

## THE EFFECT OF COTTON PLANT SPACING ON IMPORTANT INSECT PESTS AND THEIR RELATED PREDATORS AND YIELD

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### ABSTRACT

Field study was carried out at Desuq district, Kafr El-Sheikh Governorate during two successive seasons, 2007 and 2008 to determine the effect of cotton plant spacing on the important insect pests and their associated predators as well as the cotton yield.

The results showed that the important insect pests were the piercing and sucking insect pests (*Bemisia tabaci* (Genn.), *Aphis gossypii* (Glov.), *Empoasca lybica* deBarg, and *Thrips tabaci*), *Spodoptera littoralis* (Boisd.), *Pectinophora gossypiella* (Sound.) and *Earias insulana* Lind. . The cotton plant spacing had significant effect on piercing sucking insect pests, where the population of these pests increased in the narrow bed with rate 25 cm inter and 59.16 cm intra, followed by narrow row with the same rates of plant spacing. While, in the wider rates (50 cm inter and 118.32 cm intra) were lowest. As for other insect pests, there were no significant differences between these pests in the four spacing rates.

The important predators were the coccinellids, (*Coccinella undecimpunctata*, and *Scymnus interruptus* Mals.), *Paederus alfieri*, *Syrphus* spp., *Orius* spp. and *Chrysoperla canrea* Steph. The predators correlated only with their prey but had no correlation with plant spacing. On the other hand, there was significant relationship between coccinellid predators and aphid and between *Chrysoperla carnea* Steph. and both aphid and whitefly as well as between *Paederus alfieri*, Kokh and *Spodoptera littoralis* Boisd.

The results also indicated that the significant increasing of cotton yield in narrow row spacing inter-25 cm and intra-59.16 cm (11.2 and 9.1 quintals/fed. in the two seasons, respectively followed by the same spacing rate on bed (9.8 and 8.7 quintal/fed., respectively), while in wide spacing (50 cm. inter-row) 9.5 and 7.9 quintal/fed., respectively and in wide bed spacing 8.5 and 7.2 quintal/fed. in the two seasons, respectively.

**Keywords:** Cotton, Insect Pests, Predators, Cotton yield.

### INTRODUCTION

Cotton (*Gossypium barbadense* L.) is the main cash money crop in Egypt. Cotton plants are subject to infestation with several insect pests throughout the growing season, beginning from seed germination up to harvest, causing a serious damage to the yield quantity and quality (Ahmed, 2004). Several investigations controlled the cotton pests by many methods throughout integrated pest management. On the other hand, several researches were applied for agricultural methods and plant spacing to find their effect on the yield, but these investigations which to deal with the pervious methods with the pest control were very rarely. So this work

aimed to evaluate the effect of cotton plant spacing on the insect pests and their related predators as well as on the cotton yield.

## **MATERIALS AND METHODS**

The study was carried out at Desuq district, Kafr El-Sheikh Governorate during two successive cotton growing seasons; 2007 and 2008. One feddan was chosen for sampling. The experimental field was divided into four equal parts (treatments). Cotton variety Giza 86 (recommended by Ministry of Agriculture) was cultivated on 4<sup>th</sup> week of March, in both seasons. The first treatment was sown on row of 25 cm. inter-spacing and 59.16 cm. intra-spacing. The second one was sown on bed of 25 cm inter-spacing and 59.16 intra-spacing. The third one was sown on row of 50 cm inter-spacing and 59.16 intra-spacing. The fourth was sown on bed of 25 cm inter-spacing and 118.32 intra-spacing. Direct counts of insect pests and their associated predators were taken weekly by the end of May until the first week of October and the sample contained 10 plants except in case of *Bemisia tabaci* and bollworms. *B. tabaci*, immatures stages (eggs, larvae and pupae) were counted in 20 in<sup>2</sup> of the cotton leaves (10 leaves x 2 in<sup>2</sup>). As for bollworms (*Pectinophora gossypiella* and *Earias insulana*), the sample contained 10 green bolls starting from July 1<sup>st</sup> until the last week of September. In the laboratory, the bolls were examined and considered infested when containing one larva or more of any of the two bollworm species. (Mesbah 2007). At the end of every season, the yield of each treatment was estimated.

