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INFLUENCE OF SOME AGRICULTURAL PRACTICES ON INFESTATION OF CANOLA, *BRASSICA NAPUS* (L.) WITH THE CABBAGE APHID, *Brevicoryne brassicae* (LINN.) (HOMOPTERA, APHIDIDAE) AND YIELD LOSSES OF THREE CANOLA VARIETIES IN UPPER EGYPT

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ABSTRACT

Effects of four sowing dates (1st October, 15th October, 1st November and 15th November), three nitrogen fertilization levels (30, 45 and 60 kg/fed.) and two potassium fertilization levels (24 and 48 kg/fed.) on infestation of canola plants *Brassica napus* (L.) with the cabbage aphid, *B. brassicae* were studed. In addition, yield losses of three canola genotypes due to aphid infestation were estimated at Shandaweel Agric. Res. St., Sohag Governorate, Upper Egypt during 2004/2005 and 2005/2006 growing seasons. The obtained results indicated that infestation with *B. brassicae* increased by delaying sowing dates during both seasons. The effect of planting dates 1st Oct., and 15th Oct., exhibited the lowest rate of infestation with *B. brassicae* during both seasons. Infestation with *B. brassicae* significantly increased by increasing nitrogen fertilization levels during both seasons. On the contrary, infestation with *B. brassicae* significantly decreased by increasing potassium fertilization levels during both seasons. The results of interactions among the different treatments, sowing dates x nitrogen fertilization levels, sowing dates x potassium fertilization levels, nitrogen x potassium fertilization levels and sowing dates x nitrogen levels x potassium levels had a significant effect on the population density of *B. brassicae* during both seasons. Also, the interactions between the early sowing date (1st Oct.) x N level (30 kg/fed.), the early sowing date (1st Oct.) x K level (48 kg/fed.), N level (30 kg/fed.) x K level (48 kg/fed.) and the early sowing date (1st Oct.) x N level (30 kg/fed.) x K level (48 kg/fed.) recorded the lowest aphid population density during both seasons. In spite of the treatments 1st Oct. x 30 kg N/fed. and 48 kg K/fed. achieved the lowest aphid infestation during both seasons, so according to recommendations of the Ministry of Agriculture, they gave low yield. Therefore, the treatments 15th Oct. x 45 kg N/fed. and 48 kg K/fed. were suitable for giving a low aphid infestations and a high yield at the same time. There was a highly significant positive correlation between aphid numbers and yield loss of the three canola genotypes during 2005 and 2006 seasons and there were insignificant differences among the three genotypes during both seasons.

Key words: *agricultural practices, yield losses, Brassica napus, Brevicoryne brassicae,*

1. INTRODUCTION

Canola (*Brassica napus* L.) is one of the newly introduced oil crops in Egypt. Canola was introduced recently to contribute in reducing oil shortage, especially it could be cultivated in soils affected by salinity. Oil seed rape is one of the important oil crops all over the world. It has the third position in world oil production crops, second position in total world area for oil crops and the fifth in world international trade for crops (Kandil *et al.,* 1996). Rape seed has a bright future in Egypt because of its ability to grow in the newly reclaimed lands under wide soil variation as drought and salinity as revealed by some Egyptian investigators (Kandil *et al.,* 1996). Canola cultivation is recommended for increasing the total oil production to bridge the gab between production and consumption from

edible oil. The majority of local edible oil production, in Egypt, which comes from cotton seed does not cover the total needs of oil production. Canola has gained much attention in order to meet the increasing demand from oil.

Canola crop is attacked by several insect pests among which the cabbage aphid, *Brevicaryne brassicae* (L.) represents the most serious pest (Ali and Munir 1984). Aphids suck the plant sap from the leaves and inflorescence and deform them. In severe infestation, plants are densely covered with aphids causing stunting growth and poor pod formation (Maiti *et al.*, 1988). In rape and mustard seeds, 50-75% reduction in yield has been attributed to aphid infestation (Beg, 1982). Canola is the host of 21 insect pest species in the world (Lamb, 1989), among which aphid dominates the others (Weber *et al.*, 1991).

The present study was conducted to clarify the effect of sowing dates, nitrogen and potassium fertilization levels and the interaction among these treatments on the infestation of canola plants by the cabbage the aphid, *B. brassicae*, and also, to estimate the yield loss due to aphid infestation.

