RESULTS AND DISCUSSION

IV. RESULTS AND DISCUSSION

IV.1. Effect of certain agricultural treatments on the infestation symptoms of maize plant with some main insect pests:

IV.1.1. Effect of planting date on the rate of infestation symptoms caused by corn borers:

The relation between planting date and the infestation of maize plant by insects in some cases of great importance as it might be possible, by choosing a suitable time of planting to obtain partial control against infestation. The present experiments were carried out at the Experimental Farm, Faculty of Agriculture, Moshtohor (Kalubia) Governorate during the two seasons of 1996 and 1997 to through some light on these points.

IV.1.1.a. Early spring plantation:

The first season 1996 (sown April 18th):

Data in Table (1) show that, damaged plants (perforated leaves and those with dead hearts) began to appear after 15 days of sowing (5 infested plants/100 plants) with the rate of infestation 5% on May, 2nd. The number of infested plants increased gradually to reach 9 plants/100 plants on May, 9th. Then increased sharply to reach a noticeable infestation (54 plants/100 plants) showing 54% as accumulative percentage of infestation on May, 16th. Such counts in numbers of damaged plants increased to 76 plants/100 plants (76% infestation) in the subsequent sample of May 23rd. The subsequent three samples show gradually increase in the rate of infestation. The maximum of infestation recorded on June 6th and 13th (98 and 97%, respectively). Then, the rate of infested plants

was 94% in subsequent two samples of June 20th and 27th. The remaining four samples did not show any increase in the rate of infestation. Also, data indicated that, the highest rate of infestation was recorded during the 1st and 2nd week of June, while the lowest rate of infestation was during the 1st and 2nd week of May.

The second season 1997 (sown April 21st):

The data of infested plants (Table, 1) reveal that damaged plants started to appear after 21 days of sowing (23 infested plants/100 plants) on May, 13th showing 23% as accumulative percentage of infestation. The percentage of infestation increased by 15% (38 infested plants/100 plants) in the subsequent sample of May 20th. Then, the number of damaged plants increased gradually to reach its maximum damage (37/50 plants) on June, 24th showing 74% as accumulative percentage of infestation. There was more increase in the rate of infestation in the remaining inspections. It could be concluded that the highest number of damaged plants was observed on the 4th week of June while the lowest were recorded on the 2nd week of May.

It could be also, observed from Table (1), the total infestation by the three corn borers together was generally higher in 1996 than 1997 where the overall averages of infestation were 74.2% and 50.6% during 1996 and 1997 seasons, respectively.

IV.1.1.b. Recommended plantation:

In both seasons, damaged plants caused by corn borers began to appear 21 days after sowing and continued very low in the

subsequent samples. But in the first season 1996 (sown May 20th), the rate of infestation increased at the end of the season until reaching highest accumulative percentage of infestation (16% on August, 29th). While, in the second season 1997 (sown May 21st), the sample of inspected plants did not show any increase in the rate of infestation which remained unchanged until harvest (Table, 1).

Data in Table (1) also, indicated that the overall number of infested plants was higher in 1996 (40 plants) than 1997 (30 plants).

IV.1.1.c. Early summer cultivation:

The first season 1996 (sown June 17th):

Damaged plants caused by corn borers began to appear after 15 days of sowing on July, 4th with rate of infestation 2% (two plants/100 plants). The number of infested plants started very low and increased successively in the two subsequent samples until reached a highest accumulative number (18 infested plants/100 plants) on July, 18th, showing 18% as accumulative percentage of infestation by an increase 1% infestation than the previous inspection. Counts in number of infested plants was 8 plants/100 plants (8%) in the subsequent sample of July 25th (Table, 1). From the same data there was slight differences in infestation rate appeared between the remaining samples until harvest.

The second season 1997 (sown June 23rd):

Damage to maize plants started on July, 8th (3 infested plants/100 plants) with a rate of infestation 3%. Then the percentage of infestation increased by 5% than the previous inspection in the

Table (1): Accumulative rates of infestation caused by corn borers on corn plants throught 1996 and 1997 seasons.

Planting dates	Season 1996								
	First plantation sown April 18th			Second plantation sown May 20th			Third plantation sown June 17th		
Date of inspection	No. of inspected plants	No. of infested plants	Infestation %	No. of inspected plants	No. of infested plants	Infestation %	No. of inspected plants	No. of infested plants	Infestation %
May 2nd	100	5	5						
9th	100	9	9						
16th	100	54	54						
23rd	100	76	76						
30th	100	91	91						
June 6th	100	98	98	100	0	0			
13th	100	97	97	100	3	3			
20th	50	47	94	100	4	4			
27th	50	47	94	100	5	5			
July 4th	50	46	92	100	3	3	100	2	2
11th	50	45	90	100	6	6	100	17	17
18th	25	20	80	100	6	6	100	18	18
25th	25	21	84	50	2	4	100	8	8
August 1st				50	1	2	100	11	11
8th				50	1	2	100	11	11
15th				50	2	4	100	13	13
22nd				25	1	4	50	7	14
29th				25	4	16	50	5	10
September 5th				25	2	8	50	5	10
12th							50	5	10
19th							25	3	12
26th							25	4	16
October 3rd							25	2	8
Averages		50.5	74.2		2.9	4.8		7.9	11.4
Mean no. of infested plants/ one replicate		131.2			8.0			22.2	

L.S.D. at 5% = 14.07

Planting dates	Season 1997								
	First plantation sown April 21st			Second plantation sown May 21st			Third plantation sown June 23rd		
Date of inspection	No. of inspected plants	No. of infested plants	Infestation %	No. of inspected plants	No. of infested plants	Infestation %	No. of inspected plants	No. of infested plants	Infestation %
May 6th	100	0	0						
13th	100	23	23						
20th	100	38	38						
27th	100	57	57						
June 3rd	100	58	58						
10th	100	59	59	100	0	0			
17th	100	66	66	100	5	5			
24th	50	37	74	100	4	4			
July 1st	50	32	64	100	3	3			
8th	50	32	64	100	4	4	100	3	3
15th	50	26	52	100	2	2	100	8	8
22nd	25	12	48	100	4	3	100	8	8
29th	25	13	52	50	1	2	100	10	10
August 5th	25	13	52	50	1	2	100	6	6
12th	25	13	52	50	2	4	100	7	7
19th				50	1	2	100	12	12
26th				25	1	4	50	4	8
September 2nd				25	1	4	50	3	6
9th				25	1	4	50	6	12
16th							50	8	16
23rd							25	5	20
30th							25	7	28
October 7th							25	6	24
Averages		31.9	50.6		2.1	3.1		6.6	12.0
Mean no. of infested plants/ one replicate		95.8			6.0			18.6	

L.S.D. at 5% = 8.27

subsequent two samples of July, 15th and 22nd respectively, then increased to 10% (10 infested plants/100 plants) on July 29th. The highest rate of infestation by corn borers was recorded during September, the highest peak of infestation was 28% on September, 30th. It also, obvious that in the two seasons there were no differences in the level of overall mean of infestation by corn borers (11.4% and 12% during 1996 and 1997, respectively).

From the mentioned two years data, it could be deduced that on the third plantation, infestation to maize plants by *Sesamia cretica* started, approximately, two or three weeks after plantation.

The infestation of maize plants by the three corn borers was higher in 1996 than 1997, showing an increase in number of infested plants with subsequently increasing in the rate of infestation(Table, 1).

Also, it could noticed from the same table that the rates of infestation to maize plants with corn borers in the two successive seasons was the highest in first plantation (74.2% and 50.6% during 1996 and 1997, respectively) while the plants of second plantation (sown May) received the lowest rate of infestation (4.8% and 3.1%, during 1996 & 1997 respectively). These results are agreement with those obtained by Willcocks (1925), who found that the very early sowing maize suffers heavy attacks by *S. cretica*, Ahmed and Kira (1960) who reported that April plantation received the greater number of *S. cretica* egg-masses. Similar results had also been found by Abul-Nasr *et al.* (1968), Ismail *et al.* (1974), Metwally

(1976) and Mostafa (1981). In this respect, Chaudhary and Sharma (1990) found that, maximum infestation by *Chilo partellus* on maize was recorded in the crop sown on 16th April. Abd el-rhim *et al.* (1991) found that maize plants of mid-May sowing were subjected to the least infestation by *S. cretica* while those sown during April harboured the highest infestation.

From the foregoing data, there was significant differences between all plantation under study in 1996. Generally, the first plantation was the most infested followed by the third plantation and finally the second plantation which received the lowest infestation. Also, statistical analysis of data clarified that there was high significant difference between first plantation and both second and third plantation, while, in 1997 there was high significant difference between all plantations. The plants of the first plantation as the same in 1996 were the most infested followed by the plants of third and second plantations respectively.

IV.1.2. Effect of planting date on rate of infestation with aphids and number of their predators:

Rhopalosiphum maidis Fitch. was found the dominant aphid species that infested maize plants throughout 1996 and 1997. In the first season (1996), colonies of aphids were not encountred on maize plants before the appearance of tassels in second plantation, while in the first and third plantation colonies of aphids were counted after 15 days of sowing.

Survey and counts of aphidivorous insects in maize fields were made by direct examination of both leaf surfaces and under the leaf sheath of each sample. Five predator species were concerned in this study one Neuropterous, *Chrysoperla carnea* Steph. (Chrysopidae), and four Coleopterous *Peaderus alfierii* Kich. (Staphylinidae), *Scymnus sp.* (*intrruptus* Goeza and *syriacus* Mars), ladybird beetls *Coccinella undecimpunctata*, *C. septempunctata*, *Cydonia vicina* var *nilotica* Muls and *Cydonia vicina* var *isis* Muls.

Number of the counted aphids and its predators on each plantation were recorded. The recorded data of weekly rate of infestation by aphids are summarized in Table (2) while counts of both aphids and predators are tabulated in Table (3) as follows:

IV.1.2.a. Early spring plantation:

In 1996 and 1997 seasons data tabulated in Table (2) show that maize sown in (April 18th and April 21st respectively) was not infested with aphids until harvesting time. As for aphidivorous insects in 1996 season, the highest number of predators was 15 individuals/10 plants (14 Staphylinidae and one Coccinellidae) occurred on July 4th. While in 1997 the highest abundance was 18 individuals/10 plants (11 Staphylinidae, one Chrysopidae and 6 Coccinellidae) recorded on June 17th Table (3).

IV.1.2.b. Recommended plantation:

In 1996 season, the highest abundance of aphids found on maize plants was 7075 individuals plant on August 8th with

100% rate of infestation. After that,the population decreased sharply during the remaining weeks until harvest. While the highest number of predators was 115 individuals/10 plants (one staphylinidae and 114 coccinellidae) was recorded in the subsequent week for highest abundance of aphids (mid-August). In the subsequent season (1997), the aphids activity started on July 29th, 0.1 aphid/one plant with a rate of infestation 4%. Two peaks of aphids were noticed, the first peak was on August 12th (5 individuals/one plant) and the other was on September 9th (14.9 individuals/one plant). During this season three peaks of predators were recorded. The first peak of predators (5 individuals/10 plants) occurred on mid-July, while the 2nd peak was recorded (9 individuals/10 plants) on August 5th preceded the first peak of aphids by one week. On the other hand, the third peak was coincidence with the second peak of aphids (September 9th).

