Influence of stubble-management practices on crown rot of wheat

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Summary

The influence of five wheat stubble management treatments on the incidence of crown rot in two wheat cultivars was examined. The incidence of plants infected by *F. graminearum* Group 1 was significantly higher in plots where stubble was retained on the soil surface than in plots where stubble was burnt soon after harvest but was not affected by a late stubble burn or tillage. The incidence of infected plants in the cultivars Suneca and Sunstar did not differ significantly.

Introduction

The traditional practices of stubble burning and the use of disc implements in the northern wheat belt of New South Wales are being replaced gradually by stubble retention and the use of subtillage implements (Harte and Armstrong 1983). However, there is little information on the influence of stubble-management practices on crown rot of wheat caused by *Fusarium graminearum* Schwabe Group 1. This fungus persists mainly as hyphae in stubble residues on and in soil (Wearing and Burgess 1977). Thus it is probable that stubble retention will lead to an increase in inoculum levels of the crown rot fungus. In this paper we report on the influence of five stubble-management practices on the incidence of crown rot in two wheat cultivars, Suneca and Sunstar, in 1986.

Materials and methods

The trial was located on a black self-mulching soil near Narrabri, in the northern wheat belt of New South Wales in 1985 and 1986. Five stubble-management treatments were imposed following harvest of the 1984 wheat crop in which the incidence of plants infected by the crown rot fungus was approximately 64%. The experimental layout was based on a split plot randomized complete block design with three replicates. Whole plots (100 m × 40 m) comprised the stubble-management treatments and each was split into 10 alternating subplots (10 m × 40 m) of the two wheat cultivars, Suneca and Sunstar. Plots were sown on 29 May 1985 and 6 June 1986. The five stubble-management treatments were: No burn + tillage, stubble retained *in situ* and weeds controlled with glyphosate; Burn + no tillage, stubble burnt after harvest and weeds controlled with glyphosate; No burn + tillage, stubble incorporated after harvest with discs and weeds controlled with a scarifier; Burn + tillage, stubble burnt after harvest, residues then incorporated with discs and weeds controlled with a scarifier; Blade plough + late burn, stubble retained on surface after harvest, weeds controlled by blade ploughing, stubble burnt in April.

Disease assessment

The incidence of disease was not assessed in 1985. In 1986, 10 plants were collected from each subplot at anthesis (10 September) and maturity (21 November). The presence or absence of browning of the bases of all tillers from the plants collected at anthesis was noted. Stem browning is a characteristic symptom of crown rot (McKnight and Hart 1966).

One main stem was detached from each plant collected at maturity and the leaf sheaths removed. Stem segments were removed from the base and 15 cm above the base of each stem, surface sterilized in 1% sodium hypochlorite in 10% ethanol, air-dried and plated on a modified Czapek-Dox medium (Burgess and Liddell 1983). The frequency of isolation of *F. graminearum* Group 1 was noted and used in an estimate of the incidence of plants infected by *F. graminearum* Group 1.

Results

As there was no difference between cultivars in respect of the incidence of infected plants nor were there any interactions between stubble-management practices and cultivars, the data for the two cultivars were combined. The incidence of infected plants was significantly higher in plots where stubble was retained compared to plots where the stubble was burnt after harvest (Table 1). The incidence of infected plants in the blade plough + late-burn plots was significantly higher than in the early-burn plots and did not differ from the incidence in plots where stubble was retained. The tillage practices within the stubble-burn and stubble-retained treatments did not affect the incidence of plants infected by *F. graminearum* Group 1. The incidence of stem browning differed between treatments and reflected the differences in the incidence of infected plants (Table 1).

Discussion

The results are in general agreement with the findings of Dodman and Wildermuth (1979) and our own unpublished data from a complementary study at Moree, N.S.W. The reduction in the incidence of plants infected by *F. graminearum* Group 1 following a stubble burn after harvest is not surprising. The predominant source of inoculum of this pathogen consists of hyphae in stem residues (Wearing and Burgess 1977). Indeed, the lower three or four internodes are usually colonized by the fungus during the parasitic phase. The incidence of infected plants and presumably inoculum levels, were not affected by the tillage practices within either the stubble-burn or stubble-retained treatments. Theoretically, the incorporation of residues should increase the rate of decomposition and hence cause a reduction in the level of infested residue during the fallow

Table 1 Influence of stubble management on the incidence of stem browning and the recovery of *Fusarium graminearum* Group 1 from stems of two wheat cultivars, Suneca and Sunstar. Values followed by same letter in each column not significantly different at $P = 0.05$

Stubble management practice	Incidence of stem browning at anthesis (%)	Frequency of isolation of *Fusarium graminearum* Group 1 at maturity	
		Stem base	Stem, 15 cm above base
No burn + No tillage	55d[A]	37[bB]	1.8a[B]
No burn + Tillage	40b[c]	30b	3.3a
Burn + No Tillage	19a	17a	2.3a
Burn + Tillage	27ab	16a	0.9a
Blade plough + Late burn	42cd	34b	4.3a

[A] Incidence of stem browning for both cultivars.
[B] Mean of recovery for two cultivars, Suneca and Sunstar.

period. However, decomposition is also dependent on adequate soil moisture. Thus the influence of tillage practices on the inoculum of this fungus is likely to be dependent on the rainfall during the fallow. These aspects are worthy of further investigation.

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