 (Zadoks 10-20).

Experimental seed-treatments

In the spring hand-sown trials imazalil (5 and 10 g ai/100 kg seed) and prochloraz (25 g ai/100 kg seed) alone or in combination with furmecycloz or carboxin respectively, gave 100% control of net blotch on all three cultivars tested. Similar results

were obtained in a glasshouse trial. In autumn sown trials the addition of imazalil to triadimenol + fuberidazole markedly improved performance on all cultivars (Table 4).

In tractor sown trials imazalil gave marginally better control of net blotch at all sites than did carboxin + thiram (Table 3). By Feekes G.S. 11.1 (Zadoks 77) little difference in disease severity was evident in any trial because of secondary spread.

Yield effects

In the mist-o-matic treated tractor-sown trials both the mixture of carboxin + thiram and imazalil alone gave increased yields (Table 5). The yield obtained with imazalil in the Wairarapa trial was significantly better than that with triadimenol + fuberidazole.

TABLE 4: Effect of imazalil on percent net blotch control in hand-sown field trials in the Wairarapa in the autumn of 1982-83.

	Zephyr Triumph	Mata Kym	Koru Magnum	Lada Grit	Maxima Conquest
triadimenol + fuberidazole					
15 g + 2 g	100	68	21	65	44
triadimenol + fuberidazole + imazalil					
22 g + 2 g + 3.3 g	100	99	98	96	100
imazalil 5 g	100	100	95	100	98
organo-mercury 2.2 g	100	100	—	100	96
untreated*	13**	20**	15***	6***	8**
Diseased	—	—	—	—	—
Emerged	602	535	560	577	626
	576	635	546	533	552

* ** *** see Table 1.

TABLE 5: Effect of seed treatments on yield : mist-o-matic treated cv Triumph in the spring of 1982-83.

Treatment and rate ai/100 kg seed	Mean yield/ha (kg)		Yield as % of untreated	
	Wairarapa	Wanganui	Wairarapa	Wanganui
triadimenol + fuberidazole				
15 g + 2 g	5535 b	5672	96	98
carboxin + thiram				
50 g + 50 g	6135 ab	6012	106	104
imazalil 10 g	6285 a	6108	109	106
untreated	5777 ab	5769	100	100

DISCUSSION AND CONCLUSIONS

Triadimenol + fuberidazole gave poor control of net blotch on all of the newer cultivars tested, including Triumph and Mata. It still performed well on cv Zephyr. The reasons for this cultivar/fungicide interaction are unknown, but reduced uptake or metabolism within the plant may be responsible. This is currently being researched by our biochemists. The problem is not due to insufficient coverage of seed since no difference in performance was obtained between laboratory, concrete mixer and mist-o-matic treatments.

Carboxin + thiram and carbendazim + mancozeb generally performed satisfactorily. The former, however, gave unsatisfactory control of net blotch on cv Mata in some trials while the latter was only tested on a few cultivars. There is a need, therefore, to screen all currently available cultivars for response to the registered seed treatments before recommendations are made.

The experimental material imazalil performed well in glasshouse and field trials and gave a significant yield increase. It was effective on all cultivars tested. Because it does not control loose smut of barley it should be used in combination with a chemical which does, eg furmecycloz, carboxin or triadimenol. The mixture of imazalil + triadimenol + fuberidazole gave excellent control of net blotch on all cultivars tested but its effect on loose smut was not studied. Imazalil is currently used as a single product on barley in Denmark and in combination with carboxin or methfuroxam in Sweden and Germany (Duytschaever pers comm. 1983). Prochloraz, a chemically related seed treatment also gave good control of net blotch in these trials. Imazalil (used as WECO 2279) and prochloraz gave good control of foot rot and spot blotch of barley (Sheridan *et al* 1982) as well as net blotch in 1981-82 trials (Sheridan and Grbavac 1982b). In these earlier trials some phytotoxicity was observed on cv Zephyr with the formulations then available and difficulties were encountered in mixing with water. These have been overcome with the newer formulations where ethanol is used as a diluent. Commercial application of imazalil should pose no problem since the formulation used by us proved effective whether treatment was applied in laboratory, concrete mixer or with the mist-o-matic machine.

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REFERENCES

- Hampton, J.G., 1980. The role of seed-borne inoculum in the epidemiology of net blotch of barley in New Zealand. *N.Z. J. Exp. Agric.* 8: 297-299.
- Sheridan, J.E., Dawson, H.V. and Grbavac, N., 1982. New seed treatments and foliar sprays for control of spot blotch of barley. *Proc. 35th N.Z. Weed and Pest Conf.*: 237-241.
- Sheridan, J.E. and Grbavac, N., 1979. Healthy barley crops demand constant surveillance. *N.Z. J. Agric.* 139(4): 25-29.
- Sheridan, J.E. and Grbavac, N., 1982a. Cultivar response to seed treatments for control of net blotch of barley. In Cereal Diseases Supplement No. 1. 1981-82. *Mycology and Plant Pathology Report No. 19*, Botany Department, Victoria University of Wellington.
- Sheridan, J.E. and Grbavac, N., 1982b. Cereal Diseases 1981-82. Disease survey, disease control and yields in the Wairarapa and Manawatu. *Mycology and Plant Pathology Report No. 19*, Botany Department, Victoria University of Wellington.
- Sheridan, J.E. and Grbavac, N., 1983. Cereal Diseases 1982-83. Disease survey, disease control and yields in the Wairarapa and Manawatu/Rangitikei. *Mycology and Plant Pathology Report No. 20*, Botany Department, Victoria University of Wellington.
- Shipton, W.A., Khan, T.N. and Boyd, W.J.R., 1973. Net blotch of barley. *Review Plant Path.* 52(5): 269-290.