NEW SYSTEMIC FUNGICIDES FOR THE CONTROL OF SEED-BORNE AND FOLIAR DISEASES

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Summary

Triadimenol (KWG 0519) used as a seed treatment controlled seed-borne diseases of bunt (*Tilletia caries*) in wheat and loose smut (*Ustilago nuda* and *U. avenae*) in wheat and oats and gave protection from foliar diseases of powdery mildew (*Erysiphe graminis*) and rust (*Puccinia recondita*). Triadimefon (MEB 6447) applied as a foliar spray controlled powdery mildew and leaf rust in wheat and stem (*Puccinia graminis*) and crown rust (*Puccinia coronata*) in ryegrass in two seasons of trials in Canterbury and Southland.

INTRODUCTION

Triadimenol and triadimefon are both new systemic fungicides showing protective and eradivative effect against a range of fungus diseases infecting cereals and grasses.

Overseas triadimenol used as a seed treatment has controlled the following diseases found in New Zealand:-

In wheat seed-borne diseases of bunt (*T. caries* and *T. foetida*), loose smut and glume blotch (*Leptosphaeria nodorum* = *Septoria nodorum*), also gives protection from stem and foliar diseases such as powdery mildew, stem rust and leaf rust.

In oats it controls seed-borne diseases of covered smut (*Ustilago hordei*), loose smut and helminthosporium leaf spot (*Helminthosporium avenae*) and also gives protection from stem and foliar diseases of stem rust and crown rust.

Triadimefon applied as a foliar spray controls powdery mildew, stem rust, leaf rust and speckled leaf blotch (*Mycosphaerella graminicola* = *Septoria tritici*) of wheat, stem rust and crown rust of oats, stem rust, crown rust, blind seed disease (*Gloeotinia temulenta*) and ergot (*Claviceps purpurea*) of ryegrass.

METHODS

There were six triadimenol trials on wheat and two on oats and two triadimefon trials on wheat and two on ryegrass in Canterbury and Southland over the 1977/78 and 1978/79 seasons.

Trials were either of small randomised block design of 3-5 replicates varying in area of 22.5 - 45m² or larger 1-3 replicated blocks of 0.1-1.0 ha or single row 5 replicated trials for loose smut of oats and bunt of wheat. Trials were harvested by taking the whole plot or two runs through the middle of each block. Triadimenol was applied to the seed to ensure accurate seed coverage, while triadimefon sprays were applied either using a precision back-pack sprayer with a hand held boom fitted with Tee-Jet nozzles applying 340-380 litres/ha at 200 kPa or by commercial land vehicle.

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RESULTS

Wheat seed treatment trials

Trials were conducted over the 1977-78 season to evaluate triadimenol for bunt and loose smut control (Table 1).

Table 1. Emergence and percentage heads infected with bunt Trial A and loose smut Trial B on wheat variety Karamu 1977/78 season.

Treatment	g/100 kg of seed	Trial A - bunt		Trial B - loose smut	
		No. plants /row	% heads infected	No. plants /3m row	% heads infected
untreated		266	7.41 A	116	3.25 a
captan	67.5	277	1.0 B	120	4.0 a
carboxin	50				
+ thiram	50	291	0	118	0
carbendazim	30				
+ mancozeb	120	296	0	—	—
triadimenol	15	305	0	115	0
triadimenol	22.5	302	0	125	0
triadimenol	30	283	0	121	0
CV%		19.3	9.5	21.0	24.9

Trial A had single row plots while Trial B plots were 22.5m²

There was no significant difference in emergence ($P=0.05$) in either trial. Captan gave a significant reduction ($P=0.01$) in bunt in Trial A however there was no significant difference between untreated and captan in the level of loose smut in Trial B. In both trials triadimenol at all rates and carboxin + thiram gave complete control of bunt and loose smut as did carbendazim + mancozeb on bunt in Trial A.

Two trials with the same layout on variety 'Karamu' were conducted in Timaru and Lincoln in the 1977-78 season (Table 2).

Table 2. Effects of wheat seed treatment on powdery mildew and yield 1977-78 season. Mean of 2 trials.