From the data of the two years Table (2) it could be concluded that infestation to maize plants by aphids was very higher in 1996 than 1997, where the overall means of infestation were 82.5% and 4.6% during 1996 and 1997, respectively.

It could be also, concluded that number of aphids on maize plants was higher in 1996 than 1997 where the overall means were 1490.9 and 2.01 individuals in 1996 and 1997, respectively. Also, number of predators was very higher in 1996 than 1997 where the counts were 27.8 and 4.0 individuals/10 plants as overall means in 1996 and 1997, respectively (Table, 3).

Table (2): Rate of infestation caused by aphids on 25 corn plants throughout 1996 and 1997 seasons.

Season 1996								Season 1997							
Planting dates		First plantation sown April 18th		Second plantation sown May 20th		Third plantation sown June 17th		Planting dates		First plantation sown April 21st		Second plantation sown May 21st		Third plantation sown June 23rd	
Date of inspection		No. of infested plants	Infest-ation %	No. of infested plants	Infest-ation %	No. of infested plants	Infest-ation %	Date of inspection		No. of infested plants	Infest-ation %	No. of infested plants	Infest-ation %	No. of infested plants	Infest-ation %
May	2nd	0.0	0.0					May	6th	0.0	0.0				
	9th	0.0	0.0						13th	0.0	0.0				
	16th	0.0	0.0						20th	0.0	0.0				
	23rd	0.0	0.0						27th	0.0	0.0				
	30th	0.0	0.0					June	3rd	0.0	0.0				
June	6th	0.0	0.0						10th	0.0	0.0	0.0	0.0		
	13th	0.0	0.0						17th	0.0	0.0	0.0	0.0		
	20th	0.0	0.0						24th	0.0	0.0	0.0	0.0		
	27th	0.0	0.0					July	1st	0.0	0.0	0.0	0.0		
July	4th	0.0	0.0						8th	0.0	0.0	0.0	0.0	0.0	0.0
	11th	0.0	0.0						15th	0.0	0.0	0.0	0.0	0.0	0.0
	18th	0.0	0.0	7	28	0	0		22nd	0.0	0.0	0.0	0.0	0.0	0.0
	25th	0.0	0.0	20	80	6	24		29th	0.0	0.0	1.0	4.0	0.0	0.0
August	1st			25	100	11	44	August	5th	0.0	0.0	3.0	12.0	1.0	4.0
	8th			24	96	21	84		12th	0.0	0.0	1.0	4.0	7.0	28.0
	15th			25	100	25	100		19th			0.0	0.0	20.0	80.0
	22nd			21	84	10	40		26th			3.0	12.0	22.0	88.0
	29th			23	92	19	76	September	2nd			5.0	20.0	20.0	80.0
September	5th			20	80	7	28		9th			3.0	12.0	11.0	44.0
	12th					11	44		16th					12.0	48.0
	19th					10	40		23rd					13.0	52.0
	26th					0	0		30th					13.0	52.0
October	3rd					0	0	October	7th					9.0	36.0
Averages		0.0	0.0	20.6	82.5	10.0	40.0	Averages		0.0	0.0	1.1	4.6	9.1	36.6
Mean no.of infested plants/one replicate		Zero		33		24		Mean no.of infested plants/one replicate		Zero		3.2		25.6	

L.S.D. at 5% = 4.26

L.S.D. at 5% = 1.87

Table (3): Number of aphids and their predators on inspected corn plants during 1996 and 1997 seasons.

Planting dates		Season 1996						Planting dates		Season 1997					
		First plantation sown April 18th		Second plantation sown May 20th		Third plantation sown June 17th				First plantation sown April 21st		Second plantation sown May 21st		Third plantation sown June 23rd	
Date of inspection		No. of aphids/ one plant	No. of predators/ 10 plants	No. of aphids/ one plant	No. of predators/ 10 plants	No. of aphids/ one plant	No. of predators/ 10 plants	Date of inspection		No. of aphids/ one plant	No. of predators/ 10 plants	No. of aphids/ one plant	No. of predators/ 10 plants	No. of aphids/ one plant	No. of predators/ 10 plants
May	2nd	0.0	-					May	6th	0.0	0.0				
	9th	0.0	-						13th	0.0	0.0				
	16th	0.0	-						20th	0.0	1.0				
	23rd	0.0	-						27th	0.0	9.0				
	30th	0.0	-					June	3rd	0.0	10.0				
June	6th	0.0	-						10th	0.0	14.0	0.0	0.0		
	13th	0.0	-						17th	0.0	18.0	0.0	0.0		
	20th	0.0	-						24th	0.0	12.0	0.0	1.0		
	27th	0.0	11					July	1st	0.0	13.0	0.0	2.0		
July	4th	0.0	15						8th	0.0	14.0	0.0	3.0	0.0	0.0
	11th	0.0	4						15th	0.0	12.0	0.0	5.0	0.0	0.0
	18th	0.0	6	285	3	0	0		22nd	0.0	16.0	0.0	4.0	0.0	0.0
	25th	0.0	8	639	1	0	1		29th	0.0	12.0	0.1	1.0	0.0	0.0
August	1st			1410	7	43	3	August	5th	0.0	8.0	0.1	9.0	0.0	1.0
	8th			7075	5	89	3		12th	0.0	0.0	5.0	8.0	0.2	2.0
	15th			2354	115	3551	22		19th			1.0	3.0	39.5	1.0
	22nd			30	37	7	16		26th			4.0	6.0	725.5	4.0
	29th			82	26	39	14	September	2nd			3.0	6.0	485.1	13.0
September	5th			52	28	9	14		9th			14.9	8.0	43.9	8.0
	12th					45	17		16th					5.4	6.0
	19th					13	27		23rd					28.0	10.0
	26th					0	26		30th					52.8	11.0
October	3rd					0	21	October	7th					36.2	15.0
Overall		0.0	44.0	11957.0	222.0	3796.0	164.0	Overall		0.0	139.0	28.1	56.0	1416.6	71.0
Averages		0.0	8.8	1490.9	27.8	316.3	13.7	Averages		0.0	9.3	2.01	4.0	101.2	5.1
Mean no.of infested plants/one replicate		0.0		2385.4		759.2		Mean no.of infested plants/one replicate		0.0		5.6		283.3	

L.S.D. at 5% = 6.09

L.S.D. at 5% = 5.98

IV.1.2.c. Early summer plantation:

In 1996 aphids activity began on 1st August (43 individuals/one plant) then number of aphids increased and reached the highest abundance on August 15th (3551/one plant) a maximum rate of infestation 100%. The highest abundance of predators was 27 individuals/10 plants (2 Staphylinidae, 5 Chrysopidae and 20 Coccinellidae) occurred on September 19th (Table, 3).

Three peaks of aphids were estimated on maize plants of the early summer plantation, the first peak was on August 15th (3551 aphid/one plant), while the second and third peak were on August 29th and September 12th (39 & 45 individuals of aphids, respectively. On the other hand, only two peaks of aphidivorious insects were recorded on August 15th (22 predators/10 plant) and on September 19th (27/10 plants), the first peak of predators is coinicident with the first peak of aphids, while the second peak of entomophagous insects occurred in the subsequent week of the third peak of aphids.

In 1997, aphids could be noticed on August 12th 0.2 individuals/one plant. Then the number of aphids increased sharply to reach its highest abundance during the fourth week of August (725.5 individuals/one plant), with a rate of infestation reached to 88% (the highest infestation during this season) then the number of aphids decreased sharply again. Two peaks of both aphids and their predators were recorded. The two peaks of aphid were on August 26th (725.5 individuals) and on September 30th (52.8 individuals)

and these peaks preceded the two peaks of predators (13 & 15 predators/10 plants) by one week.

These results show that the highest infestation to maize plants sown in the third planting date occurred during August. Aphids abundance was higher in 1996 than 1997, where overall mean was 316.3 and 101.2/one plant in 1996 and 1997, respectively.

Generally, it could be observed from Table (2 & 3) that infestation to maize plants by aphids in 1996 was higher than 1997. Also, in 1996 season, the rate of infestation and number of aphids were higher in recommended plantation than early summer plantation, while in 1997 percentage of infestation and number of aphids were higher in early summer plantation than recomended plantation.

Generally, it could be concluded that *R. maidis* started to attack corn plants after mid-July and continued until the harvesting time and the highest population of aphids was recorded during August month. Aphid population and, subsequently, rate of infestation were affected by planting date and climatic factors from season to another. In this respect, El-Hariry (1979) found that maize planting date effect on the level of aphid infestation. On the other hand, Archer *et al.* (1990) and Atiyeh *et al.* (1996) reported that aphid population was not affected by planting date.

From the foregoing data in Table (2) there was high significant differences between all plantating dates under study in

Table (4): Correlation between mean percentage of infestation with the three corn borers and aphids and maize yield per feddan in different planting dates during 1996 and 1997 seasons.

Date of Plantation	Season 1996			Season 1997			Mean of yield Ardab/fed. For the two seasons
	Infestation %		Yield Ardab/ feddan	Infestation %		Yield Ardab/ feddan	
	Corn borers	Aphids		Corn borers	Aphids		
First plantation (April)	74.2	0.0	-	50.6	0.0	14.00	14.00
Second plantation (May)	4.8	82.5	20.7	3.1	4.6	18.65	19.57
Third plantation (June)	11.4	40.0	23.4	12.0	36.6	16.65	20.03

1997 L.S.D. at 5% = 1.9.

Ostrinia nubilalis Hubn.) and yielded more than any other plantation and the differences in yield between early and late plantations in the absence of serious borer infestation may be attributed to the complex of the prevailing weather conditions.

IV.2. Effect of fertilizer levels on rate of damage caused by some major insect pests attacking maize plants with special reference to number of their predators in the corn fields:

Application of ammonium nitrate as nitrogen fertilizer, might affect the infestation of maize plant with insects and their natural enemies, either by its influence on the seedling making them more attractive to insects or by its effect on the texture of leaves where the insects mostly survived.

An experiment was carried out in 1996 and repeated in 1997, in which the infestation of maize with corn borers and aphids was compared with three adjacent fields which received almost similar cultural practices throughout the two seasons but varried only in the quantity of ammonium nitrate, as nitrogen fertilizer (388, 298 and 208 kg/feddan).

IV.2.1. Effect of fertilization levels on rate of infestation caused by corn borers:

Data presented in Table (5) show the number of infested plants and infestation percentages with corn borers on the tested maize plants sown in May and fertilized by three nitrogen levels during 1996 and 1997 seasons. Results showed that damaged plants began to appear, approximately, after 21 days of sowing. The

highest rate of infestation caused by the three corn borers was recorded during August with all three nitrogen levels and control.

