

EFFECT OF TRANSPLANTING AND PLANTING DATES OF COTTON AND THE INFESTATION LEVELS OF PINK AND SPINY BOLLWORMS

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Abstract

The present work was carried out to investigate the development of bollworm infestations in the transplanting cotton and cotton sowing by seeds during three successive cotton growing seasons of 1993, 1994 and 1995 at Gharbia, Kafr el-Sheikh and Beheira Governorates. The infestation by cotton bollworms, *Pectinophora gossypiella* (Saunders) and *Earias insulana* (Boisd.) in the squares, flowers and green bolls were estimated during the whole period of investigation for the three tested localities combined. Cotton sowing by seeds harboured the highest infestation levels, while cotton cultivated by transplanting of cotton seedlings received less cotton bollworm infestations.

INTRODUCTION

Cotton in Egypt is considered as the main cash crop. Cotton plants are liable to attack with many arthropod insect pests. The cotton bollworms causes the greatest part of yield losses resulted from one million feddans cultivated annually. Previous ecological studies concerning changes in the population dynamics of pink bollworm, *Pectinophora gossypiella* (Saunders) and spiny bollworm, *Earias insulana* Boisd. were carried out in different Agro-ecosystems (Salman *et al.*, 1979).

The infestation parameters of the pink and spiny bollworms were estimated in squares, flowers and green bolls. The effect of transplanting cotton in comparing with cotton sowing by seeds was studied. It was thought that a complete understanding of the limiting factors that regulate population trends of cotton bollworms cannot be achieved without enough informations. In order to achieve control tactic compatible with other control measures, it is necessary to be integrate with integrated a crop mangement programme.

For considering the aformentioned concepts, it was thought of great importance to study the population cycle of these insect pests.

MATERIALS AND METHODS

Three field trials were carried out at Gemeiza Agricultural Research Station, Gharbia Governorate and Sakha Agricultural Research Station, Kafr El-Sheikh Governorate for three successive cotton growing seasons, 1993, 1994 and 1995 to study the simultaneous effect of transplanting of cotton on the population cycles of cotton bollworm pests. For Noubaria, Beheira Governorate, similar field experiment was conducted, but for only two seasons (1993 and 1994)

Dates of sowing cotton by seeds and transplanting of seedlings

The dates of sowing cotton by seeds and transplanting of cotton are shown in Table 1 in every locality through the periods of the study along with dates of picking and corresponding cotton yield weights.

Monitoring the infestation levels of *Pectinophora gossypiella* and *Earias insulana* (squares, flowers & green bolls) in the transplanting cotton and cotton sowing by seed fields

Weekly random samples of squares, flowers and green bolls (100/100 plants) representing the different stages and levels of cotton growth stages counted from transplanted cotton and sowing by seeds were examined weekly during the whole period of investigation in the three tested localities to evaluate the percentage of infestation for *Pectinophora gossypiella* and *Earias insulana*.

RESULTS AND DISCUSSION

Gharbia Governorate

A. *Pectinophora gossypiella*: Data in Tables 2-4 indicate that the first occurrence of infestation of this insect was observed in the squares of transplanting and seed sowing cotton plants during the first week of July 1993, but with scarcely levels and increased gradually reaching a maximum of 10, 12 and 15 larvae/100 squares in the 1st week of August, for T1, T2 and S., respectively.

For 1994, the first infestation symptoms in the squares started as early as the 1st week of July and one to two weeks earlier for the two planted cotton seedlings. The infestation increased gradually reaching a peak of 14, 19 and 22 larvae/100 squares for (T1), (T2) and (S), respectively on the third week of August. The total numbers of infested squares during the season were 61, 97 and 124 in T1, T2

Table 1. Date of sowing, transplanting cotton varieties and corresponding yield weights of cotton at Gharbia, Kafr El-Sheik and Beheira Governorates, during 1993, 1994 and 1995 cotton growing seasons.

