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INFLUENCE OF SOME AGRICULTURAL PRACTICES ON THE INFESTATION WITH THE EUROPAEN CORN BORER, *Ostrinia nubilalis* HUB. (LEPIDOPTERA: PYRALIDAE).

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ABSTRACT

The present studies were carried out during two successive seasons; 2006 and 2007 at Sakha Agricultural Research Station Kafr El-Sheikh Governorate. An area of about 1.5 fed. was cultivated with corn to study the influence of planting dates, nitrogen fertilizer levels and planting spaces between hills on corn infestation with the European corn borer, *Ostrinia nubilalis* Hub..

Corn plants sown in April plantation were subjected to the least numbers of ***O. nubilalis*** larvae with average numbers of 1.7±0.9 and 2.1±0.9 larvae / 5 plants while in June plantation, the larvae occurred with a moderate numbers with averages of 5.0±1.4 and 8.6±2.2 and reached its maximum in July plantation with averages of 54.3±11.5 and 80.5±15.7 larvae / 5 plants during the two successive seasons. The statistical analysis revealed highly significant differences in the number of the insect larvae between the three planting dates.

Increase of nitrogen fertilizer levels from zero to 360 kg / fed. caused significant increase in the numbers of infested plants and percentages of infestation. When the corn plants were supplied with 360, 260, 160 and zero kg nitrogen / fed., the average numbers of infested plants with ***O. nubilalis*** were 9.5±1.7 and 8.6±1.7 , 7.8±1.5 and 7.6±1.4 , 6.5±1.2 and 7.1±1.4 and 4.9±1.0 and 5.4±1.2 / 20 plants during seasons 2006 and 2007, respectively.While percentages of infestation were 47.7±8.6% and 42.9±8.5%, 39.1 ± 7.5% and 37.9±7.0%, 32.7±6.2% and 35.4±7.2% and 24.5±4.8% and 27.1±5.9 % to four nitrogen levels during seasons 2006 and 2007, respectively. The statistical analysis revealed highly significant differences in the average number of infested plants with ***O. nubilalis*** between levels of nitrogen fertilizer during both seasons.

Increase of planting spaces from 20 to 30 cm between hills caused insignificant decrease in the numbers of infested plants and percentages of infestation. The average numbers of infested plants with ***O. nubilalis*** for the three planting spaces, 20, 25 and 30 cm were 9.1±1.9 and 10.2±2.0, 8.6±1.7 and 9.1±1.8 and 7.2±1.4 and 6.8±1.4 /20 plants during two seasons 2006 and 2007, respectively. While, percentages of infestation were 45.4±9.6% and 51.1±9.9% , 43.2±8.5% and 45.4±8.9% and 36.1±7.2% and 33.9±6.9% to three planting spaces during two seasons 2006 and 2007, respectively. The statistical analysis revealed insignificant differences between the three planting spaces during the two successive seasons of study.

INTRODUCTION

Corn (Zea *mays* L.) is an important cereal crop in Egypt and several countries of the world. It acts as an important source of animal and poultry feeding and also for human food. Corn is ranked as the third cereal crop in

the world (F.A.O 1988). Also in Egypt, it is the third cereal crop after rice and wheat.

The area devoted for corn cultivation in Egypt is about 2.0 million feddans annually and the average yield reached about 24.05 ardab / fed. in 2000 season (Ismail, 2001).

Corn plants are attacked by insect pests during all the different stage of plant growth, the European corn borer is the most serious insect pest; Abd El-Rahman *et al.*(1984) and Aguiler *et al.* (1987) .

In the region of Delta, several trials were made to study the seasonal abundance of some corn pests and their natural enemies, effect of planting dates, effect of nitrogen levels, planting spaces ; Semeada *et al.*(1993), Abd El- Gayed (1995), Galal *et al*.(1997), Ahmed (2000), Metwally(2002) and Stepanek *et al.* (2008).

MATERIALS AND METHODS

The present experiments were carried out at the experimental farm of Sakha Agricultural Research station, Kafr El-Sheikh Governorate during two successive seasons; 2006 and 2007 to study the influence of some cultural practices i. e, planting dates, nitrogen fertilizer levels and planting spaces on the european corn borer, *O. nubilalis*. All treatments received the ordinary cultural practices, and no insecticides were used in the two seasons.

