ELIMINATING SEED-BORNE INOCULUM OF *FUSARIUM OXYSPORUM* F. SP. *VASINFECTUM* IN COTTON

S. J. Allen and J. K. Kochman
Cotton Seed Distributors Ltd. and
Queensland Department of Primary Industries
Australian Cotton Cooperative Research Centre
Narrabri, Australia

Abstract

Fusarium wilt has developed as a major threat to cotton production in Australia. The pathogen can be dispersed as seed-borne inoculum and may survive within the seed between the kernel and the seed coat. With the increasing distribution and prevalence of Fusarium wilt it has become more difficult to locate 'clean' areas for seed production. Fourteen seed treatment fungicides were evaluated for the control of seed-borne inoculum of the pathogen. Only TCMTB, carbendazim and the current Australian standard cotton seed treatment, PCNB-metalaxyl gave repeated complete control in the Petri plate tests. When PCNB and metalaxyl were tested separately only metalaxyl gave repeated complete control. The unexpected efficacy of metalaxyl is discussed.

Introduction

Fusarium wilt, caused by *Fusarium oxysporum* Schlecht. f.sp. *vasinfectum* (Atk.) Snyd. and Hans., has developed as a major threat to cotton (*Gossypium hirsutum* L.) production in Australia since it was first observed in Queensland in 1993 (Kochman, 1995).

The disease was observed in NSW in one field on one farm in December 1994. By the end of the 1999/2000 season Fusarium wilt had been confirmed in samples from 67 fields from 37 farms across most cotton growing areas of NSW.

Symptoms of Fusarium wilt include yellowing, wilting and death at any stage of growth along with browning of the vascular tissue. The incidence of the disease in Queensland is so high in some areas that whole fields and, in some cases whole farms, have been rendered unsuitable for cotton production. Considerable resources have been allocated to the task of developing components of an integrated control strategy for Fusarium wilt of cotton.

Australian isolates of the pathogen have been characterised using DNA amplification fingerprinting and vegetative compatibility grouping (Kochman et. al., 1998). Two distinct races that are unique to Australia have been identified.

The pathogen can be dispersed as seed-borne inoculum and may survive within the seed between the kernel and the seed coat (Wickens, 1964). Farmers insist on pathogen free seed for planting. Seed production areas have always been located away from areas where the disease is known to occur and seed crops are inspected three times to ensure freedom from the disease. Seed production fields are abandoned if Fusarium wilt is found elsewhere on the same farm.

With the increasing distribution and prevalence of Fusarium wilt it has become more difficult to locate 'clean' areas for seed production. It is possible that the disease could be present in a field and escape detection. The objective of this study was to determine if a fungicide seed treatment could be used to eliminate seed-borne inoculum of *F. oxysporum* f.sp. *vasinfectum*. Is sufficient fungicide absorbed by the seed during imbibition to provide control of the pathogen?

Materials and Methods

Seed cotton was hand harvested from plants that had vascular symptoms of Fusarium wilt. After ginning, the fuzzy seed was wet-acid-delinted and the immature seed, that floated in water, were discarded.

Seed were placed on 1.5% water agar in Petri plates and incubated at room temperature for at least seven days before assessment. Five seeds were placed on each plate and 20 plates were prepared for each treatment. Assessment was by direct microscopic inspection and the pathogen was identified on the basis of macro and micro-conidia being present.

Fourteen seed treatment fungicides were selected and applied at recommended rates in a water slurry made up to 2mL per 100g seed (Table 1). Treatments that gave complete control were retested up to six times.

Results

Up to 56% of fuzzy seed and 11% of graded, delinted seed carried inoculum of the Fusarium wilt pathogen. Only TCMTB, carbendazim and the current Australian standard cotton seed treatment, PCNB-metalaxyl, gave repeated complete control in the petri plate tests. When PCNB and metalaxyl were tested separately only metalaxyl gave repeated complete control. Pathogen growth from treated seed was completely suppressed by metalaxyl treatments in six separate experiments.

Discussion

The complete suppression of the pathogen resulting from seed treatment with metalaxyl was surprising. Metalaxyl has no reported activity against *Fusarium* species and did not stop growth of the pathogen when incorporated into agar media.

The incidence of infection in the untreated seed samples has declined considerably since these experiments were completed and further experiments to evaluate various rates of application and possible modes of action will be delayed until fresh samples of infected seed are obtained at the end of the current season.

The fact that Fusarium wilt of cotton has not been observed in three remote cotton growing areas or in the large western Namoi region suggests that seed-borne dispersal of the pathogen has not occurred to date. It is hoped that the use of seed treatments that suppress the pathogen, combined with rigorous inspection of seed production fields, will continue to prevent seed-borne dispersal in the future.

References

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Table 1. Seed treatment fungicides tested for the control of seed-borne inoculum of *Fusarium oxysporum* f.sp. *vasinfectum*.

Active ingredient	**Formulation**	**Recommended rate**
Triadimenol	150g/L	1.5mL product /kg seed
Tebuconazole	25g/L	1mL product/kg seed
Difenconazole	30g/L	24g ai / 100kg seed
TCMTB	30%	2.9mL product/kg seed
Carbendazim	500g/L	1.5mL product/kg seed
Thiabendazole	450g/L	5g ai / 100kg seed
Benomyl	500g/kg	2g product/kg seed
Carboxin-TBZ	16.7%-1.5%	3.26mL product/kg seed
Hymexazol	30%	4mL product/kg seed
Fludioxonil	100g/L	5g ai /100kg seed
Imazalil	31%	0.33 mL product/kg seed
Azoxystrobin	100g/L	20g ai / 100kg seed
PCNB	500g/L	2.16 mL product/kg seed
		3.6 mL product/kg seed
Metalaxyl	350g/L	0.43mL product/kg seed