Locality	Year	Date of sowing in the nursery	Date of transplanting	Date of sowing seed in the field	Cotton varieties	Date of picking		Date of picking	
						Tranplanting cotton	Seed plants	Tranplanting cotton	Seed plants
Gharbia	1993	31 Mar.	1 May	31 Mar.	Giza 75	27 Sept.	27	7.6	11.3
		31 Mar.	15 May			27 Sept.	Sept.	7.1	
	1994	31 Mar.	2 May	31 Mar.	Giza 75	30 Sept.	30	7.8	11.4
		31 Mar.	1 May			30 Sept.	Sept.	7.2	
	1995	31 Mar.	1 May	31 Mar.	Giza 75	30 Sept.	30	8	12
		31 Mar.	15 May			30 Sept.	Sept.	7.2	
Kafr El Sheikh	1993	28 Mar.	1 Apr.	28 Mar.	Giza 76	20 Sept.	25	3.4	6.2
		28 Mar.	1 May			9 Oct.	Sept.	3.2	
	1994	31 Mar.	1 Apr.	31 Mar.	Giza 84	20 Sept.	2	3.5	5.9
		31 Mar.	1 May			5 Oct.	Oct.	3.3	
	1995	30 Mar.	1 Apr.	30 Mar.	Giza 86	22 Sept.	30	3.6	6.2
		30 Mar.	1 May			5 Oct.	Sept.	3.4	
Beheira	1993	30 Mar.	1 May	30 Mar.	Giza 75	25 Sept.	5 Oct.	3	5.5
	1994	28 Mar.	1 May	28 Mar.	Giza 75	26 Sept.	7 Oct.	3.1	5.3

T1: first planting date (transplanted cotton)

T2: second planting date (transplanted cotton).

S. : cotton sowing by seeds.

and S., respectively, thus indicating the reliable occurrence of PBW larvae in the "S" treatment. The infestation for 1995 season was comparatively higher than 1993 and 1994 cotton growing seasons.

For infestation in flowers, data in Tables 2-4 indicate that the BPW infestation started in flowers on mid July of 1993 and 1995, and one week earlier for 1994. The infestation then increased gradually forming a peak on late July. The total number of infested flowers was obviously higher in cotton sowing by seeds. The infestation was again high at 1995 than both 1993 and 1994 cotton growing seasons.

As for infestation in green bolls, data in Tables 2-4 indicate that the infestation started during the 1st half of July and increased gradually, thus forming a peak on the third week of September. The larval content in green bolls reached 44, 56 and 64 for T1, T2 and S.treatments, respectively.

It appears from these results that obvious preferendum of PBW larvae to attack green bolls, with special preference to attack cotton plants sowing by seeds. Table 9 demonstrates the deviation of larval content/squares/flowers and/green bolls averages from the general average for 1993, 1994 and 1995. For transplanting, the deviation values were negative in 1993, 1994 and 1995. For seed sowing treatments (s), the deviations were positive, thus revealing the highest level of infestation by the PBW larvae throughout the growth stages of cotton. As shown in Table 2 & 3, the analysis of variance reveal the presence of significant differences between S. and T1 treatments for 1993 and 1994. The L.S.D. value indicate that no significant differences occurred between (T2) and (S) treatments from one hand and between T2 and T1 from the other. For 1995, the analysis of variance yielded an insignificant "F" value.

B. *Earias insulana*: Data in Tables 2-4 indicate that the first appearance of larvae infestation was observed in the squares during the third week of July 1993 in T1 and 2 weeks later for (T2) and (S) treatments. It increased gradually forming a small peak on the 4th week of August 1993 and 1994. When the total infestation was considered, (S) treatment demonstrates the highest infestation level. For 1995, the infestation in the squares was comparatively low, Table 4.

Generally, the highest infestation by *Earias insulana* in the flowers for the three tested treatments occurred during August and comparatively high in seed sowing plants than transplanting ones.

Table 2. Rate of infestation by bollworms in squares, flowers and green bolls in transplanting and seed sowing cotton during 1993 at Gharbia Governorate.