1- Influence of planting dates:

Corn was sown earlier than normal, on 20th of April, and at the recommended date was on 1st of June, and later than normal on 20th July. Giza 2 corn cultivar was used in the three planting dates and each date was divided to four replicates. From each corn plantation, twenty plants were sampled weekly for examination starting two weeks after planting until harvesting. In each of the weekly samples, five plants were chosen at random from each of the four plots (replicates).

2- Influence of nitrogen fertilizer levels.

An experiment was conducted on corn plants sown on 20th July during two successive seasons 2006 and 2007. This plantation was selected as the observations indicated that it had the highest european borer damage. The infestation of corn plants with the pests was compared in plots treated with urea (46.5% nitrogen) and other plots having no nitrogen fertilizer. The experiment was divided into 16 plots arranged in a Completely Randomized Design. Three nitrogen fertilizer levels with four replicates each were used. Urea was used at three levels 160, 260 and 360 kg (74, 120 and 166 units) urea /feddan, respectively. Four plots were left without fertilizer as a control. The quantity of fertilizers was added to plants at two equal splits, the first was added three weeks after planting date and the second was added two weeks later (after 36 days from planting). No Pesticides were applied. The weekly examinations started two weeks after sowing. Samples were taken from each treatment (nitrogen fertilizer level) and the percentage of infestation was calculated according to the following formula:

$$\% \text{ of infestation} = \frac{\text{No. of infested plants}}{\text{Total no. of inspected plants}} \times 100$$

3- Influence of planting spaces between hills.

Corn plants were sown on 20th of July in 2006 and 2007 seasons to study the influence of planting spaces on ***O. nubilalis***. The spaces between hills were 20, 25 and 30 cm, and the spaces between rows were 70 cm. The weekly examinations started two weeks after sowing and continued till harvest. Samples were taken from each treatment to calculate the percentage of infestation according to the following formula.

$$\% \text{ of infestation} = \frac{\text{No. of infested plants}}{\text{Total no. of inspected plants}} \times 100$$

The collected data were subjected to statistical analysis according to the Least Significant Differences Test (LSD) ± Standard Error (±SE).

RESULTS AND DISCUSION

1-Influence of planting dates.

Data illustrated in Fig (1) show the population abundance of ***O. nubilalis*** larvae in the three planting dates during 2006 season. It was observed that, in April plantation, larvae of this borer were found in a few numbers in plants of this plantation in June and July . The highest number of larvae reached 2.8 larvae / 5 plants on July 27th. In June plantation, the larvae were detected during August until the end of the season with a peak of 3.8 larvae /5 plants at the last week of August, . In July plantation, the infestation by *O. nubilalis* larvae began on corn plants with an average numbers of 5 larvae / 5 plants on August 24th, about 5 weeks after planting and continued until end of the season. A peak of 34.5 larvae / 5 plants had been recorded in the second week of October.

The data illustrated in Fig (2) show the population abundance of *O. nubilalis* larvae in the three planting dates during season 2007. In April plantation, the numbers of *O. nubilalis* larvae were very slight about (0.8 larvae / 5 plants) on July 13th. Then it increased to reach its peak of 3 larvae / 5 plants in the first week of August. In June plantation, the larvae appeared on July 27th with an average number of 1.5 larvae / 5 plants and reached its peak of 6.3 larvae / 5 plants in the last week of August. In July plantation, larvae began to appear in moderate numbers (6.8 larvae / 5 plants) in the last week of August and increased greatly to reach its peak of 42.5 larvae / 5 plants in the second week of October.

Data presented in Table (1) show the monthly average numbers of ***O. nubilalis*** larvae in the three planting dates during two successive seasons of study 2006 and 2007. The highest average numbers of larvae in April plantation were 4.8±2.3 larvae / 5 plants in July 2006 and 9.0±3.0 larvae / 5 plants in August 2007. In June plantation, the highest average numbers of

larvae were 11.3±1.5 larvae / 5 plants in September, 2006 and 16.5±2.0 larvae / 5 plants in August, 2007. The highest average numbers of larvae in July plantation were 107.8±10.5 and 145.0±9.8 larvae / 5 plants recorded in October 2006 and 2007, respectively.

As a conclusion, data represented in Fig. (1 and 2) and Table (1) indicated that corn plants sown in April plantation were subjected to the least numbers of *O. nubilalis* larvae with average numbers of 1.7±0.9 and 2.1±0.9 while in June plantation, larvae appeared with moderate numbers with averages of 5.0±1.4 and 8.6±2.2 and reached its maximum in July plantation with an average of 54.3±11.5 and 80.5±15.7 larvae/ 5 plants during two successive seasons 2006 and 2007, respectively. The statistical analysis revealed highly significant differences in the number of *O. nubilalis* larvae between the three planting dates during 2006 and 2007 seasons.

