Evaluation of a new class of fungicides on grain yield in wheat and barley

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Abstract

In Europe, a new chemical-class of fungicides, strobilurins, has been shown to increase yields by up to 15% in wheat and barley in comparison to conventional triazole fungicides. Trials were conducted in the high-rainfall zones of Victoria and Tasmania to determine if similar results could be achieved in Australia. For long season wheat, there was no significant difference in yield between fungicide treatments. In one trial, barely showed a 25% increase in yield with the use of a strobilurin plus and a triazole compared to a conventional triazole fungicide.

Key words

Strobilurin, leaf senescence, grain yield, high-rainfall zone, long season wheat

Introduction

An important development in crop protection in recent years has been a group of fungicides called strobilurins. These fungicides have a number of environmental advantages; they have low toxicity (1), a half-life of 4-6 weeks in soil, and they are completely mineralised by microbes and light. The use of these fungicides also appears to delay chlorophyll loss and hence leaf senescence (2), thereby increasing the photosynthetic duration of the crop. In the UK, strobilurins offer a 15% yield advantage over conventional fungicides (3). We investigated the use of strobilurins in the high-rainfall zone of Tasmania and south-western Victoria to determine if there was a yield advantage due to either disease control or delayed leaf senescence.

Methods

Three trials were conducted in northern Tasmania with 3 replicates arranged in a randomised complete block design. Treatment details are shown in Table 1. The fungicides applied were: Allegro, (a commercial mix of a c(epoxiconazole)) at 1 L/ha, Triad, (a triazole (triadimefon)) at 1 L/ha, and Opus (a triazole (epoxiconazole)) at 0.75 L/ha. . Control plots were unsprayed.

Table 1. Crop and fungicide timing details for treatments included in Experiments 1 to 3

Exp	Year	Crop	Zadoks DC (4)	T 1	T 2	T 3	T 4
1	2000	Barley (cv. Franklin)	37	Control	Allegro	Triad	-
2	2001	Barley (cv. Gardiner)	34	Control	Allegro	Triad	-
3	2001	Wheat (cv. Tennant)	51	Control	Allegro	Triad	Opus

Exp 4 was sown at Gnarwarre, Victoria in 2001. The trial was a split plot design with nine spray treatments as main plots (application details in Table 2), four wheat varieties as sub-plots and three replications. Fungicides applied were a strobilurin, Amistar (azoxystrobin), with and without a triazole, Impact (flutriafol) and an insecticide, Dominex (alphacypermethrin). Varieties were: Kellalac (susceptible to Barley Yellow Dwarf Virus (BYDV) and leaf rust), Mackellar (resistant to BYDV and resistant to leaf rust), LH52IR1 (resistant to BYDV and susceptible to leaf rust) and Rudd (susceptible to BYDV and resistant to leaf rust).

Table 2 Fungicide applied and timing of application for treatments included in experiment 4

	Treatment	Zadoks DC		Treatment	Zadoks DC
T1	Unsprayed control		**T6**	Dominex	11
T2	Amistar & Impact	39	**T7**	Amistar	32 & 39
T3	Impact	39	**T8**	Amistar	39
T4	Amistar & Impact	32 & 39	**T9**	Dominex & Amistar & Impact	11 32 & 39
T5	Impact	32 & 39			

Results and Discussion

In the two barley trials (Exp 1 and 2), there were large and consistent visual differences in the level of disease. At grain filling, both leaf rust and scald were severe on control plots. Allegro-treated plots showed very low levels of scald and minor leaf rust infection while disease levels on the Triad-treated plots were intermediate. Final yield results for both trials reflected this pattern (Table 3). In Exp 1, only the Allegro treatment was significantly higher than the control. In Exp 2, yield of the treatments was ranked Allegro > Triad > nil. In Exp 2, Allegro-treated plots were greener in the stem than the other treatments during grain filling. Significant rainfall during grain filling probably favoured the Allegro treated plots resulting in greater yields. It is not possible to identify whether the greater yield achieved in the Allegro treatment is due to the combination of the strobilurin and triazole or to their separate effects.

There was no significant difference between fungicide treatments in Exp 3. Tennant showed symptoms of BYDV that may have negated any yield increase that could be achieved using fungicides. In Exp 4, yields ranged from 88 to 111% of the control yields, but the differences between fungicide treatments were not statistically different (data not presented).

Table 3. Effect of different fungicide treatments on grain yield (t/ha) of barley in northern Tasmania in 2000 (Experiment 1) and on barley and wheat in 2001 (Experiments 2 and 3).

Treatment		**Yield (t/ha)**	
	Experiment 1	**Experiment 2**	**Experiment 3**
Control	5.2	5.4	5.0
Allegro	5.9	7.5	5.5

Triad	5.6	5.9	5.3
Opus	-	-	5.2
l.s.d (*P*=0.05)	0.5	0.4	NS

Conclusions

Fungicides in Australian agriculture are normally applied when disease is likely to cause economic loss. This preliminary study did not demonstrate an advantage in applying strobilurins together with conventional fungicides, unlike Europe, where the yield increase due to the retention of green leaf makes it economically viable to apply strobilurins even in the absence of disease. Results from Exp 2 indicate that strobilurin application in Australia may increase yield in some seasons, possibly through delaying leaf senescence. However, the general lack of response may reflect the inability of Australian crops to respond to strobilurins because of the earlier onset of heat or water stress during grain development during which green leaf area is the first visible crop attribute to suffer. Further, the common use of fungicides in the UK has led to varieties being selected partly on the basis of responses to strobilurins, whereas selection in Australia has been without fungicide intervention. Overall, it seems that yield responses to strobilurins may vary considerably with environmental conditions, and that further studies are justified in the coolest parts of our high-rainfall zone where worthwhile responses are probably most likely.

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