Influence of different pre-emergence herbicides on cotton diseases caused by *Rhizoctonia solani* and *Fusarium oxysporum* f.sp. *vasinfectum*

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**Key words** Cotton *Fusarium oxysporum vasinfectum* Pre-emergence herbicides

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**Summary** Field experiments were carried out during 1978–1982 in different provinces in Egypt to study the side effects of different pre-emergence herbicides (trifluralin, dinitramine, fluometuron, diuron, dalapon, and prometryn) at three different concentrations (1/2X, 1X, and 2X of recommended dose) on *Rhizoctonia solani* and *Fusarium oxysporum* f.sp. *vasinfectum* incidence. All the tested herbicides did not affect significantly *R. solani* disease incidence. Fusarium disease incidence was reduced significantly by the higher concentrations of all the tested herbicides. Prometryn and dalapon showed to be effective ones.

No additive effects on diseases incidence could be detected due to the herbicide treatments. All the tested herbicides did not affect significantly the resistance of cotton plants to Fusarium infection, the soluble carbohydrates and amino acids exuded by cotton seedlings, and the saprophytic activity of *Fusarium oxysporum* f.sp. *vasinfectum*. Chlamydomspore germination in soil was inhibited by the higher concentrations of all the tested herbicides. Prometryn and dalapon which showed to be the most effective herbicides in inhibiting chlamydomspore germination in soil, were the most effective ones in reducing the disease in field.

**Introduction**

Several kinds of herbicides has been reported to increase or decrease plant diseases, especially those caused by soil-borne plant pathogens1,5,6,7,9. Since herbicides are now used extensively in cotton culture, it was of interest to determine the extent to which these chemicals affected plant-disease relationships.

The present study was carried out to determine the effect of different pre-emergence herbicides usually used in cotton culture on the incidence of *Rhizoctonia solani* Kuhn and *Fusarium oxysporum* Schlect. f.sp. *vasinfectum* (Atk.) Snyd. Hans., respectively.

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Materials and methods

Herbicides

Six pre-emergence herbicides were used in this study, namely trifluralin, dinitramine, fluometuron, diuron, prometryn, and dalapon. All the herbicides were added to the soil, as recommended by the manufacturer at 1/2X, 1X, and 2X of recommended dose. As for laboratory experiments, herbicides were tested at three concentrations corresponding to the active ingredient in those of the field.

Organisms

The organisms used in this study were *Rhizoctonia solani*, and *Fusarium oxysporum f.sp. vasinfectum*, locally isolated from diseased cotton plants.

Effect of the herbicides on the diseases

Field experiments were done in the provinces of Kafr El-Sheikh (clay soil, pH 8.0), Behixa (silt clay soft, pH 7.8), Beni Suef (clay soil, pH 8.2), and Giza (sandy clay loam soil, pH 8.0) during 1978 to 1982. The treatments were arranged in a complete randomized plot system and replicated five times. Each replication had 100 planting hills with 10 cotton seeds planted in each (local cultivars). The emerged seedlings were counted 15, 22, and 30 days after sowing. Pre-emergence and post-emergence damping-off were determined weekly up to the 30 and 45 days after sowing, respectively. The number of Fusarium wilted plants was determined periodically up to 90 days after sowing. The percentages of Fusarium wilted plants and post-emergence damping-off were based on stand at the time of assay.

Up 1978, a new field was used along with the older one in Kafr El-Sheikh. The same plots of the later field were treated annually with the same herbicide concentration in order to study the additive effects of the used herbicide.

Effect of the herbicides on the diseases

A. In vitro effect. The effect of the herbicides on mycelial growth were determined by growing the organisms on water agar medium (linear growth) and in Czapek’s medium (dry weight) at 28–29°C. Herbicides were added separately to the media at different concentrations. The linear growth was measured daily until the growth covered the total area of the plate, whereas dry weight was recorded after 8 days incubation.

At the end of the experiment, 5 ml of sterile distilled water was poured in each of three plates and the spores were scraped off, and centrifuged at 3500 rpm for 15 min. The supernatant was discarded and the number of spores per ml was determined using Neubauer chamber.

In all cases, each experiment was repeated twice with four replicates for each herbicide concentration.

B. Effect on germination of Fusarium chlamydospores in soil. Clay soil was enriched with chlamydospores of *F. oxysporum f.sp. vasinfectum* (produced by incubating conidia at 5°C in autoclaved soil extract for 4 wk). Small soil samples (500 mg) were placed on microscope slides, the soils were treated with different herbicide concentrations (~0.9 bars moisture), and the slides were incubated in a moisture chamber at 28°C for 6 h. The soil was examined for spore germination by smearing it on the slide, staining it with lactophenol cotton blue and examining the smears microscopically. Counts were based on 5 replicates with a count of at least 100 chlamydospores/replicate. The length of germ tubes were also measured.

In all cases, the experiment was repeated twice with the above mentioned replications.

C. Effect on saprophytic activity of *F. oxysporum f.sp. vasinfectum*. Soil naturally infested with *F. oxysporum f.sp. vasinfectum* was placed in 600-ml beakers and covered with polyethylene film to prevent loss of moisture. The infested soil was kept at ~0.9 bars moisture. Herbicides were added to the soil hatches separately. After 1, 2, 4, and 8 days, 100 g of the soil was withdrawn (four replicates) and the surviving *F. oxysporum vasinfectum* was determined by a baiting method using cotton stem segments.