The above mentioned results are in agreement with those obtained by Ragab (1988) and Abdallah and Bleih (1994) who found that *O. nubilalis* larvae were more relatively abundant in corn late plantation than in the early one. El-Naggar (1991) found that corn cultivars sown on mid-April were free from the infestation. The rate of infestation tended to increase throughout mid-June and first July. Abd El-Gayed (1995) found that occurrence of *O. nubilalis* on corn began 3-5 weeks later than *Sesamia cretica* and extended until end of the season .Anderson *et al.*(2003) showed that later planting dates of millet were more heavily infested than earlier dates.

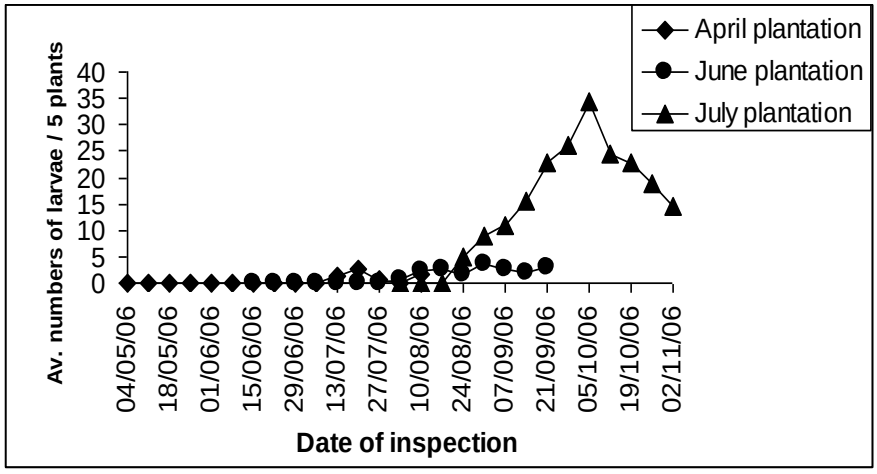

Fig (1) : Population abundance of the European corn borer, *O. nubilalis* larvae / 5corn plants in the three planting dates during 2006 season.

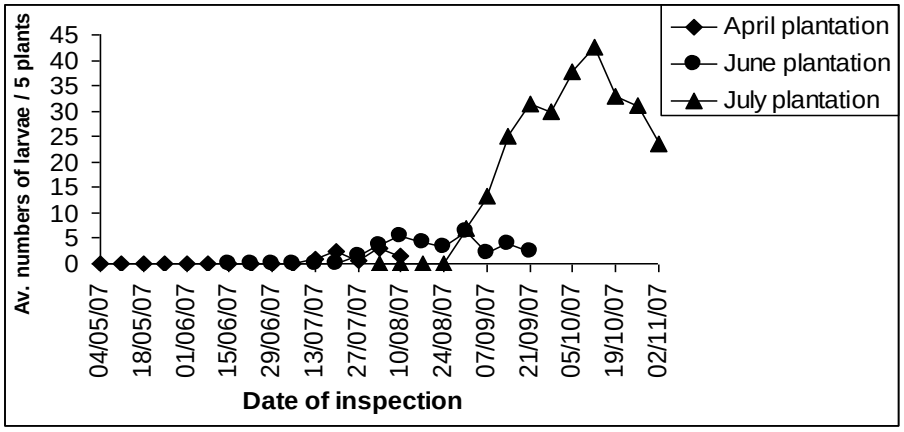

Fig (2) : Population abundance of the European corn borer, *O. nubilalis* larvae / 5 plants in the three planting dates during 2007 season.

Table (1): Monthly average number of the European corn borer, *O. nubilalis* larvae in the three planting dates during 2006 and 2007 seasons.

