

Influence of atrazine and chlorsulfuron on the saprophytic and parasitic activity of *Fusarium graminearum* Group 1

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Summary

Data from *in vitro* studies indicate that atrazine and chlorsulfuron do not affect the saprophytic growth of *Fusarium graminearum* Group 1 at rates equivalent to those recommended for use in the field for wheat. The results of field studies indicate that atrazine and chlorsulfuron do not affect the incidence of wheat plants infected by *F. graminearum* Group 1 at recommended rates of application.

Introduction

The residual herbicides, atrazine and chlorsulfuron (Glean Dupont) are used regularly in conservation tillage programs in northern New South Wales, where crown rot of wheat is prevalent (Burgess *et al.* 1981; Burgess and Klein 1985). Herbicides may affect the incidence and severity of plant disease by direct effects on the pathogen or by indirect effects on the susceptibility of the crop or alternative weed hosts (Katan and Eshel 1973; Altman and Campbell 1977). However, there is no information on the possible interactions of these herbicides with crown rot of wheat caused by *Fusarium graminearum* Schwabe Group 1 (Francis and Burgess 1977). This is a preliminary report on the influence of atrazine and chlorsulfuron on the growth of *F. graminearum* Group 1 *in vitro*, and on the incidence of wheat plants infected by the fungus in field plots.

Effects of the herbicides on *F. graminearum* on three media

The effect of atrazine and chlorsulfuron on the growth of *F. graminearum* Group 1 was assessed on three media: Defined Buffered Agar (DBA), Potato Dextrose Agar (PDA) and PDA with buffer (PDAT). The DBA medium was developed for this project and is suitable for the growth of all major soil-borne fungal pathogens of wheat. A biological buffer, 50 mM TES (Sigma) (Good and Izawa 1972) was added to DBA and PDAT. The media were adjusted to pH 7.5, sterilized, and herbicides added as technical grade active ingredients prior to pouring. The media were amended with atrazine at 1.0, 5.0, 10.0 and 50.0 ppm, and with chlorsulfuron at 0.5, 1.0, 10.0, and 50.0 ppm, with unamended controls.

Atrazine inhibited growth of *F. graminearum* Group 1 but only at 10–50 ppm which is equivalent to the recommended

rate for use with grain sorghum (Table 1). Wheat would not normally be exposed to this level of atrazine. Chlorsulfuron had no effect on the growth of the fungus at 0.5 ppm which is equivalent to the recommended rate for use with wheat (Table 1).

Effect of the herbicides on the incidence of infected wheat plants

The effect of atrazine on the incidence of infected plants was assessed on a grey clay where crown rot was prevalent in the previous growing season, 1985, at Livingston Farm, Moree, N.S.W. Atrazine was applied at 0.5 and 0.75 kg ha⁻¹ a.i. in December 1985. Two cultivars, Suneca and Sunstar, were planted in June 1986. The frequency of isolation of *F. graminearum* Group 1 from the crowns and subcrown internodes was used as an estimate of the incidence of infected plants. There was no effect of atrazine at these rates on the incidence of plants infected by *F. graminearum* Group 1 when assessed at 9 weeks after sowing and at harvest maturity (Table 2). The atrazine did not affect grain yield or dry matter production by cv. Sunstar (Table 3). However, the grain yield and dry matter production of cv. Suneca was reduced significantly ($P \leq 0.05$) by

the highest rate of application, 0.75 kg ha⁻¹ a.i. (Table 3).

The effect of chlorsulfuron at 15 and 30 g ha⁻¹ a.i., applied either by incorporation at sowing or as a foliar spray at 5 weeks after sowing, on the incidence of infected plants was assessed at an adjacent location in 1986. The recommended rate of application for wheat is 15 g ha⁻¹ a.i. at sowing or post-sowing. The same cultivars, Suneca and Sunstar, were used. Chlorsulfuron did not affect the incidence of *F. graminearum* Group 1 in either cultivar at the rates used (Table 4). In addition, it did not affect grain yield or dry matter production.

Discussion

Atrazine, at 50 ppm in PDA, caused approximately 10% reduction in linear growth of *F. graminearum* Group 1. Houseworth and Tweedy (1972) reported a similar reduction in the growth of *F. graminearum* Group 2 (*Giberella zeae* (Schw.) Petch) due to atrazine on the same medium. There have been no previous reports on the influence of chlorsulfuron on the crown rot *Fusarium* or other *Fusarium* species. The results indicate that these herbicides do not have a significant effect on *F. graminearum* Group 1 at rates recommended for use with wheat.