The first season (1996):

Data demonstrated in Table (5) showed that the damaged plants began to appear in the plantations with three fertilizer levels (388, 298 and 208kg/f.) on June 13th (4, 3 and 4 infested plants/100 plants, respectively), then increased to reach the first peak of damage on June, 20th showing 6, 3 and 5% as comulative rate of infestation. On the contrary, damaged plants began to appear in untreated plots on June, 20th (3 infested plants/100 plants).

Results in Table (5) also, revealed that the tested maize plants did not exhibit substantial variation as infested by corn borers when applied with the two higher doses of nitrogen fertilizer (388 and 298 kg/fed.), showing 3.3 and 3.4% as overall mean percentages of infestation. But infestation rate of the concerned maize plants by borers are markedly affected by the level of nitrogen fertilization 208 kg/fed., showing 5.4% as overall mean percentage of infestation. This means that an increase in the rate of nitrogen fertilizer not necessarily followed by increase in the infestation with stem insect borers.

These results agree with there obtained by Farag *et al.* (1991) who found that the infestation to maize plants by *S. cretica* was not affected by increasing the rate of nitrogen fertilizer, while the present results are in disagreement with those obtained by Metwally (1988) who mentioned that the degree of maize infestation by *S.*

cretica increased by increasing of nitrogen fertilizer. Also, Nawar *et al.* (1992) indicated that increasing nitrogen level to 120 kg/fed. caused a significant increase in infestation rate with corn borers.

Statistical analysis of data obtained in this respect clarified that the relation between infestation rates to maize by borers and N fertilizer application was significant at the level of 70 N units (208 kg/fed.), while insignificant at the two other levels of nitrogen fertilization (388 & 298 kg/fed.) and zero fertilization.

The second season (1997):

As mentioned before, the influence of the different levels of nitrogen fertilizer on the damage caused by corn borers are summarized in Table (5). It appears from the obtained results that the tested maize plants supplied with different nitrogen levels insignificantly responded to borers infestation.

The highest percentage of infested plants (5.2% as overall mean) received 388 kg N fertilizer/fed., while this percentage decreased to 3.6 and 4.1% in the case of both 298 and 208 kg/fed. levels, respectively. The lowest rate of infestation (3.3%) was of those did not receive any amount of N fertilization (zero fertilization).

Therefore, it could be concluded that application with different nitrogenous fertilization rates showed insignificant effects on maize plants infestation by corn borers. Similar results were reported by Metwally (1988) who found that nitrogen fertilizer did not increase the infestation rates to maize plants by *O. nubilalis*.

Table (5): Accumulative rate of infestation caused by corn borers on corn plants as affected by nitrogen fertilizer levels during 1996 and 1997 seasons.

	Season 1996									Season 1997							
N level kg/fed.	388 kg N/fed.		298 kg N/fed.		208 kg N/fed.		Control		N level kg/fed.	388 kg N/fed.		298 kg N/fed.		208 kg N/fed.		Control	
Date Of Inspection	No. of infested plants	Infest-ation %	No. of infested plants	Infest-ation %	No. of infested plants	Infest-ation %	No. of infested plants	Infest-ation %	Date Of Inspection	No. of infested plants	Infest-ation %	No. of infested plants	Infest-ation %	No. of infested plants	Infest-ation %	No. of infested plants	Infest-ation %
June 6th *	0	0	0	0	0	0	0	0	June 7th*	0	0	0	0	0	0	0	0
13th	4	4	3	3	4	4	0	0	14th	5	5	4	4	5	5	1	1
20th	6	6	3	3	5	5	3	3	21st	4	4	4	4	4	4	3	3
27th	2	2	3	3	8	8	2	2	28th	2	2	3	3	3	3	2	2
July 4th	2	2	4	4	6	6	1	1	July 5th	3	3	6	6	4	4	3	3
11th	1	1	3	3	4	4	1	1	12th	8	8	4	4	8	8	3	3
18th	1	1	3	3	9	9	1	1	19th	7	7	3	3	8	8	4	4
25th**	1	2	1	2	4	8	1	2	26th**	6	12	2	4	2	4	2	4
August 1st	1	2	2	4	2	4	1	2	August 2nd	3	6	2	4	2	4	3	6
8th	1	2	1	2	2	4	1	2	9th	4	8	1	2	2	4	2	4
15th	2	4	2	4	4	8	1	2	16th	3	6	2	4	1	2	2	4
22nd***	2	8	2	8	2	8	1	4	23rd***	1	4	1	4	1	4	1	4
29th	2	8	1	4	1	4	1	4	30th	1	4	1	4	1	4	1	4
September 5th	1	4	1	4	1	4	0	0	September 6th	1	4	1	4	1	4	1	4
Average	1.9	3.3	2.1	3.4	3.7	5.4	1.0	1.7	Average	3.4	5.2	2.4	3.6	3.0	4.1	2.0	3.3
Mean no. of infested plants/ one replicate	5.2		5.8		10.4		2.8		Mean no. of infested plants/ one replicate	9.6		6.8		8.4		5.6	

* Inspection on 100 plants. L.S.D. at 5% = 3.75

** Inspection on 50 plants.

*** Inspection on 25 plants.

IV.2.2. Effect of nitrogen fertilizer levels on number of predators in the corn fields:

Data illustrated in Table (6) cleared number of predaceous insects on corn plants as affected by different nitrogen levels during the two seasons.

IV.2.2.1. Fertilizer level 130 units/fed. (388 kg N/fed.):

IV.2.2.1.a. The rove-beetle: *Peaderus alfierii* Koch):

In 1996 this predator covered most of the growing period of corn plants in the field. It began to appear on maize plants on June, 27th (11 adults/25 plants) and continued until harvest time. Two peaks of predators were recorded, the first peak (37 adults/100 plants) on July 4th and the 2nd peak was observed on August, 29th (15 adults/100 plants). While, in 1997 the predator began to appear on maize plants after one month of sowing (June, 21st) 12 predators/100 plants. Then increased in number throughout the subsequent four inspections to reach its maximum 30 adults/100 plants (first peak) on July, 11th.

Also, other two peaks of this predator were recorded on August, 8th and 29th, showing 8/50 plants and 10/25 plants, respectively.

From the aforementioned data in Table (6) it could be concluded that the highest number of *P. alfierii* was recorded during July in the two seasons. *P. alfierii* population was higher in 1997 than 1996 season showing 168 and 138 adults as overall mean, respectively.

IV.2.2.1.b. Aphid lion: (*Chrysoperla carnea* Stephens):

In 1996, these predators (adults) were observed with few number in the late season. Highest counts of 4 adults/25 plants were detected in the last inspection on September 5th. On the other hand, in 1997, also, the same predator appeared with few number during August. Highest count: 3 adults/25 plants was detected on August, 22nd.

IV.2.2.1.c. Ladybird beetles:

In 1996, this group of predators began to appear on maize plants on June, 27th (two individuals/100 plants). highest counts of coccinellidae were detected on August, 15th (385 individuals/50 plants). In 1997, Coccinellid... individuals started to appear in corn fields after 21 days from sowing (8 individuals/100 plants) on June, 13th and continued till the end of the season. Throughout this period, highest abundance of ladybird beetles (40 individuals/50 plants) was observed on August, 1st.

IV.2.2.2. Fertilizer level 100 units/fed. (298 kg/fed.):

IV.2.2.2.a. The rove-beetle (*Peaderus alfierii* Koch):

In 1996, adults of *P. alfierii* started to appear on June, 27th (6 individuals/100 plants). In this season, two peaks of adults occurred on July, 4th and September, 5th when 37 and 24 adults were counted/100 plants and 25 plants, respectively (Table, 6). While, in the subsequent season (1997), adults of *P. alfierii* started to appear with the 2nd sample on June, 13th (2 adults/100 plants). The predator was observed from June, 13th till September, 5th showing its highest number (23 adults) on July, 4th.

IV.2.2.2.b. Aphid lion (*Chrysoperla carnea*):

This predator was found in very few numbers throughout the two seasons in this level of fertilization as total number of 12 and 3 individuals were counted throughout the whole season 1996 and 1997, respectively.

IV.2.2.2.c. Ladybird beetles:

In 1996, this group of predators was observed throughout a period extended from June, 27th until the end of the season. Highest counts of predators were detected on mid-August 543 individuals/50 plants. In 1997 season, the predators appeared on maize plants after 21 days of sowing on June, 13th. In this season, two peaks of abundance of Coccinellidae were recorded. The first peak occurred on July 11th (20 individuals/100 plants), the other occurred on August 8th (34 individuals on 50 plants).

IV.2.2.3. Fertilizer level 70 units/fed. (208 kg/fed.):

IV.2.2.3.a. The rove-beetle (*Peaderus alfierii*):

Data in Table (6) indicated that in 1996, the first appearance of these predators was detected on June 27th (12 adults/100 plants) and its highest abundance occurred on July 4th (35 adults/100 plants). On the other hand, in 1997 the same predator appeared after one month of sowing (one adult/100 plants) on June, 20th. Two peaks were recorded, the first one occurred on July, 11th (32 adults/100 plants), while the second recorded on August, 1st (12 adults/50 plants).

Table (6): Number of predaceous insects on corn plants as affected by nitrogen levels during 1996 and 1997 seasons

Nitrogen fertilizer level	388 kg N/fed.				298 kg N/fed				208 kg N/fed.				Control			
Date of inspection	Staphylinidae	Chrysopidae	Coccinellidae	Total no.	Staphylinidae	Chrysopidae	Coccinellidae	Total no.	Staphylinidae	Chrysopidae	Coccinellidae	Total no.	Staphylinidae	Chrysopidae	Coccinellidae	Total no.
	Season 1996															
June 6th	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13th	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20th	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27th	11	0	2	13	6	0	8	14	12	0	18	30	6	0	8	14
July 4th	37	0	0	37	37	0	3	40	35	0	5	40	15	1	3	19
11th	23	0	3	26	36	1	2	39	33	0	7	40	2	0	3	5
18th	7	0	0	7	14	1	4	19	10	0	1	11	8	0	2	10
25th **	7	0	7	14	6	0	1	7	3	1	7	11	17	0	1	18
August 1st	2	0	39	41	4	1	30	35	2	0	16	18	6	0	2	8
8th	6	0	74	80	3	0	120	123	5	0	39	44	2	0	9	11
15th	5	0	385	390	4	0	543	547	7	0	197	204	3	0	47	50
22nd ***	10	2	98	110	10	0	107	117	11	4	59	74	3	0	33	36
29th	15	0	19	34	14	4	33	51	11	0	22	33	13	1	16	30
September 5th	15	4	34	53	24	5	53	82	10	0	23	43	20	0	19	39
Overall	138	6	661	805	158	12	904	1074	139	5	394	548	95	2	143	240
Mean	9.9	0.4	47.2	57.5	11.3	0.9	64.6	76.7	9.9	0.4	28.1	39.1	6.8	0.1	10.2	17.1

Table (6): Cont.

