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Influence of Various Irrigation Methods on *Frankliniella* spp. (Thysanoptera:Thripidae) in Cotton Fields

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Abstract: Population dynamics of *Frankliniella* spp. were studied in furrow, drip, border and sprinkler-irrigated field from 1999 to 2000 in Aydın province, Turkey. *Frankliniella occidentalis* (Pergande) and *Frankliniella intonsa* (Trybom) were recorded as thrips species. Full irrigation rate of each method at different irrigation periods was tested each year. There were significant differences found among irrigation methods. Number of *Frankliniella* spp. on leaves and flowers were highest in furrow and border irrigation plots. However, the lowest number of the population was observed in sprinkler-irrigated plot. Result indicates that furrow irrigation and drip irrigation methods in the cotton fields did not give any advantage to reduce the population dynamics compared with the border method. However, sprinkler irrigation may be useful in management of *Frankliniella* spp.

Key words: *Frankliniella* spp., irrigation methods, cotton

Introduction

About 700 ha of upland, *Gossypium hirsitum* L. are grown annually in Turkey, mostly in South, Southeastern and Aegean Regions. In recent 1.7 millions hectares will be opened to irrigation with the Southeastern Anatolia Project.

Most of cotton fields in Turkey were irrigated by border irrigation method. Due to changing of climatic factors and high price of water, growers have started looking for alternative irrigation method. In recent some growers have already started using furrow irrigation method. Besides two systems, drip and sprinkler methods were used in water-limited area. Because of the high costs of irrigation water, drip irrigation mainly in greenhouse and sprinkler irrigation in some plant fields are used in the middle part of Anatolia in Turkey where water is limited.

Different irrigation methods have an important role on plant quality and yield as well as management with pests. The effects of different irrigation methods on pests of cotton and some plants have been studied. Nakahara *et al.* (1985) on the family of Plutellidae, Tabashnik and Mau, (1986); Hoffman and Hogg (1992) on *Empoasca fabae* (Harris), Legette (1993) on some arthropods, Flint *et al.* (1994) on *Pectinophora gosyypiella* Saunders, Mor (1993) and Flint *et al.* (1995) on *Bemisia tabaci* Genn., Parihar *et al.* (1999) on aphid populations and Gencsoylu *et. al.* (2003) on *B. tabaci* in cotton fields were studied. Little data have been published on the effect of irrigation methods on the population of *Frankliniella* spp. associated with cotton. It was mainly in other crops. Wheatley *et al.* (1989) and Latimer and Oetting (1994) were studied the effect of drought stress on *Frankliniella schultzei* (Trybom), *Scirtothrips dorsalis* Hood. and *Frankliniella occidentalis* (Pergande).

Thrips puncture the leaves, flowers, or stems with their mouth parts and suck up the exuding sap. General thrips injury on foliage causes a characteristic silvery appearance, eventually browning and dying. Leaf tips wither, curl and die. The undersides of leaves are spotted with small black specks. Flowers become flecked, spotted, and deformed and many buds fail to open. Thrips can be found in greatest numbers between leaf sheaths and the stem (Metcalf, 1962). The western flower thrips is primarily a flower feeder that eats both the flower petals and pollen. On cotton Gonzalez *et al.* (1996) reported that it caused the cotton plant to age prematurely, advanced the opening of bolls and caused loss of boll weight and a decrease in the production and number of bolls. Roberts and Rechel (1996) also reported that it caused significant reductions in plant root development, leaf area and final dry matter of both above and below ground biomass.

Frankliniella spp. has recently gotten a potential pest in cotton fields of US (Graves *et al.*, 1987; Reed and Reinecke, 1990) and Israel (Klein and Ben-Dov, 1991). It has recently found economically important and damaged in cotton fields of Turkey (Atakan and Özgür, 1999). However, the management for the pest with is difficult due to oviposition site (Hata *et al.*, 1991; Kecelioglu and

Madanlar, 2002). Therefore, new practices are needed.

The aim of the study was to investigate the population dynamics of *Frankliniella* spp. in different irrigated-cotton field and possibility of irrigation methods on the management of the pest.

Materials and Methods

In the growing seasons of 1999 and 2000, experiments were conducted in cotton fields at Adnan Menderes University, Research Center of Agricultural Faculty in Aydin Province, Turkey.