Month	2006			2007		
	April plantation	June plantation	July plantation	April plantation	June plantation	July plantation
May	0.0	-	-	0.0	-	-
Jun.	0.0	0.0	-	0.0	0.0	-
Jul.	4.8±2.3	0.0	-	3.5±1.5	1.5±1.5	-
Aug.	3.5±3.5	7.5±1.7	0.0	9.0±3.0	16.5±2.0	0.0
Sept.	-	11.3±1.5	50.2±12.5	-	14.3±3.9	85.0±19.6
Oct.	-	-	107.8±10.5	-	-	145.0±9.8
Nov.	-	-	66.5±8.6	-	-	101.0±8.1
Mean±SE	1.7±0.9	5.0±1.4	54.3±11.5	2.1±0.9	8.6±2.2	80.5±15.7
LSD 0.05	2.4			3.2		
0.01	3.1			4.2		
0.001	4.0			5.3		

2. Influence of nitrogen fertilizer.

The data presented in table (2) show influence of nitrogen fertilizer levels on corn infestation with *O. nubilalis* during 2006 season. Increase nitrogen fertilizer levels led to an increase in corn infestation. The infestation appeared on corn plants which were treated with four levels (zero, 160, 260 and 360 kg urea / fed.) on September 7th recording 7, 5, 5 and 4 infested plants and percentages of infestation reached 35, 25, 25 and 20 %, respectively. The infestation increased to reach the maximum on October 19th recording 16, 13, 12 and 9 infested plants and 80, 65, 60 and 45 % as percentages of infestation for the four nitrogen levels, respectively.

The data presented in Table (3) show influence of nitrogen fertilizer levels on the number of infested plants and percentages of infestation with ***O. nubilalis*** during 2007 season. Increase nitrogen fertilizer levels led to an

increase in number of infested plants and percentages of infestation. The infestation appeared on corn plants which were fertilized with four levels (zero, 160, 260 and 360 kg urea / fed.) on September 12th recording 2, 3, 2 and 1 infested plants and 10, 15, 10 and 5 % as percentages of infestation, respectively. The infestation increased to reach the maximum on October 17th recording 18, 15, 15 and 11 infested plants and 90, 75, 75 and 55 % as percentages of infestation for the four nitrogen levels, respectively.

Tables (2 and 3) indicated that increase in nitrogen fertilizer levels from zero up to 360 kg / fed. caused significant increase in the numbers of infested plants and percentages of infestation. When corn plants were supplied with 360, 260, 160 and (zero) kg nitrogen / fed., the average numbers of infested plants were 9.5±1.7 – 8.6±1.7, 7.8±1.5 – 7.6±1.4, 6.5±1.2 – 7.1±1.4 and 4.9±1.0 – 5.4±1.2 / 20 plants during two seasons 2006 and 2007, respectively. While percentages of infestation were 47.7±8.6% – 42.9±8.5%, 39.1 ± 7.5%- 37.9±7.0% , 32.7±6.2% – 35.4±7.2% and 24.5±4.8% – 27.1±5.9 % for the four nitrogen levels during 2006 and 2007 seasons respectively. The statistical analysis revealed highly significant differences between levels of nitrogen fertilizer and the average number of infested plants during both seasons.

Table(2): Influence of nitrogen fertilizer levels on the number of infested plants and percentages of infestation with the European corn borer, *O. nubilalis* during 2006 season.

N Level kg/fed.	360 N/fed.		260 N/fed		160 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 %
Aug. 24	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0
Sept. 7	7	35	5	25	5	25	4	20
14	6	30	3	15	5	25	2	10
21	11	55	9	45	6	30	5	25
28	15	75	12	60	10	50	5	25
Oct. 5	13	65	12	60	12	60	7	35
12	15	75	11	55	9	45	6	30
19	16	80	13	65	12	60	9	45
26	10	50	11	55	7	35	7	35
Nov. 2	12	60	10	50	6	30	9	45
Total	105		86		72		54	
Mean±SE	9.5± 1.7	47.7± 8.6	7.8± 1.5	39.1± 7.5	6.5± 1.2	32.7± 6.2	4.9± 1.0	24.5± 4.8
LSD 0.05	0.6							
0.01	0.8							
0.001	1.1							

These results agree with those obtained by Manuwoto and Scriber (1985) who observed that the growth rate of 5th – instar larvae of *O. nubilalis* increased with corn nitrogen content. Farag *et al.* (1991) found that the number of *O. nubilalis* larvae, entrance holes and infested ears reached its maximum values on maize cultivars supplied with 120 kg N/fed. Nawar *et al.* (1992) found that increasing nitrogen level from 60 to 120 kg N / fed. caused

a significant increase of corn infestation rate with corn borer. Galal *et al*. (1997) found that the number of holes / 100 corn internodes differed from one year to another and increased with increasing the nitrogen levels. Bartos and Michalski (2006) found that increasing nitrogen rates increased the losses caused by this insect.

Table(3): Influence of nitrogen fertilizer levels on the number of infested plants and percentages of infestation with the European corn borer, *O. nubilalis* during 2007 season.