Date of inspection	<i>Pectinophora gossypiella</i>						<i>Earias insulana</i>					
	Squares		Flowers		Green bolls		Squares		Flowers		Green bolls	
	T1	T2	S	T1	T2	S	T1	T2	S	T1	T2	S
16/6/1993	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	3	0	0	0	0	0	0	0	0	0
7/7	1	2	4	0	0	3	0	1	0	0	2	0
14	2	3	6	1	1	7	0	1	0	1	0	0
21	4	5	6	1	1	8	1	1	1	1	1	2
28	6	7	8	2	2	10	1	1	2	2	3	1
4/8	8	10	10	2	2	11	2	5	6	2	3	4
11	9	12	12	1	3	14	3	5	6	2	4	5
18	10	12	15	1	4	19	5	6	8	3	5	11
25	3	7	11	0	1	20	4	4	9	1	2	13
1/9	0	0	0	0	0	24	0	0	0	1	0	20
8	0	0	0	0	0	31	0	0	0	0	0	23
15	0	0	0	0	0	45	0	0	0	0	0	25
22/9	0	0	0	0	0	50	0	0	0	0	0	29
Total	43	58	75	8	14	335	16	23	35	11	15	183

F value = 1.13 (insignificant) P = 0.336

F value = 3.26* L.S.D. = 13.22

Mean : C.S. = 36.92 T.P.2 = 28.75 T.P.1. = 19.92

Variance : aabb

T1: first planting date (transplanted cotton)

T2: second planting date (transplanted cotton).

S. : cotton sowing by seeds.

Table 3. Changes in infestation by bollworms in squares, flowers and green bolls in transplanting and seed sowing cotton during 1994 at Gharbia Governorate.

Date of inspection	<i>Pectinophora gossypiella</i>										<i>Earias insulana</i>									
	Squares			Flowers			Green bolls			Squares			Flowers			Green bolls				
	T1	T2	S	T1	T2	S	T1	T2	S	T1	T2	S	T1	T2	S	T1	T2	S		
	18/6/1994	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2/7	1	2	4	0	0	2	1	1	3	0	0	1	0	0	0	0	0	0	0	
9	1	3	6	1	2	3	2	4	5	0	1	2	0	1	0	4	0	4	0	
16	3	5	8	1	2	2	2	4	6	1	1	5	0	2	3	1	5	1	5	
23	4	8	10	2	3	3	5	6	9	2	2	6	1	2	2	4	5	6	6	
30	7	11	13	3	3	8	9	11	14	2	2	8	2	3	3	5	7	11	11	
6/8	9	13	15	2	4	7	11	15	18	3	5	5	3	4	5	6	10	16	16	
13	12	16	20	3	1	5	12	17	20	5	6	9	3	5	6	13	27	27	27	
20	14	19	22	1	2	3	14	19	26	7	10	11	4	5	8	12	17	29	29	
27	8	10	16	0	1	3	17	22	37	9	12	13	2	2	5	15	26	30	30	
3/9	2	9	8	0	0	1	24	29	43	2	8	8	2	0	2	21	27	35	35	
10	0	0	0	0	0	0	39	41	54	0	0	0	0	0	0	27	30	38	38	
17	0	0	0	0	0	0	45	48	55	0	0	0	0	0	0	29	33	40	40	
24	0	0	0	0	0	0	49	61	69	0	0	0	0	0	0	31	35	42	42	
Total	61	97	124	13	18	37	230	278	359	31	47	68	17	24	34	162	204	283	283	

F value = 3.26* L.S.D. = 12.7 F value = 3.15* L.S.D. = 11.095
 Mean : C.S. = 39.8 T.P.2 = 28.85 T.P.1. = 23.38 Mean : C.S. = 29.62 T.P.2 = 20.31 T.P.1. = 16.23
 Variance : aabb Variance : aabb

T1: first planting date (transplanted cotton)
 T2: second planting date (transplanted cotton).
 S.: cotton sowing by seeds.

Table 4. Changes in infestation by bollworms in squares, flowers and green bolls in transplanting and seed sowing cotton during 1995 at Gharbia Governorate.