Nitrogen fertilizer level	388 kg N/fed.				298 kg N/fed				208 kg N/fed.				Control			
Date of inspection	Staphylinidae	Chrysopidae	Coccinellidae	Total no.	Staphylinidae	Chrysopidae	Coccinellidae	Total no.	Staphylinidae	Chrysopidae	Coccinellidae	Total no.	Staphylinidae	Chrysopidae	Coccinellidae	Total no.
	Season 1997															
June 6th	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13th	0	0	8	8	2	0	1	3	0	0	0	0	2	0	2	4
20th	12	0	2	14	0	1	4	5	1	0	3	4	6	0	8	14
27th	15	0	11	26	8	0	5	13	17	1	14	32	11	0	11	22
July 4th	28	0	25	53	23	0	19	42	21	0	16	37	14	0	10	24
11th	30	0	18	48	20	0	20	40	32	0	12	44	7	0	12	19
18th	30	0	12	42	19	0	18	37	16	0	10	26	5	0	16	21
25th **	14	0	4	18	3	1	7	21	3	0	4	7	2	0	0	2
August 1st	7	0	40	47	10	0	26	36	12	0	56	68	4	0	3	7
8th	8	1	28	37	4	0	34	38	10	0	44	54	9	0	5	14
15th	3	1	14	18	8	0	14	22	3	0	10	13	3	0	4	7
22nd ***	5	3	7	15	4	0	7	12	6	0	11	17	0	0	4	4
29th	10	1	7	18	9	1	7	17	4	0	18	22	3	0	4	7
September 5th	6	0	11	17	5	0	10	15	3	0	13	16	4	0	8	12
Overall	168	6	187	351	115	3	172	301	128	1	211	340	70	0	87	157
Mean	12	0.4	13.4	25.1	8.2	0.2	12.3	21.5	9.1	0.1	15.1	24.3	5.0	0	6.2	11.3

* No. of inspected plants 100 plants. ** No. of inspected plants 50 plants. *** No. of inspected plants 25 plants.

IV.2.2.3.b. Aphid lion: (*Chrysoperla carnea*):

Weekly counts of *Ch. carnea* on maize plants throughout either of the two seasons of study were much fewer than those recorded in case of *P. alfierii* (Table, 6). The total counts of aphid lion during the first season, 1996 were only 5 adults. While, in 1997, only one predator appeared during the whole season.

IV.2.2.3.c. Ladybrid beetles:

In 1996, the predators belonging to this group were found in higher abundance than the previous species (Table, 6), these predators began to appear on June, 27th (18 individuals/100 plants). Highest abundance of predators was 197 individuals/50 plants on mid-August. While, in 1997, the predators were observed from June, 20th (3 individuals/100 plants) till September, 5th (13/25 plants). The highest abundance of these predators was 56 individuals/50 plants on August 1st. Three peaks of predator were recorded, the first 16 individuals/100 plants on July 4th, the 2nd peak (56 individuals/50 plants) on August 1st and the third (18 individuals/25 plants) on August 29th.

IV.2.2.4. Predators' abundance in the unfertilized treatment:

IV.2.2.4.a. The rove-beetle: (*Peaderus alfierii*):

In 1996 season, the adults of this predator began to appear on June, 27th (6 adults/100 plants). Three peaks of abundance were recorded, the first on July, 4th (15 adults/100 plants), the second on July, 25th (17 adults/50 plants) and the third peak (20 adults/25 plants) occurred in the last inspection. In the second season 1997, the predator appeared after 21 days of sowing (2 adults/100 plants).

Only two peaks of 14 adults/100 plants and 9/50 plants occurred on July, 4th and on August, 8th, respectively.

IV.2.2.4.b. Aphid lion: (*Chrysoperla carnea*):

In 1996, only two individuals were recorded throughout the whole season. While, in the subsequent season the predator had not been observed at all on maize plants.

IV.2.2.4.c. Ladybird beetles:

Results summarized in Table (6) showed that in 1996, this group of predators were first observed on maize plants on June, 27th (8 individuals/100 plants). The highest counts of these predators (47 individuals/50 plants) occurred on mid-August. While in the subsequent season, the predators were first detected on June, 13th (two individuals/100 plants). The highest count was recorded on July, 18th (16 individuals/100 plants).

It may be concluded that total numbers of these predators recorded on maize plants (fertilized with three levels of nitrogen (388, 298 and 208 kg N/fed.) were 805, 1074 & 548 and 351, 301 & 340 predators during the two seasons, respectively, being higher than those recorded on unfertilized maize plants (240 and 157 individual of predators, during the two seasons, respectively). This may be due to the higher population of predator which is associated with high content of leaf nitrogen. These results agree with Schmidt (1991) who found that higher abundance of the parasitoid (*Plutella xylostella* and higher rates of its parasitism on *Brassica oleracea* was associated with total leaf nitrogen.

The aforementioned three groups of predators can be arranged descending order, according to their abundance on maize plants, in the following groups:

Group (1): Highest abundance - Ladybird beetles.

Group (2): Relatively high abundance – the rove-beetle.

Group (3): Lowest abundance – Aphid lion.

IV.2.3. Effect of nitrogen fertilizer levels on rate of infestation by the aphid *R. maidis* and number of its predators:

The effect of the different levels of nitrogen fertilizer on infestation rate of maize plants, caused by aphids are indicated in Table (7). While their influence on the numbers of *R. maidis* and its predators, are summarized in Table (8).

IV.2.3.1. Season 1996:

In 1996, the highest abundances of aphids on maize were 2947, 8907, 5920 individuals/one plant with rate of infestation 100% with all nitrogen levels 388, 298, 208 kg N/fed., respectively, recorded on August, 8th. While in control, the highest abundance (233 individuals/one plant and 100% infestation) occurred on August 15th, then number of aphids decreased sharply in the subsequent samples until harvest. While, the highest abundance of predators was 78, 110, 41 and 18 individuals/10 plants, respectively recorded in the subsequent week of the highest number of aphid, this may be due to entomophagous insects may respond to increased pery to increase density by increasing their own number (Huffaker *et al.*, 1971).

Table (7): Rate of infestation caused by aphids on corn plants as affected by nitrogen level during 1996 and 1997 seasons.

	Season 1996									Season 1997							
N level kg/fed.	388 kg N/fed.		298 kg N/fed.		208 kg N/fed.		Control		N level kg/fed.	388 kg N/fed.		298 kg N/fed.		208 kg N/fed.		Control	
Date Of Inspection	No. of infested plants	Infest-ation %	No. of infested plants	Infest-ation %	No. of infested plants	Infest-ation %	No. of infested plants	Infest-ation %	Date Of Inspection	No. of infested plants	Infest-ation %	No. of infested plants	Infest-ation %	No. of infested plants	Infest-ation %	No. of infested plants	Infest-ation %
	-	-	-	-	-	-	-	-	June 7th*	0	0	0	0	0	0	0	0
	-	-	-	-	-	-	-	-	14th	0	0	0	0	0	0	0	0
	-	-	-	-	-	-	-	-	21st	0	0	0	0	0	0	0	0
	-	-	-	-	-	-	-	-	28th	0	0	0	0	0	0	0	0
	-	-	-	-	-	-	-	-	July 5th	0	0	0	0	0	0	0	0
	-	-	-	-	-	-	-	-	12th	0	0	0	0	0	0	0	0
	-	-	-	-	-	-	-	-	19th	0	0	0	0	0	0	0	0
July 18th*	22	88	20	80	17	68	10	40	26th	1	4	1	4	1	4	0	0
25th	25	100	22	88	25	100	15	60	August 2nd	1	4	4	16	3	12	1	4
August 1st	25	100	25	100	25	100	15	60	9th	3	12	5	20	3	12	1	4
8th	25	100	25	100	25	100	22	88	16th	0	0	1	4	1	4	1	4
15th	25	100	25	100	25	100	25	100	23rd	4	16	3	12	4	16	2	8
22nd	23	92	25	100	25	100	13	52	30th	9	36	9	36	8	32	2	8
29th	22	88	18	72	18	72	13	52	September 6th	12	48	6	24	5	20	5	20
September 5th	17	68	10	40	15	60	7	28	Average	2.14	8.6	2.1	8.3	1.8	7.1	0.9	3.4
Average	23	92	21.3	85	21.9	87.5	15	60									
Mean no. of infested plants/ one replicate	36.8		34.0		35.0		24.0		Mean no. of infested plants/ one replicate	6.0		5.8		5.0		2.4	

* Inspection/25 plants.

L.S.D. at 5% = 5.02

L.S.D. at 5% = 1.88

Table (8): Number of aphids and their predators on inspected corn plants as affected by nitrogen level during 1996 and 1997 seasons.

	Season 1996								Season 1997								
N level kg/fed.	388 kg N/fed.		298 kg N/fed.		208 kg N/fed.		Control		N level kg/fed.	388 kg N/fed.		298 kg N/fed.		208 kg N/fed.		Control	
Date Of Inspection	No. of aphids/ one plant	No. of predat-ors/10 plants	No. of aphids/ one plant	No. of predat-ors/10 plants	No. of aphids/ one plant	No. of predat-ors/10 plants	No. of aphids/ one plant	No. of predat-ors/10 plants	Date Of Inspection	No. of aphids/ one plant	No. of predat-ors/10 plants	No. of aphids/ one plant	No. of predat-ors/10 plants	No. of aphids/ one plant	No. of predat-ors/10 plants	No. of aphids/ one plant	No. of predat-ors/10 plants
	-	-	-	-	-	-	-	-	June 7th*	0.0	0	0.0	0	0.0	0	0.0	0
	-	-	-	-	-	-	-	-	14th	0.0	0	0.0	0	0.0	0	0.0	0
	-	-	-	-	-	-	-	-	21st	0.0	0	0.0	1	0.0	1	0.0	2
	-	-	-	-	-	-	-	-	28th	0.0	3	0.0	2	0.0	3	0.0	2
	-	-	-	-	-	-	-	-	July 5th	0.0	5	0.0	4	0.0	4	0.0	3
	-	-	-	-	-	-	-	-	12th	0.0	5	0.0	4	0.0	4	0.0	2
July 18th*	667	2	182	2	176	1	14	1	19th	0.0	4	0.0	4	0.0	3	0.0	2
25th	1438	4	406	1	404	3	39	4	26th	0.0	4	6.1	4	0.0	1	0.0	1
August 1st	2868	8	812	7	822	4	77	2	August 2nd	0.1	9	1.0	7	0.1	14	0.3	2
8th	2947	16	8907	25	5920	9	57	2	9th	95.8	7	26.0	8	38.9	11	0.2	3
15th	830	78	1722	110	2183	41	233	10	16th	0.6	3	12.8	5	0.5	3	0.0	1
22nd	172	55	32	59	75	37	3	18	23rd	2.2	6	3.3	5	0.7	7	0.6	1
29th	51	17	71	26	27	17	4	15	30th	5.9	7	4.1	7	8.8	9	0.4	3
September 5th	26	27	15	41	28	22	5	20	September 6th	9.8	7	11.7	6	1.2	6	5.4	5
Overall	8999	207	12147	271	9635	134	432	72	Overall	114.4	60	65.0	57	50.2	66	6.9	27
Average	1124.9	25.9	1518.3	33.9	1204.4	16.8	54	9.0	Average	8.2	4.3	4.6	4.1	3.6	4.7	0.5	1.9
Mean no. of infested plants/ one replicate	1799.8		2429.4		1927		86.4		Mean no. of infested plants/ one replicate	22.9		13		10.0		1.9	

L.S.D. at 5% = 12.54

Statistical analysis of data clarified that infestation rates of maize plants by *R. maidis* are markedly affected by the addition of nitrogen fertilizer, where the overall means of infestation rate to maize by aphids were 92, 85, 87.5 and 60% with 130, 100, 70 and zero units N/fed., respectively.