The data were subjected for proper statistical analysis and Duncan's Multiple range (DMR) test at 5% probability was applied to find out the impact of plant spacing on insect pests and their associated predators and on the cotton yield.

## **RESULTS AND DISCUSSION**

### **1. Effect of plant spacing on insect pests:**

Data in Table (1) showed that the cotton plant spacing had a high effect on insect pests, especially piercing sucking insect pests, *Bemisia tabaci* (Genn.) immature stages, *Aphis gossypii* Glov., *Empoasca lybica* deBarg and *Thrips tabaci* Lind. The cotton plants in narrow bed (NB 25 cm inter-spacing) possessed high numbers of the piercing sucking insect pests, 1412 and 1249 ind./180 plants and 200 in<sup>2</sup> (*B. tabaci* immatures in the two seasons, respectively). The NR (narrow row spacing 25 cm) possessed 1197 and 1125 ind./180 plant and 200 in<sup>2</sup>. The lowest numbers of the piercing sucking insect pests were recorded on B. intra-double plant spacing (892 and 698 ind./180 plants and 100 in<sup>2</sup> in the two seasons, respectively). In contrast *Spodoptera littoralis* Boisd. larvae were recorded with high numbers on row-inter double plant spacing, 147 and 128 larvae/180 plants in the two seasons, respectively. Meanwhile, the lowest rate of *S. littoralis* larvae was recorded on NR (narrow plant spacing, 25 cm), where it was 57 and 66 larvae/180 plants during 2007 and 2008

seasons, respectively. As for bollworm, *E. insulana* and *P. gossypiella*, the normal bed had the high infestation with two pests especially in 2007 season, while, the lowest infestation was occurred on row inter-row double plant spacing (50 cm inter-spacing) Table (1).

**Table (1): Population density of cotton insects as influenced by plant spacing during 2007 and 2008 seasons.**

Treatments	Insect pests/180 cotton plants							
	Piercing sucking insect pests		<i>S. littoralis</i> Larvae		<i>E. insulana</i> ** Larvae		<i>P. gossypiella</i> ** Larvae	
	2007	2008	2007	2008	2007	2008	2007	2008
NR (25 cm)	1197	1125	57	66	2	1	1	2
NB (25 cm)	1412	1249	110	98	2	3	2	3
R. inter-d	987	728	77	66	2	0	1	1
B intra-d	892	698	147	128	2	2	1	2

\* Piercing sucking pests = Jassid, Aphid, *Bemisia tabaci* (immatures/200 in<sup>2</sup>) and thrips

\*\* *P. gossypiella* and *E. insulana* larvae/100 green bolls

NR = Normal row,

NB = Normal bed

R. inter-d = row-inter double spacing

B. intra-d = intra double spacing

**Table (2): Population density of insect predators associated with cotton insect pests as influenced by plant spacing during 2007 and 2008 seasons.**

Treatments	Insect predators/180 cotton plants									
	Coccinellids		<i>P. affierii</i>		Syrphus spp. larvae		<i>Orius</i> spp.		<i>C. carnea</i> larvae	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
NR (25 cm)	30	33	2	2	0	2	5	1	4	3
NB (25 cm)	36	32	2	2	2	3	2	3	5	3
R. inter-d	28	30	1	0	0	1	0	2	1	2
B. intra-d	27	26	3	2	0	0	2	1	1	1

\* Piercing sucking pests = Jassid, Aphid, *Bemisia tabaci* (immatures/200 in<sup>2</sup>) and thrips