Date of inspection	<i>Pectinophora gossypiella</i>						<i>Earias insulana</i>					
	Squares		Flowers		Green bolls		Squares		Flowers		Green bolls	
	T1	T2	S	T1	T2	S	T1	T2	S	T1	T2	S
21/6/1995	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	1	0	0	0	0	0	0	0	0	0
5/7	1	1	1	0	1	3	0	0	0	0	0	2
12	2	1	1	1	2	2	1	3	4	1	2	8
19	1	2	4	1	5	3	2	3	5	3	4	10
26	1	4	6	2	6	5	4	5	6	3	4	15
2/8	2	6	8	4	4	7	7	10	10	3	4	18
9	5	10	11	3	2	5	11	14	12	8	7	24
16	8	11	18	2	7	8	12	16	19	10	8	28
23	7	13	17	1	5	5	12	18	25	14	14	31
30	10	15	21	5	4	6	15	23	34	16	15	34
6/9	7	9	6	1	4	28	28	45	4	17	15	38
13	0	2	0	0	1	4	35	40	51	3	4	44
20	0	0	0	0	0	0	40	46	63	0	0	45
27	0	0	0	0	0	0	48	57	67	0	0	48
Total	44	74	94	20	38	52	215	264	344	67	81	269

F value = 1.8 (insignificant)

F value = 3.43* L.S.D. = 12.59
 Mean : C.S. = 39.77 T.P.2 = 29.62 T.P.I. = 23.69
 Variance : aab
b

T1 : first planting date (transplanted cotton)
 T2 : second planting date (transplanted cotton).
 S. : cotton sowing by seeds.

Table 5. Changes in infestation by bollworms in squares, flowers and green bolls in transplanting and seed sowing cotton during 1993 at Kafr El-Sheikh Governorate.

Date of inspection	<i>Pectinophora gossypiella</i>										<i>Earias insulana</i>									
	Squares			Flowers			Green bolls			Squares			Flowers			Green bolls				
	T1	T2	S	T1	T2	S	T1	T2	S	T1	T2	S	T1	T2	S	T1	T2	S		
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
18/6/1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
25	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2/7	1	1	5	0	0	0	0	1	2	0	1	2	0	0	0	0	0	3	4	
9	2	3	7	1	2	2	3	4	5	1	1	1	0	3	4	1	8	8	11	
16	5	7	9	1	2	4	4	8	1	3	5	1	3	4	2	9	11	12	18	
23	8	9	9	2	4	5	5	7	11	2	3	4	2	4	6	8	11	14	18	
30	9	10	12	4	4	6	7	9	14	4	5	7	3	6	8	11	14	18	27	
6/8	11	11	14	4	5	8	9	11	19	5	7	9	3	5	7	19	22	27	27	
13	12	13	16	2	5	9	14	16	21	3	4	6	4	6	5	24	25	29	30	
20	11	15	15	2	6	8	16	21	32	2	4	8	5	7	7	25	27	30	32	
27	5	17	13	1	3	6	22	37	39	6	7	10	2	5	6	29	30	32	36	
3/9	2	8	12	0	1	1	33	41	47	2	4	5	2	3	4	30	32	36	38	
10	0	5	4	0	0	0	39	52	55	1	2	4	0	1	3	31	36	40	44	
17	0	0	0	0	0	0	43	62	65	0	0	0	0	0	0	32	39	44	56	
24	0	0	0	0	0	0	48	66	71	0	0	0	0	0	0	37	44	56	61	
Total	67	99	118	17	32	49	243	330	390	27	41	61	22	43	54	249	300	341	341	

F value = 2.73* L.S.D. = 15.32 F value = 2.43* L.S.D. = 11.20
 Mean : C.S. = 42.69 T.P.2 = 35.08 T.P.I. = 25.08 Mean : C.S. = 35.1 T.P.2 = 29.5 T.P.I. = 22.9
 Variance : aab Variance : aab
 T1: first planting date (transplanted cotton)b
 T2: second planting date (transplanted cotton)b
 S. : cotton sowing by seeds.

The infestation in green bolls started to appear in early transplanting (T1) as early as the 1st week of July (2 larvae/100 green bolls) and two weeks later for (T2) and (S) treatments. The infestation then increased forming a maximum peak at the late season. This indicates the strong preference of *Earias insulana* to attack seed sowing plants. For 1994, the first appearance of larval infestation was observed during the 1st half of July and reaching a peak of 31, 35 and 42 larvae for T1, T2 and (S), respectively at the late season. For 1995, the highest infestation levels were 36, 44 and 48% for the three tested treatments, indicating the obvious increase in the infestation percentage for 1995 than both 1994 and 1993.