2. MATERIALS AND METHODS

2.1. Experiment 1:

Field experiment was conducted to study the effect of sowing dates, nitrogen and potassium fertilization levels on the population density of *B. brassicae* at Shandaweel Agric. Res. St., Sohag Governorate during 2004/2005 and 2005/2006 canola growing seasons. A split-split plot design with four replicates was employed. Sowing dates 1st Oct., 15th Oct. (recommended), 1st Nov. and 15th Nov., nitrogen fertilization levels 30, 45 (recommended) and 60 kg/fed. and potassium fertilization levels 24 (recommended) and 48 kg/fed. were randomly assigned to the main, sub and sub-sub plots, respectively. Seeds of canola genotype (Pactol) were cultivated at a rate of 3 kg/fed. three seeds were sown on one side of the ridge at 20 cm hill spacing. After complete emergence, the plants were thinned to one plant per hill. The experimental unit was 10.5 m^2 (1/400 of fed.). Nitrogen fertilizer was used in the form of the urea (46.50% N) and applied in three equal doses, the first, during sowing the second, when 3-4 leaves appeared and the third, when flower buds started to appear. Phosphorus fertilizer (in the form of super phosphate 15% P_2O_2) was used with a rate of 30 kg P_2O_2 /fed. and applied during the time of land preparation. Potassium fertilization (in the form of potassium sulfate 24% K_2SO_4) and applied when 3-4 leaves appeared. Normal recommended cultural practices followed uniformly, and insecticides were entirely avoided. 10 cm of 5 apical racemes (5 racemes/replicate) were randomly selected at 7-day intervals. Samples were transferred to the laboratory for inspection. The number of aphid was recorded. Data analysis was performed by analysis of variance and means were compared by using Duncan's Multiple Range test (1955).

2.2. Experiment 2:

Canola losses due to aphid infestation under field conditions were carried out at the farm of Shandaweel Agricultural Research Station, Sohag Governorate. correlation between the population density of aphids on three canola genotypes (Pactol, Serw 4 and Serw 6) and yield losses during 2005 and 2006 seasons was conducted. The experimental area was divided into plots, each 1/100 fed. (6 m x 7 m). Each tested genotype was replicated three times in a complete randomized block design. The seeds of the tested genotypes were sown on 15th Oct. during both seasons. Normal agricultural practices were carried out without any insecticidal treatment throughout the whole growing season, 10 cm of 5 apical racemes were collected weekly at random from each plot.

To estimate the yield loss due to aphid infestation, malathion 57% EC was applied at 10 day intervals before appearance of any aphid infestation in half of each genotype replicates to avoid any aphid infestation. At harvest, the seeds were weighted and the percentage of yield loss was calculated according to Walker (1983):

$$W = \frac{m - y}{m} \times 100$$

Where : W is the percentage of yield loss.m is the yield in the absence of aphids, and y is the yield in the presence of aphids, infestation.

In addition, simple correlation coefficient (r) between the mean numbers of aphids / 10 cm of 5 apical raceme and yield losses were estimated according to the following equation:

$$r = \frac{\sum xy - \sum x \sum y / n}{\sqrt{[\sum x^2 - (\sum x)^2 / n][\sum y^2 - (\sum y)^2 / n]}}$$

3. RESULTS AND DISCUSSION

3.1. Effect of sowing dates on the population density of *B. brassicae* infesting canola plants irrespective of nitrogen and potassium fertilization levels:

Table (1) indicates the mean numbers of the cabbage aphid, *B. brassicae* per 10 cm of 5 apical racemes at four sowing dates 1st Oct., 15th Oct., 1st Nov. and 15th Nov. during 2005 and 2006 growing seasons. The mean numbers of *B. brassicae* significantly increased by delaying sowing date in both seasons. The late sowing date (15th Nov.) caused high aphid infestation and resulted in mean numbers of 321.17 and 214.79 aphids/10 cm of 5 apical racemes during 2005 and 2006 seasons, respectively. The lowest population density of *B. brassicae* was observed on the first sowing date 1st Oct., recorded 150.25 and 122.54 aphids/10 cm of 5 apical racemes during 2005 and 2006 seasons, respectively. These results are in conformity with those of Shafique *et al.*, (1999), Saljoqi *et al.*, (2001) and Ahmed (2006), who found that *B. brassicae* significantly increased in the late sowing date.

3.2. Effect of nitrogen fertilization levels on the population density of *B. brassicae* infesting canola plants regardless of sowing dates and potassium fertilization levels:

Table (1) shows that the infestation of canola plants by *B. brassicae* during 2005 and 2006 seasons, significantly increased with the increase of nitrogen supply. It is obvious that infested plants treated with 60 kg/fed. differed significantly from 30 kg/fed. and 45 kg/fed. separately. Also,the data of 2005 and 2006 seasons referred that the nitrogen level (30 kg/fed.) harboured the least number of aphids (170.47 and 98.22 aphids/10 cm of 5 apical racemes), respectively. Whereas, those of N 60 kg/fed. had the highest number of aphids (313.41 and 267.88 aphids/10 cm of 5 apical racemes) in the two seasons, respectively. Regarding the recommended rate N 45 kg/fed. the plants less suffered from an intermediate infestation than the highest fertilization levels. These results are in agreement with those of Khattak *et al.*, (1996), Choudhary *et al.*, (2001) and Ahmed (2006) who found that increasing of nitrogen levels resulted in increase of *B. brassicae* on canola plants.