Treatment	g/100 kg of seed	Infection 48 days ^a		Infection 85 days ^a		Yield kg/plot
		Rating	% stems infected	Rating	% stems infected	
untreated		1.11	43.8	3.4	46.7	8.33
captan	67.5	1.06	39.9	3.45	41.6	8.38
carboxin	50					
+ thiram	50	1.14	40.3	3.65	48.1	8.39
triadimenol	15	0**	0.17**	1.83**	10.1**	8.62
triadimenol	22.5	0**	0.05**	1.71**	9.5**	8.7
triadimenol	30	0**	0.02**	1.6**	9.0**	8.65
CV%		14.1	12.3	7.7	7.6	17.3

Infection rating 0 = nil infection
10 = 100% infection taking top 3 leaves

a = Number of days after sowing
** = Significant ($P=0.01$)

Triadimenol gave the leaves complete powdery mildew protection for 48 days post sowing and although slight infection was found on the stem this was significantly lower ($P=0.01$) than the untreated and other

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treatments. A further assessment 85 days post sowing showed a similar relationship. On this occasion slight powdery mildew infection was found on the leaves in the triadimenol treatments however the level was significantly lower ($P=0.01$) than the other treatments and untreated. Although the yield was higher in the triadimenol treatments the increase was not significant ($P=0.05$).

Triadimenol was evaluated in two block trials during the 1978-79 season in Canterbury (Table 3) on autumn sown wheat to test its

Table 3. Effects of seed treatment on leaf spot, powdery mildew and leaf rust in autumn sown wheat sown 10 May 1978.

Treatment and disease	Days after sowing	Wheat variety	
		Kopara	Karamu
leaf spot			
captan	114	95	7
triadimenol		96	17
powdery mildew			
captan	149	13.1	11.2
triadimenol		0	0
leaf rust			
captan	190	16.8	27.3
triadimenol		0	0
captan	198	11.9	17.2
triadimenol		1.6	2.8
captan	233	42.4	51.6
triadimenol		23.6	31.7
Yield in t/ha			
captan		4.30	4.28
triadimenol		4.99	5.13
Assessments/100 plants/plot			
Leaf spot and powdery mildew % of plants infected			
leaf rust % leaf area infected			
Rates:- Captan 67.5g/100kg of seed			
triadimenol 22.5g/100kg of seed			

protective effect on foliar diseases.

In the assessment 114 days after sowing (1st Sept) triadimenol showed no effect on speckled leaf blotch. Although the captan treated blocks had a light infection of powdery mildew on the stem the triadimenol blocks were not infected 149 days after sowing and thus did not become infected with powdery mildew. In the leaf rust assessment on 16 Nov. 190 days after sowing the triadimenol blocks had no infection whereas in the captan blocks there was a high level 16.8 and 27.3% of leaf area infected. The first sighting of rust presence in the triadimenol treatments was on 24 Nov. when a slight infection had established some 198 days after sowing. The infection level continued to increase and in the assessments 233 days after sowing, on 18 Dec. the triadimenol blocks had still only half the level of infection present as in the captan blocks.

The yield obtained from the triadimenol treated plots was 16% higher in Korpara and 19.9% in Karamu when compared to captan where no powdery mildew and leaf rust protection was obtained.

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Wheat spray trials with triadimefon

During the 1977-78 season, a replicated trial was conducted in South Canterbury (Table 4) comparing two rates of triadimefon on variety Karamu to control a high level of powdery mildew infection.

Table 4. Trial conducted in South Canterbury for control of powdery mildew on variety Karamu sprayed at Feekes growth stage 7.

Treatments	Rate g/ha	Days post treatment	Flag leaf	Leaf 2	Leaf 3	Leaf 4	Yield t/ha
untreated		7	0	1.4	3.0	4.8	3.07 cC
		14	0.9	3.0	3.6	4.4	
triadimefon	62.5	7	0	0.1	1.8	4.0	3.59 aA
		14	0.5	0.9	0.9	1.9	
triadimefon	125	7	0	0.1	2.1	3.8	3.67 aA
		14	0.3	0.4	0.9	1.9	
tridemorph	525	7	0	0.2	2.3	4.3	3.22 bB
		14	0.6	1.8	2.6	3.0	
CV%							2.7
Assessment 0-10 scale where 0 = no infection							

Assessment 0-10 scale where 0 = no infection
10 = 100% plant infected

In this trial all treatments had little effect on powdery mildew on leaf 4 while on the other leaves both triadimefon 62.5g and 125g/ha gave a similar high level of powdery mildew control.

There was a significantly higher yield ($P=0.01$) from both triadimefon rates when compared to tridemorph which in turn produced a significantly ($P=0.01$) higher yield than the untreated.