\*\* *P. gossypiella* and *E. insulana* larvae/100 green bolls

NR = Normal row,

NB = Normal bed

R. inter-d = row-inter double spacing

B. intra-d = intra double spacing

Statistical analysis revealed high significant differences between *B. tabaci*, *A. gossypii*, *E. lybica* and *T. tabaci* (piercing and sucking insect pests) in the four treatments during the two study seasons. In spite of the differences in the numbers of *S. littoralis*, *E. insulana* and *P. gossypiella* in the different treatments there were no significant differences between these pests. The present results are in conformity with those of Arif *et al.* (2006) who found that the populations of jassid, whitefly and thrips were higher at lower plant spacing. Also, the present findings are in conformity with shoes of Butter *et al.* (1992), Mohite and Uthamasamy (1999) who recorded that the population of jassid was higher at lower plant spacing. However, the present findings are not in agreement with those of Sohi *et al.* (1995) who reported that incidence of jassid was not significantly affected with spacing.

The present findings of whitefly are in conformity with those of Seif (1980). From available literature, no investigation was handled the effect of plant spacing on cotton leaf worm or bollworms.

### **2. Effect of plant spacing on insect predators:**

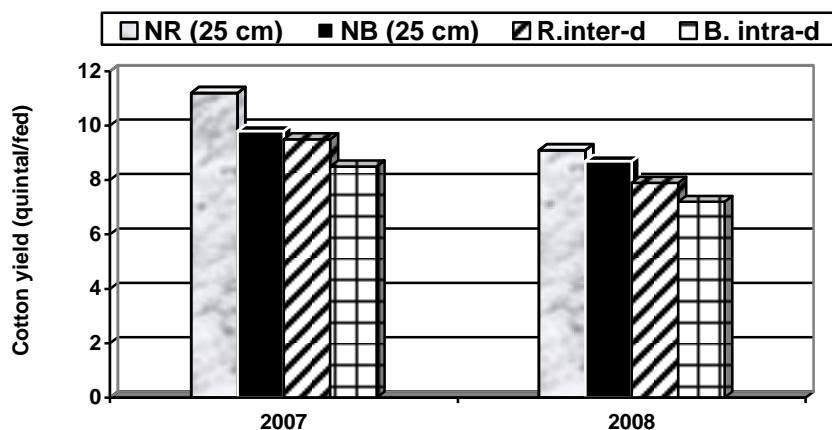
As data shown in Table (2), the coccinellid predators (*Coccinella undecimpunctata* and *Scymnus interruptus*) were the most abundant predators in the four treatments. The highest numbers of coccinellids were recorded on NB plot, 36 and 32 predators/180 plants in the two seasons, respectively followed by NR, 30 and 33 predators per 180 plants in two seasons, respectively. The lowest rate of predator numbers were detected on B. intra-d, 27 and 26 coccinellids/180 plants, respectively. In contrast for *P. alferii* was recorded with high number on B. intra-d while *C. carnea* was higher on NB spacing. As for *Syrphus* spp. and *Orius* spp. They were relatively higher on NR and NB plant spacing.

Statistical analysis revealed no significant variations among the predators in the four replications. On the other hand there were highly significant correlation between coccinellids and aphid and between *C. carnea* and both aphid and whitefly as well as between *P. alferii* and *S. littoralis*. The present data revealed no effect of plant spacing on the insect predators, where the key factor of the predators were the occurrence of their prey not the plant spacing.

### **3. Effect of plant spacing on the cotton yield:**

Fig. (1) showed that the highest cotton yield was obtained from NR (normal row spacing 25 cm) in the two seasons, 11.2 and 9.1 quintals/fed., respectively followed by NB, 9.8 and 8.7 quintal/fed., respectively. The lowest yield was recorded in B. intra-double spacing (7.2 and 7.9 quintal/fed., respectively). Statistical analysis revealed highly significant difference between NR spacing and other treatments. On the other hand, no significant differences were found among the other three treatments.

It is noteworthy that the agricultural practices were easier to be done in wide spacing (bed intra-spacing 1187.3 cm and row-inter-spacing, 50 cm) than in narrow row spacing (NB and NR spacing).