3.3. Effect of potassium fertilization levels on the population density of *B. brassicae* infesting canola plants irrespective of sowing dates and nitrogen fertilization levels:

The data presented in Table (1) demonstrated the effect of two potassium fertilization levels on the population density of *B. brassicae* infesting canola plants during 2005 and 2006 seasons. The tested two potassium fertilization levels were 24 kg K_2SO_4/fed. (recommended) and 48 kg K_2SO_4/fed.

Statistical analysis of the data revealed significant differences between the two potassium fertilization levels during both seasons. The results show that increasing of potassium level was accompanied by decreasing in aphid incidence during the two seasons. Canola plants received the higher level of potassium (48 kg/fed.) harboured significantly the lower density of aphid population (198.08 and 145.90 aphids/10 cm of 5 apical racemes during 2005 and 2006 seasons, respectively). On the contrary, the plants fertilized by 24 Kg of potassium attracted the highest number of aphids (279.77 and 193.29 aphids/10 cm of 5 apical racemes during 2005 and 2006 seasons, respectively). These results are partially in harmony with those reported by White (1978) who mentioned that the scarcity of potassium in the diet of many insect species is one of the major factors which limit their growth, development and reproductive success. Ciewci *et al.*, (1999) found that the use of potassium fertilizer improved the pest resistance of rice plants and reduced the damage caused by the brown plant hopper, *Nilaparvata lugens*. Boica and Alonsa (2000) stated that the life cycle of insects increased in the presence of potassium.

Hulesman *et al.*, (2000) found that there were significant negative correlation between the total pest and sucking pest population and potassium level in the soil in sweet potato crops. Das and Dutta (2001) mentioned that the K content of leaves exhibited significant negative correlation with the population density of *Aphis craccivora* (Koch). Parihar and Upadhyay (2001) found that increasing of K fertilization rates resulted in the decrease of incidence in leafhoppers and mites in potato crops. Ul-Hag and Van (2001) reported that wheat grown in sand and vermiculate soil with high potassium proved to be a limiting factor for aphid growth and development. El-Metwally *et al.*, (2002) and Ahmed (2004) mentioned that there was a significant decrease on the population of the red-striped soft scale insect, *Pulvinaria tenuivalvata* (Newstead) infesting sugarcane due to increasing levels of potassium.

3.4. Interaction effect among sowing date, nitrogen and potassium fertilization levels on the population density of *B. brassicae* infesting canola plants:

There were significant interactions between sowing date x N level (Table 2), sowing date x K level (Table 3), N level x K level (Table 4) and sowing date x N level x K level (Table 1) during 2005 and 2006 seasons.

Irrespective of potassium levels (Table 2) both the sowing date and N level affected the aphid infestation. The lowest aphid population density (100.38 and 65.38 aphids/10 cm of 5 apical racemes) recorded during 2005 and 2006 seasons, respectively) occurred at N-fertilization level of 30 Kg N/fed. at the first sowing date 1st October, while the highest population density (413.13 and 318.75 aphids/10 cm of 5 apical racemes) was achieved at the level of 60 Kg N/fed. at the fourth sowing date 1st November during both seasons, respectively. Regardless of nitrogen levels, both sowing date x K level influenced the aphid infestation (Table 3), the lowest aphid population density (104.58 and 98.83 aphids/10 cm of 5 apical racemes) took place under K 48 kg/fed. at the early sowing date (1st Oct.,) during 2005 and 2006 seasons, respectively, while the maximum aphid populations (366.75 and 233.92 aphids/10 cm of 5 apical racemes) was recorded at K 24 kg/fed. at the fourth sowing date.

Regardless of sowing dates, every two parameters of nitrogen and potassium levels (Table 4) affected the aphid infestation. The lowest numbers of aphids (125.56 and 76.94 aphids/10 cm of 5 apical racemes) were recorded on the plants, fertilized by N 30 kg/fed. and K 48 kg/fed., during 2005 and 2006 seasons, respectively, whereas, the highest numbers of aphids (353.00 and 292.06 aphids/10 cm of 5 apical racemes) were recorded on the plants, fertilized by N 60 kg/fed. and K 24 kg/fed., during 2005 and 2006 seasons, respectively.