Table 10 demonstrates the deviation values of the total numbers of larvae from the general average during 1993, 1994 and 1995. For T1 and T2, these deviation values were negative, i.e. around the equilibrium position level. For seed sowing method, the deviation values were positive, indicating the strong presence of *Earias insulana* in cotton sowing by seeds, i.e. around the damage threshold level.

Kafr El Sheikh

A. *Pectinophora gossypiella*: Data in Table 5-7 indicate that the infestation by PBW larvae on cotton squares during the three seasons started in transplanting and seed sowing treatments on the 1st week of July and increased gradually reaching a peak on the second half of August.

Data in Tables 5-7 indicate that the infestation of PBW larvae in the flowers were first observed during the 1st half of July with low numbers and increased gradually reaching the maximum at the 3rd week of August. The total numbers of infested squares and flowers were the highest in 1994.

For the infestation in green bolls, it also started to appear during the first week of July in the seed sowing cotton and one week later for transplanting fields and increased gradually by the progression of time. The levels of infestation at 1995 dominated that of previous seasons.

In general, it is worth to note that the highest infestation levels of *Pectinophora gossypiella* occurred in seed sowing followed by transplanting of cotton seedlings T1 and T2.

Table 10 demonstrates that the deviation mean values from the general average were negative (-121.33, -157.7 and -72.3) for 1993, 1994 and 1995 for the early transplanting. This indicates that the infestation levels for T1, were still below

Table 6. Changes in infestation by bollworms in squares, flowers and green bolls in transplanting and seed sowing cotton during 1994 at Kafr El Sheikh Governorate.

Date of inspection	<i>Pectinophora gossypiella</i>												<i>Earias insulana</i>											
	Squares				Flowers				Green bolls				Squares			Flowers			Green bolls					
	T1		T2		S		T1		T2		S		T1		T2		S		T1		T2		S	
19/6/1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
26	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
3/7	3	5	4	0	6	7	8	9	8	9	8	1	5	6	0	0	3	2	4	7	4	7	7	
10	7	7	7	4	5	8	9	10	12	10	12	4	6	8	5	6	5	5	9	12	15	15	12	
17	10	11	9	6	8	10	11	17	19	17	19	5	6	9	5	8	8	7	11	15	15	15	12	
24	10	14	12	6	9	13	12	17	21	17	21	5	9	12	7	10	13	17	22	22	22	22	22	
31	13	16	18	8	8	11	14	24	28	24	28	7	6	10	8	11	13	16	21	26	26	26	26	
7/8	15	19	22	7	10	14	19	26	32	26	32	8	12	12	9	11	10	26	32	37	37	37	37	
14	12	17	19	6	8	14	22	37	39	37	39	10	14	16	10	12	16	30	34	39	39	39	39	
21	8	21	23	6	7	10	27	43	45	43	45	10	12	11	7	14	12	32	39	44	44	44	44	
28	4	9	15	8	8	12	38	49	54	49	54	9	11	10	8	10	34	44	48	48	48	48	48	
4/9	3	9	13	4	10	12	45	56	57	56	57	6	12	14	6	8	36	40	48	48	48	48	48	
11	0	0	3	4	7	8	49	60	66	60	66	4	8	5	2	5	40	47	65	65	65	65	65	
18	0	0	0	0	0	0	54	68	71	68	71	0	0	0	0	0	48	55	66	66	66	66	66	
25	0	0	0	0	0	0	57	69	73	69	73	0	0	0	0	0	61	70	76	76	76	76	76	
Total	85	128	147	59	86	119	365	485	526	485	526	69	104	113	67	88	350	423	516	516	516	516	516	

F value = 2.46 (insignificant)

F value = 3.98* L.S.D. = 15.6

Mean : C.S. = 56.15 T.P.2 = 48.08 T.P.1 = 37.38

Variance : aab

.....b

T1: first planting date (transplanted cotton)

T2: second planting date (transplanted cotton).