Also, statistical analysis of data indicated that the relation between infestation rate of maize by aphids and levels of nitrogen fertilizer was highly significant at the three levels of nitrogen fertilzation (130, 100, 70 units N/fed.) as compared with Zero fertilization (control), while insignificant between the three levels of N fertilization.

In general, infestation to maize plants (treated with nitrogen fertilizer) with corn leaf aphid was very high in 1996 season.

Statistical analysis of data clarified that the relation between number of *R. maidis* and levels of nitrogen fertilization was highly significant at the three levels of nitrogen fertilization compared with control, showing 1124.9, 1518.3, 1204.4 and 54 individuals/one plant as overall mean with 130, 100, 70 and zero units N/fed., respectively.

Concerning, the effect of nitrogen level on the number of aphidivorious insects, data illustrated in Table (8) revealed that the number of predators increased on maize plants treated with nitrogen fertilizer, *i.e* number of predators was higher on plants treated with N fertilization than untreated plants. This may be due to two factors,

the first one is the increase of population of the prey (corn leaf aphid) which respond to an increase in number of its predator (Huffaker *et al.*, 1971) and the second factor is related to total leaf nitrogen, where, higher population of predators is associated with higher leaf N than the unfertilized plants (Schmidt, 1991).

IV.2.3.2. Season 1997:

Data presented in Table (8) showed that, corn leaf aphid activity started at the last week of July and first week of August, while the aphid predators began to appear on maize plants at the end of June (Table, 8). The highest rates of infestation to maize plants by aphids were observed on maize plants received N fertilization *i.e* rates of infestation by *R. maidis* was higher on fertilized plants than unfertilized, where the overall mean of infestation percentages were 8.6, 8.3, 7.1 and 3.4% on maize plants treated by 130, 100, 70 and zero units N/fed., respectively.

Statistical analysis of data in Table (7) clarified that the relation between infestation rates of maize plants by *R. maidis* and levels of nitrogen fertilization were significant between zero fertilization and nitrogen levels, while insignificant between the three levels of N fertilization (130, 100 and 70 units N/fed.).

Data summarized in Table (8) showed that the highest numbers of corn leaf aphid were associated with plants treated with nitrogen fertilized plants than unfertilized, where the numbers of aphids were 8.2, 4.6, 3.6 and 0.5 individuals/one plant as overall

mean on plants treated with 130, 100, 70 and zero nitrogen fertilization, respectively.

Concerning with aphid predators, data indicated that the population of predators followed the same trend of corn leaf aphid.

Statistical analysis of data clarified the relation between the numbers of aphids on maize plants and levels of nitrogen fertilization were significant, it could be concluded that the population of aphids increased by increasing rate of nitrogen fertilizer up to 298 kg N/fed., where overall means of aphids population were 54, 1204.4 and 1518.3/one plant for nitrogen fertilizer level Zero, 208 and 298 kg N/fed., respectively, (in 1996).

Also, overall means were 0.5, 3.6 and 4.6 for N fertilizer levels zero, 208 and 298 kg/fed., respectively (in 1997). These results agree with Nawar *et al.* (1992) who found that significant increase in infestation rate of aphid associated with increasing nitrogen level to 120 kg/fed. But, these results disagree with those obtained by Abdel-rahim *et al.* (1992) who stated that the effects of nitrogen fertilizer (80-120 kg/fed.) were insignificant, also with Atiyeh *et al.* (1996) who found that population growth of *R. maidis* was significantly higher at the silk stage, when nitrogen was not applied.

It could be also, observed that the rate of infestation by corn leaf aphid *R. maidis* increased with increasing nitrogen level to 388 kg/fed., where overall means were 60, 87.5, 85.0 and 92.0% on

plants fertilized with zero, 208, 298 and 388 kg N/fed., respectively (in 1996). Also, in 1997 season, the overall means of infestation % were 3.4, 7.1, 8.3 and 8.6/25 plants on plants fertilized with zero, 208, 298 and 388 kg N/fed. The present results agree with those obtained by Nawar *et al.* (1992) who reported that a significant increase in infestation rates of aphids *R. maidis* with increasing nitrogen level to 120 kg N/fed., similar results were reported by Ali (1979) and Metwally (1988) who mentioned that the population of aphids increased with the increase of nitrogen level, also Attia (1989) stated that infestation rate increased by the increase of nitrogen level from 46 to 92 N units per feddan.

IV.2.4. Ears yield and infestation rates of corn borers and aphids as influenced by nitrogen fertilizer levels:

It appears from data presented in Table (9) that, application of the different levels of nitrogen fertilizer increase the infestation rate of corn borers and corn leaf aphid and ears yield/fed., while untreated maize plants (zero N/fed.) show reduction in infestation rates of corn borers and aphid, also ears yield/fed., where the means of corn ears yield/fed., for the two seasons 1996 and 1997 were 21.1, 17.7, 15.7 and 7.4 ardab/fed. with the following nitrogen levels 388, 298, 208 and zero kg N/fed., respectively. Also, data revealed that an increase in the rate of nitrogen fertilizer from 208 kg N/fed. to 388 kg N/fed. caused an increase in ears yield/fed. from 15.7 to 21.1 ardab/fed.

Table (9): Correlation between mean percentage of infestation by the three corn borers and aphid and the yield per feddan in different nitrogen fertilization levels during 1996 and 1997 seasons.

Nitrogen fertilizer levels	Season 1996			Season 1997			Mean of yield Ardab/fed. For the two seasons
	Infestation %		Yield Ardab/ feddan	Infestation %		Yield Ardab/ feddan	
	Corn borers	Corn leaf aphid		Corn borers	Corn leaf aphid		
388 kg N/fed.	3.3	92.6	23.85	5.2	8.6	18.45	21.15
298 kg N/fed.	3.6	85.0	17.10	3.6	8.3	18.45	17.78
208 kg N/fed.	5.4	87.5	15.75	4.1	7.1	15.75	17.75
Zero N/fed. (unfertilized plants)	1.7	60.0	5.40	3.3	3.4	9.45	7.43
	L.S.D. at 5% = 0.96			L.S.D. at 5% = 2.05			

Moreover, it could be concluded that maize plants supplied with different nitrogen levels responded to corn borers and aphid infestation, but ears yield of maize significantly increased by increasing nitrogen fertilizer. This may be due to the increase in plant height, number of leaves/plant, leaf area, number of ears/plant, ear length, number of rows/ear and number of kernels/row. These results are in agreement with Nawar *et al.* (1992); Eraky *et al.* (1983), El-Maghraby *et al.* (1986), Ali *et al.* (1989) and El-Deeb (1990).

IV.3. The effect of certain insecticides on rate of damage caused by some major insect pests attacking maize plants:

Two field experiments were carried out to study the influence of two insecticides (Lannate and Malathion) on corn borers and aphid insects attacking maize plants during 1996 and 1997. Recommended rate of a commercial formulation of the previous insecticides were individually sprayed on May at two successive seasons 1996 and 1997. In these experiments, the plants were sprayed against corn borers with Lannate in two different concentrations (300 & 200 g/400 L water/fed.) on July 10th and 15th during 1996 and 1997, respectively. Then the same plants were treated against corn leaf aphid by Malathion 57% at two different concentrations 1.5 & 1 L/600 L water/fed.) on August 4th and 12th during 1996 and 1997, respectively.

IV.3.1. Effect of different concentrations of Lannate and Malathion on the infestation rate and abundance of corn borers and their predators:

IV.3.1.a. Recommended concentration of insecticide: (Lannate 300 g/400 L water/fed. and Malathion 1.5 L/600 L water/fed.):

Data summarized in Table (10) indicated the weekly rates of infestation by the corn borers and total number of predators on the same inspected plants in both seasons. In the first season, the obtained data revealed that the corn borers appeared in few numbers during the whole season where rate of infestation was 1% (one infested plant/100 plants) during the first four inspections, then 2% (two infested plants/100 plants) on July 21st (one infested plant/50 plants) on August 11th and 18th. In the second season 1997, the rate of infestation was 6% (6 infested plants/100 plants) during the first inspection, then increased to reach 7% as comulative rate of infestation on July 5th. It could be concluded that Lannate when applied with recommended concentration on maize plants in the two seasons reduced the infestation percent. The analysis of variance of infestation percent shown in Table (10) revealed highly significant differences between the two seasons. On the other hand, number of predators, during season 1996, started by 11 individuals/100 plants in the first sample at June 25th, then increased to reach a highest abundance of predators (53 individuals/100 plants) at the second week of July, then number of predators decreased sharply after application of Lannate to reach 4 individuals/100 plants, then increased gradually until harvesting, although, maize plants were sprayed with recommended concentration of Malathion on August

11th. While, in 1997, number of predators began by 19 individuals/100 plants in the first sample and continued in this level in the three following inspections, then number of predators decreased sharply (directly after application on maize plants with Lannate) on July, 19th and 26th and August 2nd, showing 5, 1 and 9 individuals, respectively (Table, 10). Then number of predators incresaed to 38 individuals/50 plants on August, 9th, then decreased during the two subsequent samples, as a result of Malathion treatment.

Such results gave the impression that treating maize plants (sown in recommended date) with recommended concentration of Lannate, protected them from infestation by corn borers from treated time until harvest. On the other hand, Lannate affected the numbers of predators, but, for a period extended from two to three weeks.

IV.3.1.b. The low concentration of insecticides: (Lannate 200 g/400 L water/fed. and Malathion one liter/600 L water/fed.).

As indicated in Table (10) the number of infested plants by corn borers in season 1996 started low (one infested plant/100 plants on June, 25th) then increased successively in the subsequent samples until reached a highest accumulative infestation percent 6% on July 14th. The remaining inspections until harvesting revealed that the infestation rates to maize plants by borers did not increase after Lannate application. While in 1997 season, it could be also, observed from Table (10) that the rate of infestation by corn borers

in the first sample was 3%. During the subsequent sample number of infested plants increased to 5 infested plants/100 plants showing 5% as accumulative percentage of infestation. Also, as in season 1996, treatment of maize plants with Lannate led to, stability in the number of infested plants until the end of the season.