During the 1978/79 season there was a replicated trial conducted in Southland (Table 5) for control of leaf rust on variety 'Takahe' which had only a trace of leaf rust infection at spraying.

Table 5. Trial conducted in Southland for control of leaf rust on wheat variety Takahe sprayed at growth stage Feekes 6-7.

Treatment	Rate g/ha	% leaf area infected 39 days post treatment		Leaf 3	Yield t/ha
		Flag leaf	Leaf 2		
untreated		0.75	11.5 9.0	9.0	3.06 bB
triadimefon	125	0.2	5.5	6.25	3.47 aA
CV%					7.3

In this trial leaf rust was not assessed until 39 days after treatment when re-infection had taken place although there was still only half the level of infection in the triadimefon treated plots as found in the untreated. Although complete elimination and protection from leaf rust had not been obtained there was a significantly ($P=0.01$) higher yield of 13.4% when compared to the untreated.

Oats

Triadimenol was tested in two similar trials (Table 6) for the control of

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Table 6. Emergence and percentage heads infected with loose smut on two oat varieties.

Treatment	g/100kg of seed	Emergence*	Percentage heads infected	
			Taiko	Onward
untreated		34.1	10.5 aA	32.3 aA
captan	97.5	33.8	—	17.0 bB
carbendazim	100	33.0	—	0
carboxin	187.5	30.8	0	0.2 cC
triadimenol	15	32.2	0	0
triadimenol	30	33.8	0	0
CV%		10.6	25.5	28.6

* = Number of seedlings/1.5m of row 14 days post sowing of Taiko

naturally infected loose smut on varieties 'Taiko' and 'Onward' during 1977/78 season in Canterbury.

Triadimenol in both trials gave complete control of naturally infected loose smut at the two rates tested and from observation gave good initial suppression of crown rust infection warranting further evaluation on this disease. There was no significant reduction in emergence from the triadimenol treatments.

Ryegrass

Two trials were conducted, one during the 1977/78 and the other during the 1978-79 season in Canterbury on the ryegrass variety 'Vigor RVP'. In Trial A triadimefon was applied once and in Trial B two applications were made (Table 7).

Table 7. Rust assessments on ryegrass following one or two spray applications of triadimefon at 125 g/ha.

	Days post treat- ment	stem rust		crown rust	
		untreated	*triadimefon	untreated	*triadi- mefon
TRIAL A (treated 23 Dec 1977)					
Pre treatment 23 Dec.			19.1		17.8
	7	20.5	1.3	18.5	2.0
	14	25.7	4.0	21.1	3.3
	25	35.0	11.2	23.1	9.2
TRIAL B (treated 8 Jan 1979)					
Pre treatment 8 Jan.			15.2		21.7
	7	17.1	1.3	23.2	2.6
	14	19.8	0.1	23.7	0.2
	14	19.8	2.4	24.1	4.1
second treatment 22 Jan					
	6	22.6	0.1	23.7	0.2
	15	20.2	0.3	19.5	0.4
Assessments - average number of pustules/plant taking 50 plants/plot.					

Assessments - average number of pustules/plant taking 50 plants/plot.

The assessments show that 7 days post treatment triadimefon had given a high level of reduction of both stem and crown rust however in the assessment a further 7 days later the level of infection had not only risen in the untreated but also in the treated. At 25 day post treatment there had been a gradual increase in both stem and crown rust infection to a

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level similar to the pre-treatment assessment.

In Trial B one application of triadimefon successfully reduced both stem and crown rust however a second application was made 14 days after the first to compete with the reinfection pressure coming mainly from the untreated crop. The second triadimefon treatment successfully kept rust infection to a very low level.

DISCUSSION AND CONCLUSION

Triadimenol applied as a seed treatment gave complete control of bunt and loose smut in wheat and loose smut in oats and demonstrated that it has strong systemic action in protecting wheat plants against powdery mildew and rust for several weeks after sowing. Triadimenol showed no activity in protecting autumn sown wheat against speckled leaf blotch. Triadimefon applied as a foliar spray gave a high level of rust control in wheat and ryegrass and powdery mildew control in wheat with a resultant yield benefit in the trials. These results were confirmed by commercial application during the 1977-78 and 1978-79 seasons around Methven and Lincoln. Triadimenol not only controls seed-borne diseases but also shows potential in protecting plants against powdery mildew and rust while triadimefon gives effective control of the major foliar diseases of cereals and rusts of ryegrass.

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