S. : cotton sowing by seeds.

Table 7. Changes in infestation by bollworms in squares, flowers and green bolls in transplanting and seed sowing cotton during 1995 at Kafr El-Sheikh Governorate.

Date of inspection	<i>Pectinophora gossypiella</i>						<i>Earias insulana</i>					
	Squares		Flowers		Green bolls		Squares		Flowers		Green bolls	
	T1	T2	S	T1	T2	S	T1	T2	S	T1	T2	S
20/6/1995	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	1	0	0	0	0	0	0	0	0	0
4/7	2	2	4	0	3	4	4	5	5	0	0	7
11	3	4	6	2	3	5	5	6	2	4	5	10
18	6	8	9	3	5	7	7	8	9	3	6	13
25	9	11	11	3	6	9	7	11	14	4	8	15
1/8	11	12	11	5	5	8	10	13	14	5	10	20
8	12	16	14	5	7	11	15	18	21	6	10	24
15	14	14	15	4	5	4	18	21	22	4	8	33
22	12	18	18	3	4	4	24	31	33	4	8	35
29	6	6	15	6	5	5	35	38	39	7	8	38
5/9	4	5	14	2	5	8	42	43	45	3	6	40
14	0	0	8	3	4	6	46	49	52	2	4	42
21	0	0	0	0	0	0	51	54	56	0	0	46
28	0	0	0	0	0	0	53	60	64	0	0	52
Total	79	96	126	36	52	71	317	356	380	39	57	381

F value = 1.31 (insignificant) F value = 3.246* L.S.D. = 11.77
 Mean : C.S. = 40.31 T.P.2 = 34.62 T.P.1 = 27.46
 Variance : aab b

T1: first planting date (transplanted cotton)
 T2: second planting date (transplanted cotton).
 S.: cotton sowing by seeds.

the general average. For T2, the deviation values were positive during 1993 and 1994, while it was negative during 1995. For seed sowing treatment, these values were as usual positive in the tested seasons.

The analysis of variance for 1993 yielded significant differences, while insignificant values were obtained for 1994 and 1995.

B. *Earias insulana* : For the data in Tables 5-7, it appear that the first appearance of *Earias insulana* infestation in the squares occurred in both 1993 and 1994 during the 1st half of July and increased gradually reaching the maximum at late August.

For the infestation in the flowers, it starts during the 1st half of July 1993 and increased gradually, reaching a maximum on the third week of July. For the infestation in green bolls, it started to appear also during the 1st week of July in the three treatments. The maximum infestation in green bolls took place at the end of 1994 season.

Generally, it can be concluded that *Earias insulana* infestation in seed sowing planting was higher than of transplanting during the three studied seasons.

Table 10 demonstrates the deviation mean values of infestation from the general average. These values were negative in case of early transplanting (T1) during the three tested years. For T2, these values were positive for both 1993 and 1994, while it was negative in 1995. For seed sowing, however, these deviations were positive in 1993, 1994 and 1995 seasons, thus indicate the strong preferendum of spiny bollworm larvae to infest cotton sowing by seeds. A significant differences between the three tested treatments were obtained, thus confirming the results obtained before.

Beheira Governorate

A. *Pectinophora gossypiella*: Data in Tables 8-9 indicate that the first occurrence of PBW infestation in the squares started during the 1st half of July and increased gradually reaching the maximum on the 3rd week of August. For 1994, the maximum of infestation occurred in the 3rd week of August.

For the flowers, the highest infestation levels of this insect took place on the 2nd and 3rd week of August, 1994.

Data in Table 10 show that the population size decreased just below the general average and negative values were accordingly obtained for (T) treatment. On the contrary, positive trend for (S) cotton fields was obtained.

B. *Earias insulana*: The infestation of *Earias insulana* larvae was first observed during 1993 in the squares on the 1st week of July 1993 in both transplanting and seed sowing treatments and reached the maximum level of infestation at late August. For 1994, the highest percentage of infestation (26 larvae) was reached one week earlier, i.e. on the 3rd week of August 1994.

