

Dispersal of the Fusarium Wilt Pathogen in Furrow-Irrigated Cotton in Israel

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ABSTRACT

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Spread of the wilt-causing *Fusarium oxysporum* f. sp. *vasinfectum* in a furrow-irrigated Pima cotton (*Gossypium barbadense*) field was recorded from 1977 to 1979 by infrared aerial photography and disease rating techniques. The primary loci of the disease spread mainly with the direction of the water flow. Furrow irrigation is important in dissemination of this wilt pathogen.

Dispersal and spread of plant pathogens by irrigation water is well documented for a number of pathogens, eg, *Fusarium*, *Phytophthora*, *Pythium*, and *Rhizoctonia* spp. (2-5). Wilt of Pima cotton (*Gossypium barbadense* L.)

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caused by *Fusarium oxysporum* Schlecht. f. sp. *vasinfectum* (Atk.) Snyd. & Hans. was detected in Israel in 1974 and its pathogenicity in this country is limited to long staple cotton (1). The pathogen was found only in the Bet-Shean Valley, where some of the cotton grown is still furrow-irrigated. The aim of this study was to determine dispersal rate and pattern of distribution of this pathogen due to furrow irrigation.

MATERIALS AND METHODS

The plot for this study, situated in the Bet-Shean Valley, was chosen from a field with a monoculture of cotton and had loci of Fusarium wilt. The spread of the disease from these loci was recorded over 3 yr beginning in 1977. The distribution pattern of the disease was

determined during the first 2 yr by infrared aerial photography and in the third year by field counts.

The field was photographed from a height of 300 m using an anochrome infrared filter 2443. The spots of diseased plants appeared grey or green and the healthy plants red. In the third year, the plot (30 rows, 0.96 m apart and 160 m long) was divided into 480 subplots, 0.96 × 10 m, which were rated individually for Fusarium wilt incidence by a four-degree empirical scale where 0 = no diseased plants, 1 = 1-30%, 2 = 31-89%, and 3 = 90% or more wilting plants. The direction of the furrow irrigation was from north to south. The plot, which was of a brown alluvial soil type, was cultivated crosswise (plowed, disc-cultivated, and harrowed) before each growing season. Isolation and pathogenicity tests were used to confirm the presence of *F. oxysporum* f. sp. *vasinfectum* in the diseased plants.

RESULTS AND DISCUSSION

The diseased loci were first noted by aerial infrared photography in 1977. Two loci 6-8 m wide and 12 m long were situated in the northern part of the plot (Fig. 1). After the aerial observation, a

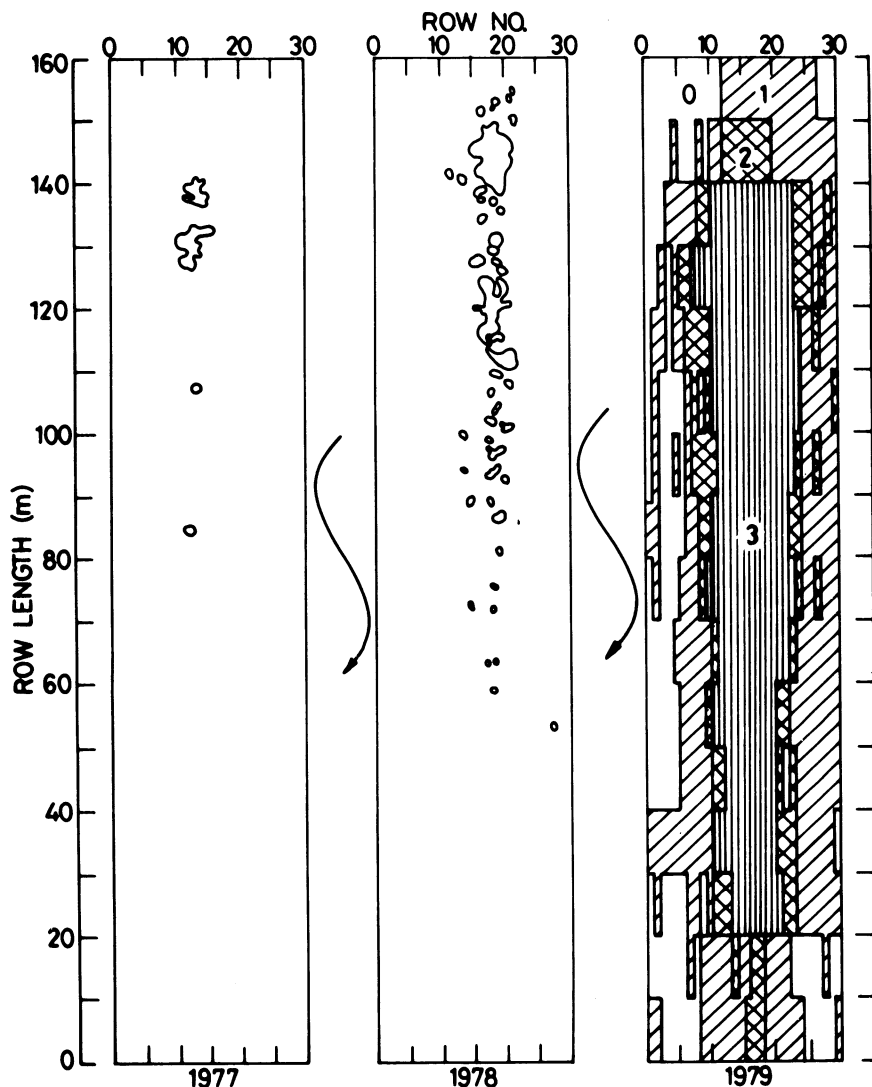


Fig. 1. Incidence of *Fusarium* wilt in a Pima cotton field in three successive years. The circles drawn for 1977 and 1978 indicate diseased spots in the field for that period and were copied from aerial infrared photographs. In 1979, disease severity was evaluated in each row in 10-m strips, using a scale of 0-3 where 0 = no diseased plants (no crosshatch marks), 1 = 1-30% (single crosshatch marks), 2 = 31-89% (double crosshatch marks), and 3 = 90% or more wilting plants (parallel lines). Arrows indicate the direction of the furrow irrigation—from north to south.

more detailed field examination showed a high disease severity in the two loci, with a disease rating of 2-3. In 1978, the width of the infested area remained almost the same but its length had increased to 80 m,

in the direction of the furrow irrigation. New small diseased spots were noted in a southerly direction from the main loci. In the third year, field examination showed further spread of the disease in the

direction of the irrigation water flow (Fig. 1). The length of the severely affected spot was 140 m.

Pathogen spread from the original spot in all directions other than that of the water flow was minimal, 4 to 8 m for the observed 3-yr period, despite the cross-cultivation method employed. This suggested that the movement of the pathogen, even by the mechanical means employed (cross-cultivation), was very limited. The pathogen spread in the southerly direction (the furrow-irrigation direction) was 15 times longer than in any other direction (130 m and more). These findings clearly indicated that dispersal of *Fusarium* wilt pathogen in cotton by furrow irrigation is very effective in moving the pathogen. This may be true for other soilborne pathogens as well.

Certain soilborne pathogens survive in water (for at least several months) and remain pathogenic (5). Because naturally occurring movement of most soilborne pathogens is restricted, furrow irrigation can be an important means for their dispersal. Therefore, furrow irrigation should be avoided, especially where a monoculture is used. This is especially true where severe disease loci are present (5).

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