The same results cleared that the number of predators at the first inspection of 1996 season were 13 individuals/100 plants, then increased until reaching 63 individuals/100 plants on July, 9th. Then number of predators decreased sharply during the subsequent two samples after spraying maize plants with Lannate. After that the number of predators increased to 22/50 plants on July, 28th and the highest abundance of predators was 95 individuals/50 plants recorded on August, 18th. On the other hand, in 1997 season, number of predators was 14 individuals/100 plants in the first sample and reached 29/100 plants on July 14th. Then number of predators decreased sharply after spraying Lannate by one week to reach 3 individuals/50 plants on July, 26th. After that, number of predators increased again and the highest abundance of predators was recorded on August, 9th, 58 individuals/50 plants.

IV.3.1.c. Untreated maize plants (control):

In 1996, data tabulated in Table (10) indicated that infestation by corn borers to maize plants started on June, 25th with 2% percentage of infestation (2 infested plants/100 plants), then increased during the subsequent samples to reach 6% on July 9th and 21st. The highest rate of infestation (12%) was reached on August 25th and September 8th. In 1997, rate of infestation started higher

than in 1996 where it was 5%, then increased to reach 6% during the following samples on July 5th and 12th. The highest, rate of infestation was 8% recorded on August 23rd and 30th. While the lowest, rate of infestation was 4% recorded on July 19th, August 16th and September 6th.

It was generally observed that infestation to maize plants by corn borers was higher in 1996 than 1997, where overall mean of infestation were 7.0% and 5.7% during 1996 and 1997, respectively.

It could be also, observed that, in 1996 season, number of recorded predators was 14 individuals/100 plants in the first sample, then increased until reaching 39 individuals/100 plants on July, 9th. Highest abundance of predators was 402 individuals/50 plants occurred on August, 18th. The lowest number of predators was 6 individuals/50 plants recorded on July, 21st. Four peaks of predators in maize fields were recorded on July 9th and 28th, August, 18th and September, 8th showing 39, 17, 402 and 59 individuals, respectively. On the other hand, in 1997 season, number of predators was 18 individuals in the first sample, then increased to reach 30 individuals/100 plants on July 19th, decreased sharply to reach 4 individuals/50 plants on July, 26th as a lowest number of predators. Then increased again to reach 38 individuals/50 plants in the subsequent samples as a highest abundance of predators. The predators recorded showed, only, three peaks during this season on July, 19th, August 2nd September, 6th.

Table (10): Accumulative rate of infestation caused by corn borers and number of predators on corn plants as affected by two insecticides during 1996 and 1997 seasons.

Insecticides	Season 1996									Insecticides	Season 1997								
	Lannate 300 g & Malathion 1.5 L/fed.			Lannate 200 g & Malathion one L/fed.			Control				Lannate 300 g & Malathion 1.5 L/fed.			Lannate 200 g & Malathion one L/fed.			Control		
Date of inspection	No. of infested plants	Infestation %	Total no. of predators	No. of infested plants	Infestation %	Total no. of predators	No. of infested plants	Infestation %	Total no. of predators	Date of inspection	No. of infested plants	Infestation %	Total no. of predators	No. of infested plants	Infestation %	Total no. of predators	No. of infested plants	Infestation %	Total no. of predators
June 25th*	1	1	11	1	1	13	2	2	14	June 28th *	6	6	19	3	3	14	5	5	18
July 2nd	1	1	23	2	2	23	3	3	23	July 5th	7	7	18	5	5	10	6	6	19
9th	1	1	53	5	5	63	6	6	39	12th	4	4	21	4	4	24	6	6	24
14th	1	1	4	6	6	18	3	3	8	14th	5	5	19	2	2	29	5	5	23
21st	2	2	13	2	2	5	6	6	6	19th	3	3	5	3	3	10	4	4	30
28th**	0	0	18	2	4	22	5	10	17	26th**	2	4	1	2	4	3	3	6	4
August 4th	0	0	17	2	4	19	4	8	10	August 2nd	2	4	9	2	4	30	3	6	38
11th	1	2	29	1	2	10	3	6	30	9th	2	4	38	2	4	58	3	6	33
18th	1	2	32	1	2	95	4	8	402	16th	2	4	13	2	4	26	2	4	20
25th***	0	0	50	1	4	43	3	12	99	23rd***	1	4	14	2	8	9	2	8	16
September 1st	1	4	49	0	0	34	2	8	48	30th	0	0	19	1	4	27	2	8	19
8th	0	0	65	1	4	78	3	12	59	September 6th	0	0	17	2	8	13	1	4	25
Averages	0.8	1.2	30.3	2.0	3.0	35.3	3.7	7.0	62.9	Averages	2.8	3.8	16.1	2.5	4.4	21.1	3.5	5.7	22.4
Mean no. of infested plants/one replicate	1.8			4.8			8.8			Mean no. of infested plants/one replicate	6.8			6.0			8.4		

* Number of inspected plants 100 plants.
** Number of inspected plants 50 plants.
*** Number of inspected plants 25 plants.
Date of Lannate application July 10th.
Date of Malathion application August 4th.

Date of Lannate application July 15th
Date of Malathion application August 12th

Finally, it could be concluded that the number of predators on untreated maize plants was higher in 1996 than 1997 where overall means were 62.9 and 22.4 individuals in 1996 and 1997, respectively.

From the aforementioned results summarized in Table (10) it could be concluded that infestation rates to maize plants by corn borers did not obviously increase after application on maize plants with Lannate (two concentrations). The infestation rates by corn borers on untreated plants were higher than treated maize plants with insecticides, during the two seasons, where the overall means of infestation were 1.2 and 3.0 (1996) and 3.8 and 4.4% (1997) with recommended concentration of Lannate and Malatthion and lower concentrations of them, respectively, while on untreated plants were 7.0 and 5.7% during 1996 and 1997, respectively.

On the other hand, Lannate with low concentration (200 g/fed.) had lower effect on the rates of infestation by corn borers (3.0 and 4.4% during 1996 and 1997, respectively) than recommended concentration (300 g/fed.) (1.2 and 3.8% as overall mean of infestation during 1996 and 1997, respectively). But the low concentration had a little effect on number of predators.

In general, treatment of maize plants with Lannate affected on numbers of predator in corn fields compared to untreated corn plants (Table, 10).

These results are in general agreement with Mustea (1979) who found that the granules formulation of different insecticides reduced the attack *Ostrinia nubilalis* by 58-71%, with a definite relationship between the amount of insecticides applied and the numbers of damaged plants.

Also, Singh and Marwah (1996) found that the relative order of effectiveness on freshly hatched larvae of *Chilo partellus* was 0.01% than 0.005% cypermethrin.

IV.3.2. Effect of different concentrations of Lannate and Malathion on the infestation percentage and abundance of *R. maidis* and its predators:

Tables (11 & 12) illustrate the rates of infestation, number of corn leaf aphid and its predators on inspected corn plants as affected by applicating insecticides through 1996 and 1997 seasons.

IV.3.2.a. The recommended concentration of insecticides: (Lannate 300 g/400 L water/fed. and Malathion 1.5 L/600 L water/fed.).

In 1996 season, the highest abundance of corn leaf aphid found on one maize plant was 1709.6 individuals recorded on August 1st with 100% rate of infestation. After that, number of aphids decreased sharply during the subsequent samples until harvesting, as a result of Malathion application on August, 4th. The lowest number of aphids was 11.8 individuals recorded at the 2nd week of August after applicating Malathion directly. On the other hand the highest abundance of predators was 33 individuals/10

plants recorded at the last sample on September 5th, while the lowest number of predators was 3 individuals recorded on July 18th and August 1st (Table, 12). Also, it was observed that the number of predators has been little affected by Malathion applications. While in 1997 season, the aphid activity started on August 3rd (9.7 individuals/one plant) with a rate of infestation 4%. One peak of aphid recorded on August, 31st (11.6 individuals/one plant). A highest rate of infestation was 40% occurred during the last sample on September 7th. Two peaks of predators were noticed on 10th and 31st August each contained 8 individuals.

Also, data in Tables (11 and 12) cleared that in the 2nd season 1997, application of Malathion on August, 12th did not achieve any noticeable effect on numbers of both corn leaf aphid (*R. maidis*) and its predators. This may be due to the numbers of aphid and its predators on maize plants, were very low during this season than the first one.

IV.3.2.b. The low concentrations of insecticides: (Lannate 200 g/400 L water/fed. and Malathion one L/600 L water/fed.).

Data reported in Tables (11 and 12) indicated that, in 1996 the highest abundance of aphids was 2117.1 individuals/one plant with 100% rate of infestation recorded on the 1st of August just before the application of Malathion. Then the number of aphids decreased sharply resulting from application of insecticide to reach 72.2/one plant on August 8th and the residual effect of Malathion was continued for three weeks.

Abundance of aphid predators was also affected by application of Malathion on maize plants, where their number was 4/10 plants (before application), while after application the number decreased to 2/10 plants on August, 8th). But after 11 days from insecticide application their numbers increased again. The highest abundance of predators was 39 individuals/10 plants occurred on September 5th.

In 1997, aphid activity started on August, 3rd, showing 0.2 aphid/one plant with a rate of infestation 4%. Then number of aphids increased gradually to reach its highest abundance on September 7th (21.9 individuals of aphid/one plant) with 32% rate of infestation (the highest, rate of infestation during this season). On the other hand, two peaks of aphidivorous insects were recorded. The first and the second peaks were 12 and 11 individuals/10 plants occurred on August 10th and 31st, respectively.

Results summarized in Table (12) clarified that application of Malathion to maize plants on August, 12th during season 1997, did not reveal any noticeable effects (as with recommended concentration) on numbers of aphid and aphidivorous insects.

Statistical analysis of data indicated that there is no differences in numbers of aphids and their predators between the plants treated by either of two concentrations and untreated plants during the period from the application of the insecticide until harvesting.

Table (11): Rate of infestation caused by corn leaf aphid on 25 corn plants as affected by applicating insecticides throughout 1996 and 1997 seasons.