Border, drip, furrow and sprinkler irrigation methods were used at full irrigation level which is amount of water needed by the cotton plant. Nazilli-84 cotton variety which is well adapted to the local environment was used during the study. Plots consisted of 50 m long by 6 rows including edge rows for furrow, drip and border and 24 rows for sprinkler irrigation method. Surface drip per two rows was used and drip emiter spacing was 0.25 m for drip irrigation. Four sprinkler systems with 7.5x7.5 m spacing between lateral lines and sprinkler heads were established in each sprinkler plot. Heads with 0.031 cm nozzles were used throughout season. The timing of sprinkler irrigation was controlled by manually switching power. Moisture deficiency in cotton root zone was measured by using gravimetric method and amount of full level of water determined was applied to all plots. Irrigation was applied on July 14, 27, August 17 and September 4 in 1999 and on July 6, 17, August 1, 22 in 2000. All plots received the same fertilization and cultivation practices during the two years of the experiment. Two thrips species were counted together. Populations of thrips were sampled from flower and two leaves at the top of each plant. Total 30 leaves and 15 flowers per 15 plants for each irrigation method with three replicates were sampled weekly. Flowers were placed individually in vials containing 70% alcohol and returned to the laboratory for processing. The total numbers of thrips were estimated.

The experimental design was randomized complete block with three replicates and 3 m space between blocks to reduce edge effects. Data were analyzed separately for each week by analysis of variance using the SAS program. DUNCAN test was conducted where significant F values were obtained.

Results

F. occidentalis and *F. intonsa* were recorded as thrips species and sampled on leaf and flower. Populations per leaf were firstly observed on July 20, 1999 and July 21, 2000 and increased through up to August in both years (Fig. 1). Populations on the leaf were greater in 2000 than in 1999. Significant differences in *Frankliniella* spp.

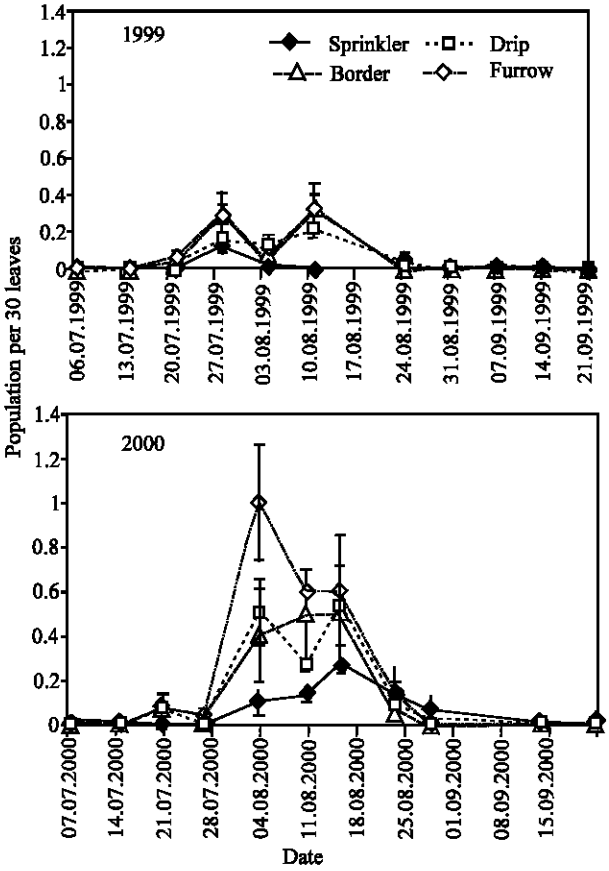

Fig. 1: Number of *Frankliniella* spp. on leaves at different irrigation methods in 1999 and 2000 ($P<0.05$). The bars indicate the +/- S.E

densities per leaf among irrigation methods were observed at the weeks (August 10,1999: $F=3.870$, df=3, 6; $P<0.05$; August 3, 2000 $F=3.073$, df= 3, 6; $P<0.05$, August 10, 2000 $F=5.916$, df=3, 6; $P<0.05$). Among irrigation methods the highest populations occurred on August 10, 1999 and in the middle of August, 2000 in border and furrow irrigation methods. However, the lowest population was observed in sprinkler irrigation method.

The populations on flower were higher in 2000 than in 1999 and firstly observed at the first week of August in 1999 and second week in 2000 and significant differences were found among methods at the weeks (August 25, 1999: $F=14.716$, df=3, 6; $P<0.05$; August 10, 2000: $F= 6.412$, df=3, 6; $P<0.05$; August 15, 2000: $F=14.668$, df=3, 6; $P<0.05$, August, 28, 2000: $F=15.680$, df=3, 6; $P<0.05$). The highest population was observed in border irrigation method (Fig. 2). On the other hand, the lowest population was occurred in sprinkler irrigation plots.