The results of the field trials indicate that atrazine and chlorsulfuron do not affect the incidence of infection of wheat by *F. graminearum* Group 1 at recommended rates for use with wheat.

The results of the field trials indicate that atrazine and chlorsulfuron do not affect the incidence of infection of wheat by *F. graminearum* Group 1 at recommended rates of application. The infected plants in these trials did not develop significant levels of severe crown rot or whiteheads because soil moisture was sufficient to prevent moisture stress. Severe crown rot is favoured by

Table 1 Colony diameters of *F. graminearum* Group 1 after 3 days on three media at 25°C, treated with atrazine and chlorsulfuron

Concentration (ppm)	Colony diameter (mm)		
	PDA	PDAT	DBA
	<i>Atrazine</i>		
0	49.6 ± 3.8 ^A	62.9 ± 2.7	58.3 ± 2.2
1	48.9 ± 4.2	61.7 ± 1.9	57.6 ± 2.4
5	48.4 ± 4.1	58.5 ± 2.3	58.8 ± 1.9
10 ^B	48.4 ± 2.8	58.6 ± 3.0	54.6 ± 2.2
50 ^B	44.8 ± 3.5	55.8 ± 3.2	54.9 ± 1.3
	<i>Chlorsulfuron</i>		
0	59.0 ± 3.2	62.1 ± 1.8	57.7 ± 1.4
0.5 ^C	58.7 ± 3.0	61.4 ± 1.5	57.6 ± 2.5
1.0	57.4 ± 2.3	62.6 ± 2.6	57.9 ± 1.8
10.0	57.8 ± 2.2	61.6 ± 1.9	59.7 ± 1.6
50.0	56.4 ± 2.0	59.8 ± 1.2	59.0 ± 0.8

^A Means of six replicates with standard deviations.

^B Concentrations approximately equivalent to recommended rates for use of herbicide with sorghum.

^C Concentration approximately equivalent to recommended rate for use of herbicide with wheat.

Table 2 Incidence of wheat plants infected by *Fusarium graminearum* Group 1 in soil treated with two levels of atrazine applied as Nutrazine (Nufarm) in December 1985 prior to sowing of wheat cvv. Sunstar and Suneca in June 1986

Atrazine application rate (kg ha ⁻¹) a.i.	Time of sampling			
	9 weeks		Harvest maturity	
	Sunstar	Suneca	Sunstar	Suneca
0	33.7 ^A	25.1	64.8	83.1
0.5	34.8	29.2	75.9	84.7
0.75	28.4	25.6	72.9	89.1

^A Retransformed mean %. No significant difference was obtained between treatments in analysis of variance of transformed data.

Table 3 Grain yield and dry matter of two cultivars of wheat sown 6 months after application of low rates of atrazine in December 1985

Atrazine application rate (kg ha ⁻¹) a.i.	Grain yield (g m ⁻²)		Dry matter (g m ⁻²)	
	Sunstar	Suneca	Sunstar	Suneca
0	248	204	742	525
0.5	220	205	656	524
0.75	201	233	619	589
l.s.d. ($P \leq 0.05$)	35.0		88.0	
CV (%)	15.6		14.0	

Table 4 Incidence of wheat plants (cvv. Sunstar and Suneca) infected by *Fusarium graminearum* Group 1 in soil treated with two levels of chlorsulfuron applied at sowing or at 5 weeks after sowing.

Chlorsulfuron application		Time of sampling			
Rate (g ha ⁻¹) a.i.	Time ^A	9 weeks		Harvest maturity	
		Sunstar	Suneca	Sunstar	Suneca
0	—	41.5 ^B	21.8	85.2	88.2
15	IBS	29.7	30.4	85.1	91.5
15	PS	43.7	20.4	88.3	86.6
30	IBS	43.2	20.9	87.8	85.3
30	PS	30.3	21.7	83.9	94.3

^A IBS, incorporated by sowing; PS, post-sowing (5 weeks).

^B Retransformed mean %. No significant difference was obtained between treatments in analysis of variance of transformed data.

moisture stress (Burgess *et al.* 1981). Thus further studies are planned to assess the influence of these herbicides on the severity of crown rot in wheat subjected to moisture stress. The influence of atrazine and chlorsulfuron along with other methods of weed control on the development of crown rot in *Phalaris paradoxa* L. are also being investigated in relation to inoculum increase during the fallow period.

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ERRATUM

In the paper 'Influence of atrazine and chlorsulfuron on the saprophytic and parasitic activity of *Fusarium graminearum* Group 1' by Jeffery, Burgess and Klein on page 14 of *Plant Protection Quarterly* Volume 3(1), the second paragraph under Discussion was included in error. This paragraph should be omitted.