Insecticides	Season 1996						Insecticides	Season 1997					
	Lannate 300 g & Malathion 1.5 L/fed.		Lannate 200 g & Malathion one L/fed.		Control			Lannate 300 g & Malathion 1.5 L/fed.		Lannate 200 g & Malathion one L/fed.		Control	
Date of inspection	No. of infested plants	Infestation %	No. of infested plants	Infestation %	No. of infested plants	Infestation %	Date of inspection	No. of infested plants	Infestation %	No. of infested plants	Infestation %	No. of infested plants	Infestation %
	-	-	-	-	-	-	June 27th	0	0	0	0	0	0
	-	-	-	-	-	-	July 4th	0	0	0	0	0	0
	-	-	-	-	-	-	11th	0	0	0	0	0	0
	-	-	-	-	-	-	13th	0	0	0	0	0	0
July 18th	20	80	23	92	25	100	20th	0	0	0	0	0	0
25th	22	88	25	100	25	100	27th	1	4	1	4	1	4
August 1st	25	100	25	100	25	100	August 3rd	1	4	4	16	5	20
8th	25	100	25	100	25	100	10th	4	16	7	28	6	24
15th	25	100	25	100	25	100	17th	1	4	4	16	6	24
22nd	21	84	25	100	23	92	24th	5	20	8	32	8	32
29th	20	80	25	100	23	92	31st	4	16	8	32	6	24
September 5th	18	72	15	60	20	80	September 7th	10	40	8	32	10	40
Mean	22	88	23.4	94	23.9	95.5	Averages	2.2	8.7	3.3	13.3	3.5	14
Mean no.of infested plants/one replicate	35.2		37.6		38.2		Mean no.of infested plants/one replicate	5.2		8.0		8.4	

Date of Lannate application July 10th
Date of Malathion application August 4th

Date of Lannate application July 15th
Date of Malathion application August 12th

Table (12): Effect of different concentrations of Lannate and Malathion on number of corn leaf aphid and their predators on inspected corn plants throughout 1996 and 1997 seasons.

Insecticides	Season 1996						Insecticides	Season 1997					
	Lannate 300 g & Malathion 1.5 L/fed.		Lannate 200 g & Malathion one L/fed.		Control			Lannate 300 g & Malathion 1.5 L/fed.		Lannate 200 g & Malathion one L/fed.		Control	
Date of inspection	No. of aphid/one plant	Total no. of predators/ 10 plants	No. of aphid/one plant	Total no. of predators/ 10 plants	No. of aphid/one plant	Total no. of predators/ 10 plants	Date of inspection	No. of aphid/one plant	Total no. of predators/ 10 plants	No. of aphid/one plant	Total no. of predators/ 10 plants	No. of aphid/one plant	Total no. of predators/ 10 plants
	-	-	-	-	-	-	June 27th	0.0	2	0.0	1	0.0	2
	-	-	-	-	-	-	July 4th	0.0	2	0.0	1	0.0	2
	-	-	-	-	-	-	11th	0.0	2	0.0	3	0.0	2
	-	-	-	-	-	-	13th	0.0	2	0.0	3	0.0	2
July 18th	442.1	3	467.4	1	733.2	1	20th	0.0	1	0.0	1	0.0	3
25th	860.0	4	1026.4	4	1537.3	4	27th	0.0	0	0.0	1	0.0	1
August 1st	1709.6	3	2117.1	4	3073.9	2	August 3rd	9.7	2	0.2	6	0.0	8
8th	11.8	6	72.2	2	4199.4	6	10th	0.4	8	0.0	12	138.3	7
15th	31.5	6	205.5	19	1803.0	80	17th	0.2	3	0.4	5	0.7	4
22nd	18.4	25	42.5	22	54.2	50	24th	2.1	6	1.0	4	12.7	6
29th	34.5	25	135.3	17	97.5	24	31st	11.6	8	9.1	11	34.8	8
September 5th	25.6	33	31.4	39	17.0	30	September 7th	6.6	7	21.9	5	30.9	10
Overall	3133.5	105	4097.8	108	11515.5	197	Overall	30.6	43	32.6	53	217.4	55
Average	391.7	13.2	512.2	13.5	1439.4	24.6	Averages	2.6	3.6	2.7	4.4	18.1	4.6
Mean no.of aphid plants/one replicate	626.7		819.6		2303.1		Mean no.of infested plants/one replicate	6.1		6.5		43.5	

Date of Lannate application July 10th
Date of Malathion application August 4th

Date of Lannate application July 15th
Date of Malathion application August 12th

These results are in disagreement with Kira *et al.* (1972) who found that Malathion was more toxic to the predators of the leaf corn aphid.

IV.3.2.c. Untreated maize plants (control):

Data reported in Tables (11&12) indicated that in 1996 season, highest abundance of aphid was 4199.4 individuals/one plant occurred on August, 8th with a rate of infestation 100%. The number of aphids decreased sharply to reach a lowest, abundance on last sample when 17 individuals were counted on one plant. Two peaks of aphid were recorded on August, 8th and 29th (4199.4 and 97.5 individuals), respectively. While, two peaks of predators were 80 and 30 individuals/10 plants recorded on August, 15th and September, 5th and also, appeared in the subsequent week for two peaks of aphids. On the other hand, in 1997 season, aphid activity appeared with its highest abundance on August, 10th when counted 138.3 individuals/one plant with a rate of infestation 24%. After that, the number of aphid decreased sharply in the subsequent two inspections, then increased again. Two peaks of aphid (138.3 and 34.8 individuals) were recorded on August, 10th and 31st, respectively. Also, three peaks of predators were noticed, the first was 3 individuals/10 plants recorded on July, 20th, while the second peak and the third were 8 and 10 individuals/10 plants recorded on August, 3 rd and September, 7th, respectively.

These results, also, show that aphid abundance was much higher in 1996 than 1997 where overall mean counts were 1439.4 and 18.1 individuals/one plant in 1996 and 1997, respectively.

It could be also, observed that the numbers of predators were higher in 1996 than 1997 where overall mean counts were 24.6 and 4.6 in 1996 and 1997, respectively.

Generally, it could be observed from Tables (11&12) that infestation to maize plants by aphid was higher in 1996 than 1997. Also it could be concluded from data of the two seasons that rate of infestation by corn leaf aphid, number of aphid and their predators were higher on untreated plants than treated maize plants with the two concentrations of Malathion, where, the overall means of infestation rate by aphid were 95.5 and 14% on untreated plants during 1996 and 1997, respectively. While, were 88 & 94 and 8.7 & 13.3% on maize plants treated with recommended and low concentrations of Malathion during 1996 and 1997, respectively. Regarding, the overall mean of aphid number with recommended and low concentration of Malathion and untreated plants, these were 391.7, 512.2 and 1439.4 individuals/one plant during 1996 season, respectively, while, in 1997 were 2.6, 2.7 and 18.1/one plant, respectively.

Also, the overall mean number of aphidivorous insects on treated plants with recommended and low concentrations of Malathion and on untreated maize plants were 13.2, 13.5 and 24.6 predators/10 plants throughout the first season, respectively, while during the second season were 3.6, 4.4 and 4.6 individuals/10 plants, respectively.

It, also, can be concluded that the recommended concentration was of higher effects on number of corn leaf aphid and their predators than low concentration of Malathion.

These results agree with those obtained by Botrell *et al.* (1973) who found that the reduced rates of Malathion were not effective against *R. maidis* as the standard ones. Also, Moreau (1987) found that population of natural enemies for *Sitobion avenae* and *R. padi* have been reduced by insecticidal treatments.

IV.4. Effect of different treatments on symptoms of infestation caused by corn borers during 1997 season:

IV.4.1. Effect of different planting dates on symptoms of infestation caused by corn borers during 1997 season:

Results presented in Table (13) revealed that symptoms of infestation began to appear after about one month of sowing on the plants of first planting date (sown April 21st) showing 66.6% perforated leaves and 382 holes/24 leaves with 17 larvae. The highest accumulative percentage of infestation was 97.1 perforated leaves recorded on July, 6th.

In plantation of second planting date the damaged plants appeared on June 22nd (44.1% perforated leaves with 122 holes After that, the infestation increased gradually until reached the highest peak of perforated leaves 37/67 leaves.

The infestation with corn borers appeared on the plants of third planting date (sown on June 23rd) after 2 weeks of sowing on

Table (13): Effect of different planting dates on symptoms of infestation with corn borers on 5 plants during season 1997.

Planting dates	First plantation sown on April 21st					Second plantation sown on May 21st					Third plantation sown on June 23rd				
Date of inspection	No. of leaves/5 plants	No. of perforated leaves	% of perforated leaves	No. of holes	Total no. of larvae	No. of leaves/5 plants	No. of perforated leaves	% of perforated leaves	No. of holes	Total no. of larvae	No. of leaves/5 plants	No. of perforated leaves	% of perforated leaves	No. of holes	Total no. of larvae
May 8th	15	0	00.0	0	0										
23rd	36	24	66.6	382	17										
June 7th	41	28	68.2	581	14	19	0	0	0	0					
22nd	72	46	63.8	644	0	34	15	44.1	122	0					
July 6th	69	67	97.1	1274	0	43	25	58.1	478	3	19	2	10.5	6	0
21st	69	33	47.8	320	0	61	32	52.4	664	5	33	15	45.4	127	0
August 4th	70	42	60.0	413	0	67	37	55.2	1027	3	51	29	56.8	313	5
19th						66	8	12.1	37	1	60	14	23.3	93	1
September 2nd						63	0	0	1	1	64	18	28.1	252	0
17th											65	4	6.1	16	6
October 2nd											54	0	0	4	2
Overall	372	240	403.5	3614	31	353	117	221.9	2329	13	346	82	170.2	811	15
Mean	53.1	34.2	57.6	516.3	4.4	50.4	16.7	31.7	332.7	1.86	49.4	11.7	24.3	115.9	2.14

July 6th showing 2 perforated leaves from 19 respectively 10.5% and 6 holes. The highest peak of percentage of accumulative infestation was 56.8 with 313 perforates and 5 larvae on August 4th.

By compared the overall means of season, it could be concluded that the plants of the first planting date harboured the highest percent of infestation with corn borers showing 57.6 of perforated leaves, 516.3 pores and 4.4 larvae/5 plants. The plants resulting from the second planting date had the second order of infestation showing 31.7 perforated leaves and 332.7 pores.

On the other hand, the plants of third planting date (sown on June 23rd) were the lowest infested plants which showed 24.3% perforated leaves with 115.9 pores and 2.14 larvae/5 plants.

From the data of abovementioned table, it could be generally stated that the infestation rate with corn borers increased on the very early plantations.

IV.4.2. Effect of nitrogen levels on symptoms of infestation with corn borers during 1997 season:

The influence of application with different levels of nitrogen fertilizer on the damage i.e. number of perforated leaves, number of perforates and larval content of corn borers are presented in Table (14). Four nitrogen levels were applied in this experiment, 130, 100, 70 and zero units as control. It appears from the obtained results that nitrogen applications increase the vegetative flat of plant and also increase the symptoms of infestation.

Table (14): Effect of nitrogen levels on symptoms of infestation with corn borers on 5 plants during season 1997.