**Fig. (1): Cotton yield as influenced by four cotton spacing.**

The size of bolls and their numbers were more in the wide plant spacing, as well as the bolls opening was highly in the wide spacing plants. The previous characters may be considered in the breeding programs. The present findings are in agreement with those of Heitholt *et al.* (1992) and Steglich *et al.* (2000) who recorded that narrow row spacing increases total seasonal light interception, which can potentially increase cotton yield. The finding was found by Wiatrak *et al.* (1998) and Cawley *et al.* (1999) who found that the UNR (Ultra-narrow row) cotton had equal or higher yields than wide row cotton. The present results are not in agreement with those of Jones *et al.* (2000) who found that lint yields were similar for cotton grown in 19, 38, 76 and 102 cm row spacing. Also, Witten and Cothren (2000) found eight cultivars yielded higher in a 38 cm row spacing than in a 19 cm row spacing because boll size were greater in the 38 cm row spacing. Finally, Boquet (2005) reported that ultra-narrow row spacing (UNR) of 25 cm or less may be viable alternative to wide-row spacing and increase in plant density decreased boll number and individual boll weight, he also found that maximum yields of UNR cotton were attained from plant densities in the range of 1280000-256000 ha.

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### تأثير مسافات الزراعة فى القطن على أهم الآفات الحشرية والمفترسات المصاحبة والمحصول

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أجريت هذه الدراسة بمنطقة دسوق - محافظة كفر الشيخ خلال موسمى 2007 ، 2008م لمعرفة تأثير مسافات الزراعة فى نباتات القطن على أهم الآفات الحشرية والمفترسات المصاحبة لها والمحصول. وأوضحت النتائج أن أهم الآفات الحشرية هى الحشرات الثاقبة الماصة وهى ذبابة القطن

البيضاء ، من القطن ، نطاط أوراق القطن وتربس البصل ، دودة ورق القطن الكبرى ، ودودة اللوز القرنفلية ودودة اللوز الشوكية وأوضحت الدراسة وجود تأثير معنوي لمسافات الزراعة على الحشرات الثاقبة الماصة جميعا ، حيث إزداد تعداد هذه الآفات فى الزراعات الضيقة فى مصاطب بمعدل 25 سم بين الجور و 59.16 بين الصفوف يليها الخطوط التى لها نفس معدلات الزراعة ، بينما كانت تلك الحشرات أقل فى المعدلات الأوسع وهى 50 سم بين الجور فى خطوط و 59.16 سم بين الخطوط وكذلك على 25 سم بين الجور فى مصاطب و 118.32 سم بين المصاطب. وبالنسبة للآفات الأخرى وبالرغم من الاختلافات العددية بينها إلا أنه لا يوجد اختلاف معنوي.

وبالنسبة للمفترسات الحشرية كان أهمها هى حشرات أبو العيد (أبو العيد ذو الأحدى عشر نقطة واسمئناس انترابنس والحشرة الرواعة وذبابة السرفس وبقة الأوريس وأسد المن وأوضحت الدراسة أن هذه المفترسات مرتبطة بفرائها زيادة ونقصا كما أوضحت الدراسة وجود ارتباط بين كل من مجموعة أبو العيد وأسد المن والحشرات الثاقبة الماصة وكذلك بين الحشرة الرواعة ودودة ورق القطن. وأوضحت النتائج زيادة محصول القطن فى المسافات الضيقة (25 سم) فى خطوط حيث كان المحصول (11.2 ، 9.1 قنطار/فدان فى موسمى الدراسة على التوالي) ثم المصاطب الضيقة (9.8 ، 7.8 قنطار/فدان على التوالي) بينما كان المحصول فى المسافات الواسعة 50 سم بين الجور فى خطوط هى 9.5 ، 7.9 قنطار على التوالي وفى المصاطب 25 سم بين الجور و118.72 سم بين الصفوف هى 8.5 ، 7.2 قنطار على التوالي خلال موسمى الدراسة.