N Level kg/fed.	360 N/fed.		260 N/fed		160 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 %
Aug. 29	0	0	0	0	0	0	0	0
Sept. 5	0	0	0	0	0	0	0	0
12	2	10	3	15	2	10	1	5
19	5	25	5	25	5	25	2	10
26	6	30	8	40	7	35	7	35
Oct. 3	9	45	9	45	11	55	8	40
10	13	65	12	60	10	50	9	45
17	18	90	15	75	15	75	11	55
24	15	75	14	70	13	65	7	35
31	12	60	10	50	7	35	10	50
Nov. 7	13	65	7	35	11	55	2	10
14	10	50	8	40	4	20	8	40
Total	103		91		85		65	
Mean±SE	8.6± 1.7	42.9± 8.5	7.6± 1.4	37.9± 7.0	7.1± 1.4	35.4± 7.2	5.4± 1.2	27.1± 5.9
LSD 0.05	0.6							
0.01	0.8							
0.001	1.1							

3. Influence of planting spaces.

Data presented in Table (4) show influence of planting spaces on the number of infested plants and percentages of infestation with *O. nubilalis* during 2006 season. The obtained results showed that increasing of spaces between hills led to a decrease in *O. nubilalis* infestation. The infestation began in the last week of August and reached its maximum in the first week of October in the three tested spaces (20, 25 and 30 cm between hills) Whereas, the highest infestation was recorded in the planting space, 20 cm reaching 19 infested plants/ 20 plants(95% as rate of infestation) while, the lowest infestation was recorded in space, 30 cm recording 15 infested plants (75%).

Data presented in Table (5) show influence of planting spaces on the number of infested plants and percentages of infestation with *O. nubilalis* during 2007 season. The obtained results showed that, increasing of spaces between hills led to a decrease in *O. nubilalis* infestation. The infestation began in the last week of August and reached its maximum in the second week of October in both planting spaces, 20 and 25 cm, while space 30 reached its maximum in the fourth week of September. The highest infestation was detected in 20 cm planting space, recording one hundred

percent of infestation and the lowest infestation was recorded in space, 30 cm reaching 13 infested plants (65%).

As a conclusion, increase planting of spaces from 20 to 30 cm between hills caused insignificant decrease in the numbers of infested plants and percentages of infestation. The average numbers of infested plants with *O. nubilalis* for the three planting spaces, 20, 25 and 30 cm were 9.1±1.9 – 10.2±2.0 , 8.6±1.7– 9.1±1.8 and 7.2±1.4– 6.8±1.4 / 20 plants during two seasons 2006 and 2007, respectively. While, percentages of infestation were 45.4±9.6% – 51.1±9.9%, 43.2±8.5% - 45.4±8.9% and 36.1±7.2% – 33.9±6.9% to the three planting spaces during two seasons 2006 and 2007, respectively. The statistical analysis indicated that, there were insignificant differences between three planting spaces during the two successive seasons of study 2006 and 2007.

This result disagrees with that obtained by Gerginov and Iordanov (1975) who found that greater planting density lowers the percentage and extent of *O. nubilalis* attack but raises the number of insects per land unit. It is not economically justifiable to grow maize at a low density in order to prevent infestation.

Table (4): Influence of planting spaces on the number of infested plants and percentages of infestation with the European corn borer, *O. nubilalis* during 2006 season.

Planting spaces	20 cm		25 cm		30 cm	
Date of inspection	No. of infested plants	Infestation %	No. of infested plants	Infestation %	No. of infested plants	Infestation %
Aug. 3	0	0	0	0	0	0
10	0	0	0	0	0	0
17	0	0	0	0	0	0
24	0	0	0	0	0	0
31	3	15	5	25	4	20
Sept. 7	8	40	9	45	8	40
14	12	60	11	55	10	50
21	16	80	13	65	11	55
28	14	70	15	75	11	55
Oct. 5	19	95	16	80	15	75
12	11	55	13	65	10	50
19	17	85	12	60	12	60
26	12	60	15	75	9	45
Nov. 2	15	75	12	60	11	55
Total	127		121		101	
Mean±SE	9.1±1.9	45.4±9.6	8.6±1.7	43.2±8.5	7.2±1.4	36.1±7.2
LSD	ns					

Table (5): Influence of planting spaces on the number of infested plants and percentages of infestation with the European corn borer, *O. nubilalis* during 2007 season.