Nitrogen fertilizer level	388 kg N. fed. (130 units/fed.)					298 kg N. fed. (100 units/fed.)					208 kg N. fed. (70 units/fed.)					Control				
Date of inspection	No. of leaves/ 5 plants	No. of perforated leaves	% of perforated leaves	No. of holes	No. of larvae	No. of leaves/ 5 plants	No. of perforated leaves	% of perforated leaves	No. of holes	No. of larvae	No. of leaves/ 5 plants	No. of perforated leaves	% of perforated leaves	No. of holes	No. of larvae	No. of leaves/ 5 plants	No. of perforated leaves	% of perforated leaves	No. of holes	No. of larvae
June 7th	19	0	0.0	0	0	19	0	0.0	0	0	16	0	0	0	0	17	0	0	0	0
22nd	32	11	34.3	83	0	31	9	29.0	88	0	34	13	38.2	120	0	35	13	37.1	134	0
July 7th	45	22	48.8	308	8	42	26	61.9	571	14	48	26	54.1	373	6	38	7	18.4	31	1
22nd	63	43	68.2	777	2	57	32	56.1	674	0	55	23	41.8	308	3	50	20	40.0	181	3
August 5th	67	30	44.7	321	3	63	24	38.0	157	2	62	30	44.3	244	3	64	34	53.1	387	4
19th	68	10	14.7	38	0	67	28	41.7	168	3	61	12	19.6	79	0	62	7	11.2	44	1
September2nd	76	2	2.6	6	1	68	6	8.8	27	0	70	5	7.1	23	1	61	2	3.2	4	3
Overall	370	118	213.3	1533	14	347	125	235.5	1685	19	346	109	205.1	1147	13	327	83	163	781	12
Mean	52.8	16.8	30.4	219	2	49.5	17.8	33.6	240.7	2.7	49.4	15.5	29.3	163.8	0.93	46.7	11.8	23.2	111.5	0.85

The comparison between whole means of infestation symptoms showed that whole mean of leaves/5 plants was higher in all nitrogen fertilizer treatments than control. The whole mean number of leaves were 52.8, 49.5, 49.4 for the treatments with 130, 100 and 70 units/feddan, respectively, compared with 46.7 in the case of control. The percentage of perforated leaves caused with insect borers were 30.4, 33.6, 29.3 and 23.2 under the application with 130, 100, 70 and zero units of nitrogen, respectively.

As for the whole mean number of larvae, also, it increased by increasing the nitrogen level. All nitrogen levels applied increased the larval content comparing with control.

The whole mean number of larvae/5 plants were 2.0, 2.7, 0.93 and 0.85 for 130, 100, 70 and zero levels of nitrogen, respectively.

From the abovementioned results, it could be concluded that the applications with nitrogen fertilizer increase damage of corn plants compared with control but fortunately increase the vegetative flat of plant. In this case, the crop yield is the to show the effect of fertilizer application.

IV.4.3. Effect of some insecticides on maize plant damage caused with corn stem borers:

In this experiment two concentration of two insecticides were applied, the first was recommended concentration 300 g Lannate and 1.5 L Malathion/fed. and the other was lower than

recommended 200 g Lannate and 1 L Malathion and other was left without treatment as a control.

Data presented in Table (15) show that perforated leaves was appeared on June 22nd. Results in this Table show also, that there were very simple differences between whole means of damage under the treatments with insecticides at the two concentration.

The mean percentage of perforated leaves were 18.1 & 29.4 for recommended and lower concentrations, respectively but was 34.7% in the case of control. Also, there was no clear difference between the two concentrations in the mean number of holes that were 151.8/14.1 leaves and 152.9/15.9 leaves which was higher in untreated plants (220.8/18.2).

From the previous Table, it may be concluded that there was small difference in the maize plant damage between the two concentrations of the two insecticides.

IV.4.4. Effect of different treatments on number of hibernating larvae in dry corn stalks in season 1997:

The hibernating corn borers larvae are considered the main source of infestation to plants of the next season. The objective of this part was to determine the number of hibernating larvae of corn borers and holes under the effect of the following treatments: three sowing dates, three levels of nitrogen fertilization and finally two concentrations of two insecticides. The plants were examined at the mid of winter (10th of Janury).

Table (15): Effect of some insecticides on symptoms of infestation with corn borers on 5 plants during season 1997.

Planting dates	Lannate 300 g & Malathion 1.5 L/fed.					Lannate 200 g & Malathion 1.0 L/fed.					Control				
Date of inspection	No. of leaves/5 plants	No. of perforated leaves	% of perforated leaves	No. of holes	Total no. of larvae	No. of leaves/5 plants	No. of perforated leaves	% of perforated leaves	No. of hols	Total no. of larvae	No. of leaves/5 plants	No. of perforated leaves	% of perforated leaves	No. of holes	Total no. of larvae
June 7th	18	0	0.0	0	0	17	0	0.0	0	0	17	0	0	0	0
22nd	34	15	44.0	136	0	32	11	34.3	113	0	30	14	46.6	159	0
July 7th	40	16	40.0	101	3	44	13	29.5	66	1	43	16	37.2	241	2
22nd	57	26	45.6	303	1	63	32	50.7	381	3	53	28	52.8	413	3
August 5th	62	25	40.3	368	1	62	32	50.0	413	0	65	28	43.0	543	0
20th	63	13	20.6	126	0	62	11	17.7	55	0	62	10	16.1	55	1
September 3rd	63	4	6.3	29	0	51	12	23.5	42	2	68	32	47.0	135	0
Overall	337	99	196.8	1063	5	333	111	205.7	1070	6	338	128	242.7	1546	6
Mean	48.1	14.1	28.1	151.8	0.71	47.6	15.9	29.4	152.9	0.85	48.2	18.2	34.7	220.8	0.85

IV.4.4.a. Effect of sowing dates:

The data presented in Table (16) showed the infestation percent of corn stalks with corn borers larvae, number of hibernating larvae and holes on infested stalks. The results in this table indicated that the number of infested plants with hibernating larvae of corn borers in their stalks increased in the plants of third date of plantation (23rd of June) as it reached 38 infested plants from 40, the plants of the second sowing date harboure 37 infested plants while the plants of the first sowing date possessed the lowest infestation 28 infested plant.

As for, the number of hibernating larvae, results revealed that the plants of the third sowing date harboured the highest number of hibernating larvae (17 larvae) followed by the plants of second sowing date which possessed 11 larvae while the plants of first date had the lowest number of diapuse larvae 1 larvae only.

Also, the number of holes on infested stalks were determined and the data in the same table showed that the plants of late sowing date have higher perforates (166) than the plants of other two sowing dates which possessed 141 and 126 holes for the second and the first sowing dates, respectively.

From the aforementioned results it is clear that the plants of late sowing date received higher number of pores & infested plants & diapoused larvae of corn borers than the plants of early sowing date and this may be due to the possibility of escaping of early sown corn plants from infestation with hibernating corn borers larvae

Table (16): Effect of different treatments on number of hibernating larvae in 40 inspected corn stalks in season 1997.

Treatments	No. of infested plants	No. of diapused larvae	No. of holes
I. Planting date:			
First date (April)	28	1	126
Second date (May)	37	11	141
Third date (June)	38	17	166
II. Nitrogen fertilizer:			
70 units/fed. (208 kg/fed.)	30	10	117
100 units/fed. (298 kg/fed.)	36	14	139
130 units/fed. (388 kg/fed.)	27	7	88
Control	19	3	34
III. Insecticides:			
Malathion 1.5 litre/fed.	31	10	95
Malathion 1.0 litre/fed.	31	11	92
Lannate 300 g/fed.	32	9	96
Lannate 200 g/fed.	34	12	80
Control	38	14	152

because of the early dryness of these plants and that the larvae are directed and prefer the very green plants.

In this scale Batrag Singh *et al.* (1977) stated that the larvae of *Chilo partellus* which infested the crop entered diapuse from late September to mid October. Stalk, cob and stubble remains harbouring 29.94, 50.85 and 19.20%, respectively of over wintering larvae.

IV.4.4.b. Effect of nitrogen fertilization:

Data in Table (16) indicated the effect of three levels of nitrogenous fertilization and control on the number of hibernating larvae of corn borers in dry stalks and also the infestation rates with corn borers.

Data revealed that all plants treated with any of the fertilization levels harboured infestation rates with corn borers higher than untreated plants as well as higher number of hibernating larvae. The infestation rate and the number of hibernating larvae increased with the increase of nitrogen fertilizer up to the level of 100 units/feddan and after that decreased. The infestation rates were 30, 36 and 27 plants from 40 for 70, 100 and 130 units/fed. respectively, opposed to 19 plants in control. Also, the numbers of hibernating larvae were 10, 14 and 7 larvae for the aforementioned levels respectively, but was 3 larvae in control. The same trend was in the number of holes in investigated stalks which increased at the rate of 100 units/feddan (139 perforates/40 plants) followed by 70

units/feddan (117 perforates/40 plants) and decreased to 88 perforates/40 plants on the plants received 130 units nitrogen/fed.

From the previous data it may be concluded that the increase of nitrogen fertilizer increased the infestation rates & the number of hibernating larvae up to 100 units after that they decreased. In other words, the increased nitrogen content of the plant encourage the hibernating larvae to inhibit the stalks up to limited level after that the increase discourage the hibernating larvae.

IV.4.4.c. Effect of insecticides:

Two concentrations of two different insecticides were used to control the corn pests. As mentioned before, Malathion was used to protect the corn from aphid infestation with two concentrations 1.5 and 1 L/feddan. Lannate was used to control the corn borers with two concentrations 300 and 200 g/fed. The dry stalks treated with the previous treatments were inspected to determine the effect of these treatments on the hibernating larvae and infestation rates after harvesting on January 10^{th}.

Data in Table (16) showed that the effect of these treatments on hibernating larvae was low. The number of infested plants and the number of hibernating larvae were higher in the control. The number of infested stalks varied from 31 to 34/40 plants in the case of treatments compared with 38 on control plants. Also, the number of hibernating larvae varied from 9 to 12 larvae/40 inspected plants and was 14 in the case of control.

The numbers of holes varied from 80 to 95 in the case of treatments opposed to 152 on the stalks of control plants.

The numbers of holes were very low compared with the high number of hibernating larvae but this may be explained by the fact that the treatments with these insecticides gave protection throughout the period of treatments and the period of insecticides efficiency. After that the insecticides lost their efficiency.

IV.5. Percentage of parasitism on the corn aphid:

Throughout the period of *R. maidis* occurence on corn plants, 100 aphid individuals were dissected and thoroughly examined by the aid of a binocular stereo-microscope. All the examined aphids from the recommended and late plantation corn seasons were found free from any parasitism.

Average temperature (temp.) and relative humidities (RH) during the experimental months from April 10th to October 10th through 1996 and 1997 seasons.

Date	Season 1996		Season 1997	
	Temp.	R.H.	Temp.	R.H.
April 10-20	25.6	61	25.7	57
21-30	27.3	59	28.1	64
May 1-10	33.3	57	30.1	58
11-20	32.0	58	34.2	55
21-31	33.2	59	34.0	57
June 1-10	32.6	59	33.6	56
11-20	33.5	60	34.7	56
21-30	34.4	60	35.5	60
July 1-10	35.2	64	34.4	63
11-20	32.6	61	33.4	67
21-31	33.3	72	33.0	72
August 1-10	34.7	71	32.4	75
11-20	34.1	72	31.8	76
21-31	33.1	71	31.6	74
September 1-10	35.0	66	30.9	74
11-20	33.8	66	31.2	76
21-30	33.1	68	30.2	68
October 1-10	31.4	69	29.7	71