The highest infestation in the flowers for 1993 and 1994 seasons was recorded at late August.

For the infestation trend in green bolls, data in Tables 8 & 9 indicate that the maximum infestation ranged between 70-80% for transplanting & seed sowing during 1993 and 79-86 for 1994. This indicates higher level of infestation in 1994. The deviation trends of the combined infestation in squares, flowers and green bolls from the general average was decreasing negatively (-110.5 and -110) for (T) treatment during both 1993 and 1994 seasons and increasing positively (110.5 and 110) for (S) treatment during the same seasons. The statistical analysis revealed that there was no significant differences between (T) and (S) treatments ($T = 3.27$ and 2.38) during the two tested seasons of 1993 and 1994.

Studying the changes in the population density of cotton pests with regard to both planting dates and cultivation methods (transplanting and cotton sowing by seeds), the following remarks could be drawn:

The least infestation averages by pink and spiny bollworm insect pests occurred in the early cotton planting dates sown by transplanting of cotton seedlings, while cotton sown by seeds received the maximum rate of infestation for a long period.

From the above results, it may be concluded that in Delta region cotton plants cultivated by transplanting of seedlings are likely to receive minimum infestation levels, but although cotton sown by seeds received the maximum infestation levels, yet it produced in the mean time better yield weights, Table 1. If preventive control measures had to be applied against sap sucking insects in young plants (early season) sown during April, yet these measures seem necessary against both pink and spiny bollworm infestations in old plants of late plantations.

The high yield weights for cotton sown by seeds denoting relatively high in-

Table 8. Changes in infestation by bollworms in squares, flowers and green bolls in trans-planting and seed sowing cotton during 1995 at Kafr El-Sheikh Governorate.

Date of inspection	<i>Pectinophora gossypiella</i>						<i>Earias insulana</i>					
	Squares		Flowers		Green bolls		Squares		Flowers		Green bolls	
	T1	S	T1	S	T1	S	T1	S	T1	S	T1	S
19/6/1995	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0
3/7	1	0	0	0	0	3	5	10	0	5	5	14
10	1	0	1	2	2	5	8	14	7	14	12	18
17	2	1	2	3	2	8	9	16	9	17	14	25
24	3	2	2	5	4	8	11	18	11	15	20	35
31	5	2	5	4	6	10	13	20	14	15	24	39
7/8	6	3	6	7	8	13	14	22	19	19	33	44
14	8	6	4	6	10	12	19	15	22	20	37	48
21	10	15	2	5	17	18	22	17	23	23	41	50
28	5	12	1	3	20	25	24	11	25	26	48	61
4/9	4	8	1	5	33	30	18	14	10	25	50	68
11	3	5	0	6	34	36	3	11	12	16	58	74
18	0	0	0	0	37	41	0	0	0	0	66	79
25	0	0	0	0	46	56	0	0	0	0	72	81
Total	48	54	24	46	219	265	146	168	152	195	480	636

T value = 2.46 (insignificant)

T value = 3.27 (insignificant)

T1: first planting date (transplanted cotton)

T2: second planting date (transplanted cotton).

S.: cotton sowing by seeds.

Table 9. Changes in infestation by bollworms in squares, flowers and green bolls in transplanting and seed sowing cotton during 1994 at Beheira Governorate.

Date of inspection	<i>Pectinophora gossypiella</i>						<i>Earias insulana</i>						
	Squares		Flowers		Green bolls		Squares		Flowers		Green bolls		
	T	S	T	S	T	S	T	s	T	S	T	S	
22/6/1994	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0
6/7	2	4	0	0	1	4	5	10	0	0	6	16	
13	3	4	1	4	2	5	7	11	8	9	13	19	
20	4	5	2	4	2	7	11	19	10	11	16	28	
27	5	5	3	6	4	9	14	21	14	26	22	36	
3/8	7	8	5	7	5	11	18	25	19	21	27	40	
10	6	8	6	7	7	13	19	26	22	28	36	47	
17	11	12	5	8	7	14	21	22	26	30	40	51	
24	12	14	3	9	12	18	26	26	29	30	44	53	
31	7	8	1	5	15	26	24	19	25	29	51	63	
7/9	5	7	1	3	28	32	12	15	19	19	54	71	
14	3	5	0	2	35	36	10	12	15	17	61	77	
21	0	0	0	0	38	40	0	0	5	0	67	82	
28	0	0	0	0	44	57	0	0	0	0	79	86	
Total	65	80	27	55	200	272	167	206	192	220	516	669	