Discussion

Our research demonstrated that irrigation done at boll setting stage affected the number of *Frankliniella* spp. in

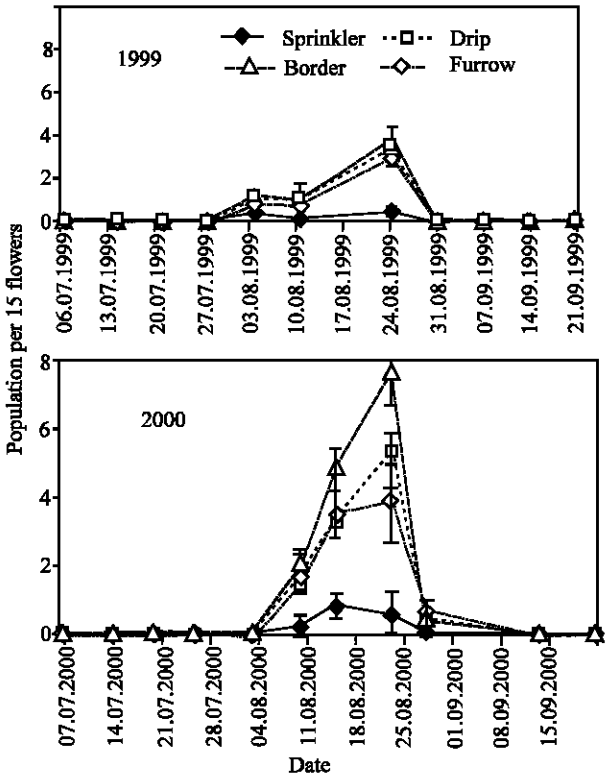

Fig 2: Number of *Frankliniella* spp. on flower at different irrigation methods in 1999 and 2000 ($P<0.05$). The bars indicate the +/- S.E

cotton. The greatest numbers on leaves were observed in border and furrow irrigation methods. Legette (1993) found that population of *F. occidentalis* was more in furrow irrigation method. The lowest amount was observed in sprinkler-irrigated plots. The effect of irrigation methods on *Frankliniella* spp. was not studied widely in cotton fields. More researches were done with furrow and drip irrigation methods on some pests in cotton and different plants. Castle *et al.* (1996) reported that sprinkler irrigation reduced whitefly population in cotton fields. Wheatley *et al.* (1989) found that the thrips *Frankliniella scultzei* and *Scirtothrips dorsalis* were at densities where drought stress was least in groundnut.

The population on flower was also found highly reduced in sprinkler irrigation. Significant reduction on densities of *Frankliniella* spp. depends on rainfall action of sprinkler method against the insect. The action of overhead sprinklers may stimulate rainfall on cotton. More information was not found about effecting on flower thrips species. It was thought that sprinkler irrigation appeared to involve a negative effect on *Frankliniella* spp. and would mainly has mechanical disturbances to leaves and flowers since the underleaf and flower habits of the pest help avoid direct contact with failing water droplets. This disturbance would involve less time for feeding and oviposition behavior or site. Gonzalez *et al.* (1996) and Atakan and Ozgur (1999) reported that larvae and adults of *Frankliniella* spp. were found in the upper layer of plant, mainly leaves and flowers.

A potential limitation to the wider use of sprinkler is the higher costs compared with the border and furrow irrigations. However, higher cost might be partially offset if reduced infestation resulted in less use of insecticide. Furrow and drip irrigation in the cotton fields did not give any advantage on the population dynamics compared with the border method. However, sprinkler irrigation may be useful in management of *Frankliniella* spp.

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Common Blossom Thrips, Frankliniella schultzei Trybom (Insecta: Thysanoptera: Thripidae)1. Garima Kakkar, Dakshina R. Seal, and Vivek Kumar2 2. Introduction. Florida is home to a large number of invasive as well as native species of thrips.Â Frankliniella schultzei is a polyphagous pest feeding on various ornamental and vegetable hosts in different parts of the world (Milne et al. 1996). It has been recorded from 83 species of plants among 35 families (Palmer 1990). The major hosts of F. schultzei are cotton, groundnut, beans, and pigeon pea. However, due to its polyphagous feeding behavior, F. schultzei also attacks tomato, sweet potato, coffee, sorghum, chillies, onion, and sunflower (Hill 1975). Economic Importance. Frankliniella spp. Thrips (Thysanoptera: Thripidae) inhabiting the flowers are hypothesized to increase hardlock by spreading the conidia or by creating entranceways for the germinating Fusarium conidia. Experiments were conducted at Marianna and Quincy in Florida in 2006 and 2007 to determine whether there was a relationship between the number of adult and larval thrips inhabiting the flowers of cotton and the incidence of cotton hardlock. Frankliniella tritici (Fitch) was > 98% of the adult thrips in the samples at both locations each year. The adults of Frankliniella bispinosa (Morgan) a