Planting spaces	20 cm		25 cm		30 cm	
Date of inspection	No. of infested plants	Infestation %	No. of infested plants	Infestation %	No. of infested plants	Infestation %
Aug. 3	0	0	0	0	0	0
10	0	0	0	0	0	0
17	0	0	0	0	0	0
24	0	0	0	0	0	0
31	7	35	6	30	4	20
Sept. 7	12	60	11	55	11	55
14	17	85	9	45	9	45
21	17	85	16	80	13	65
28	15	75	13	65	10	50
Oct. 5	13	65	15	75	11	55
12	20	100	17	85	13	65
19	15	75	12	60	8	40
26	16	80	13	65	5	25
Nov. 2	11	55	15	75	11	55
Total	143		127		95	
Mean ±SE	10.2±2.0	51.1±9.9	9.1±1.8	45.4±8.9	6.8±1.4	33.9±6.9
LSD	ns					

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تأثير بعض العمليات الزراعية علي اصابة الذرة بحفار ساق الذرة الاوربي .

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**** معهد بحوث وقاية النباتات – محطة البحوث الزراعية بسخا – مركز البحوث الزراعية – الدقى**

أجريت هذه الدراسة علي مدار موسمين متتاليين (2006, 2007) في المزرعة البحثية لمحطة البحوث الزراعية بسخا بمركز البحوث الزراعية لدراسة تأثير بعض المعاملات الزراعية (مواعيد الزراعة- التسميد النتروجيني – مسافات الزراعة) علي اصابة الذرة بحفار ساق الذرة الأوربي كما يلي:

تعرضت نباتات الذرة المنزرعة في عروة ابريل لأقل إصابة بهذه الحشرة حيث بلغ متوسط أعدادها 1.9±0.9 و 2.1± 0.9يرقة / 5 نباتات ثم ظهرت يرقات هذه الحشرة بأعداد متوسطة في عروة يونيه وذلك بمتوسط 5±1.4 و 8.6±2.2 يرقة / 5 نباتات ثم وصلت الإصابة لأعلي معدل لها في عروة يوليه بمتوسط 54.3±11.5 و 80.5±15.7 يرقة / 5 نباتات خلال موسمي الدراسة 2006 و 2007 علي التوالي. وقد اظهر التحليل الإحصائي وجود فروق عالية المعنوية بين متوسط أعداد اليرقات في المواعيد الثلاثة.

أدت زيادة معدلات التسميد النتروجيني من صفر إلي 360 كجم نتروجين/ فدان إلي زيادة معنوية في عدد النباتات المصابة ونسبة الإصابة بدودة الذرة الأوربية. عند تسميد نباتات الذرة بـ 360و 260 و 160 و صفر كجم / فدان فان متوسط عدد النباتات المصابة بدودة الذرة الأوربية كـــان (9.5±1.7- 8.6±1.7) و (7.8±1.5- 7.6±1.4) و (6.5±1.2- 7.1±1.4) و (4.9±1 – 5.4±1.2) / 20 نبات خلال موسمي الدراسة 2006 و 2007 علي التوالي. بلغت نســبة الإصــابة المئويــة (47.7±8.6 – 42.9±8.5%) و (39.1±7.5- 37.9±7%) و (32.7±6.2 – 35.4±7.2%) و (24.5±4.8- 27.1±5.9%) لمستويات التسميد الأربعة خلال موسمي الدراسة علي التوالي. اظهر التحليل الإحصائي وجود فروق عالية المعنوية في عدد النباتات المصابة بدودة الذرة الأوربية بين مستويات النتيروجين.

أدت زيادة مسافة الزراعة بين الجور من 20 الي 30 سم إلي خفض غير معنوي في عدد النباتات المصابة ونسبة الإصابة بدودة الذرة الأوربية. حيث بلغ عدد النباتات المصابة بدودة الــذرة الأوربيــة لمســافات الزراعــة الثلاثــة 20و 25 و 30 ســم (9.1±1.9-10.2±2) و (8.6±1.7- 9.1±1.8) و (7.2±1.4 – 6.8±1.4) / 20نبــات خــلال موســمي الدراســة 2006و2007 علي التوالي. بينما سجلت نسب الإصابة المئوية (45.4±9.6- 51.1±9.9%) و (43.2±8.5- 45.4±8.9%) و (36.1±7.2- 33.9±6.9%) لمسافات الزراعة الثلاثة خلال عامي الدراسة علي التوالي. ويشير التحليل الإحصائي إلي وجود فروق غير معنوية بين مسافات الزراعة الثلاثة خلال موسمي الدراسة .

قام بتحكيم البحث

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