T value = 2.31 (insignificant)

T value = 2.38 (insignificant)

festation levels by main cotton insect pests could be explained in the light of:

1. The relatively big and well formed roots of cotton sown by seeds and its high efficiency in penetration the soil and consequently, strong and healthy cotton plants are obtained.

2. The ideal formation of large green bolls of cotton sown by seeds. The case for cotton transplanted by seedlings was the other way around, i.e. small sized green bolls and less number of fruiting parameters.

From the aforementioned results, it could be concluded that, our findings were in close agreement with the findings of Nobel (1969), Moawad (1974), Barania (1979), Salman *et al.* (1979), Soliman (1979), Galal and Abdel-Hamid (1980), Henneberry and Clyton (1982), Singh and Sidhu (1983), El-Zanan (1987), Kostandy (1990), Shaker *et al.* (1991), Abdalla (1991-1992) and El-Refai & Emam (1994).

Table 10. Deviation of total infestation by bollworms in transplanting and seed sowing from the general average at Gharbia, Kafr El-Sheikh and Beheira during 1993, 1994 and 1995.

Locality	Year		<i>Pectinophora gossypiella</i>			<i>Earias insulana</i>		
			T1	T2	S.	T1	T2	S.
Gharbia	1993	Total	239	345	446	160	201	245
		Mean		343.3			202	
		Deviation	-104.3	1.70	102.7	-24.0	-1.0	43
	1994	Total	304	393	520	210	275	385
		Mean		405.7			290	
		Deviation	-101.7	-12.7	114.3	-80	-15.0	95
	1995	Total	279	376	490	308	385	518
		Mean		381.7			403.7	
		Deviation	-102.7	-5.7	108.3	-95.7	-18.7	114.3
Kafr El Sheikh	1993	Total	327	461	557	298	384	456
		Mean		448.3			379.3	
		Deviation	-121.3	12.7	108.7	-81.3	4.7	76.7
	1994	Total	509	699	792	486	615	730
		Mean		666.7			610	
		Deviation	-157.7	32.3	1245.3	-124	5	120
	1995	Total	432	504	577	357	451	524
		Mean		504.3			444	
		Deviation	-72.3	-0.3	72.7	-87	7	80
Beheira	1993	Total	T		S.	T.		S.
		Mean	291		365	778		999
		Deviation	-37	328	37	-110.5	888.5	110.5
	1994	Total	292		407			
		Mean		349.5			985	
		Deviation	-57.5		57.5	-110		110

T1: First planting date (transplanted cotton).

T2: Second planting date (transplanted cotton).

S : cotton sowing by seeds.

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تأثير شتل ومواعيد زراعة القطن علي معدل الاصابة بديدان اللوزالقرنفلية والشوكية

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أجريت هذه الدراسة لمعرفة مدى تطور الإصابة بديدان اللوز القرنفلية والشوكية في كل من القطن الذي تمت زراعته بطريقة الشتل والقطن الذي زرع بطريقة البذرة (الطريقة العادية) وذلك خلال ثلاث مواسم متتالية لزراعة القطن (١٩٩٣ ، ١٩٩٤ ، ١٩٩٥) في محافظات الغربية وكفر الشيخ والبحيرة. ولتوضيح هذه العلاقة درست كل منطقة علي حده، وقدرت نسبة الإصابة بديدان اللوز القرنفلية والشوكية في كل من الوسواس والأزهار واللوز طوال فترة المواسم الثلاثة في المحافظات المذكورة. وقد بينت النتائج ارتفاع نسبة الإصابة بكل من دودة اللوز القرنفلية والشوكية في نباتات القطن المنزرعة بطريقة البذرة (الطريقة العادية) عنها في النباتات المزروعة بطريقة الشتل.