Finally, concerning sowing date x N level x K level (Table 1), it is clear that the plants, cultivated on (Oct. 1st) and fertilized by 30 units N/fed. and 48 units K/fed. had the lowest number of aphids (80 and 50.75 aphids/10 cm of 5 apical racemes) during 2005 and 2006 seasons, respectively, whereas the plants, sown on (Nov., 15th) and fertilized by 60 units N/fed. and 24 units K/fed. harboured the highest number of aphids (450.25 and 337.50 aphids/10 cm of 5 apical racemes) during 2005 and 2006 seasons, respectively.

The forementioned results coincide with those of Narayanasamy *et al.* (1976), who found that the high levels of potassium reduced the population density of the green leafhopper *Nephotettix virescens* (Dist.) on rice plants. Also, Perrenoud (1977) found that the application of potassium reduced mite population. Tabola *et al.*, (1994) found that the application of N fertilizer increased *B. brassicae* on oil seed rape cultivars. In addition, Prasad and Lal (2001) demonstrated that the population of mustard aphid *Lipaphis erysimi* was lower in early sown than in late sown mustard plants. Choudhary *et al.*, (2001) found that increasing N fertilizer levels resulted in increasing of mustard aphid, *Lipaphis erysimi* and *Myzus persicae* on Brassicae species. Karmakar (2003) reported that the mustard aphid, *Lipaphis erysimi* was lower on early sown rape and mustard plants in comparison with the late sown plants. Ahmed (2006) referred that canola plants sown early supported the lowest numbers of *B. brassicae*, however, canola plants, sown lately harboured the highest numbers of aphids.

Table (1): Effect of sowing date, nitrogen and potassium fertilization levels on the population density of *B. brassicae* infesting canola plants (No. aphids /10 cm of 5 apical racemes) during 2005 and 2006 seasons.

Sowing date	2005 season						
	Avg. no. aphids /10 cm of 5 apical racemes						
	N levels (kg /fed.)						Mean No.
	30		45		60		
	K levels (kg /fed.)						
	K24	K48	K24	K48	K24	K48	
1st Oct.	120.75 a	80.00 a	191.50 b	110.00 a	275.50 d	123.75 a	150.25 a
15th Oct.	180.50 b	101.75 a	230.75 c	165.75 b	305.75de	295.50 d	213.33 b
1st Nov.	270.25 d	140.50ab	301.50 d	233.00 c	380.50 f	300.00de	270.96 bc
15th Nov.	290.00 d	180.00 b	360.00 f	270.75 d	450.25 g	376.00 f	321.17 c
N levels (kg/fed.)	170.47 a		232.91 b		313.41 c		
K levels (kg /fed.) 24	279.77 b						
K levels (kg /fed.) 48	198.08 a						

Sowing date	2006 season						
	Avg. no. aphids /10 cm of 5 apical racemes						
	N levels (kg /fed.)						Mean No.
	30		45		60		
	K levels (kg /fed.)						
	K24	K48	K24	K48	K24	K48	
1st Oct.	80.00 a	50.75 a	130.00ab	75.50 a	228.75 d	170.25bc	122.54 a
15th Oct.	104.75 a	60.00 a	160.00bc	100.25 a	290.25 e	215.50 d	155.13 ab
1st Nov.	131.50ab	85.25 a	180.75bc	117.25 a	311.75 ef	289.00 e	185.92 bc
15th Nov.	161.75bc	111.75ab	202.50cd	175.25bc	337.50 f	300.00 e	214.79 c
N levels (kg/fed.)	98.22 a		142.69 ab		267.88 c		
K levels (kg /fed.) 24	193.29 b						
K levels (kg /fed.) 48	145.90 a						

Means within each column followed by the same letter(s) are not significantly different at the 0.05 level of probability.

Table (2): Interactions effect of sowing dates and nitrogen fertilization levels regardless of potassium fertilization levels on the population density of *B. brassicae* infesting canola plants (No.aphids /10 cm of 5 apical racemes) during 2005 and 2006 growing seasons.

Sowing dates	2005 season		
	Avg. no. aphids /10 cm of 5 apical racemes		
	N levels (kg/fed.)		
	30	45	60
1st Oct.	100.38a	130.75 a	199.63 b
15th Oct.	141.13 a	198.25 b	300.63 d
1st Nov.	205.38 b	267.25 cd	340.25 de
15th Nov.	235.00 bc	315.38 d	413.13 f

Sowing dates	2006 season		
	Avg. no. aphids /10 cm of 5 apical racemes		
	N levels (kg/fed.)		
	30	45	60
1st Oct.	65.38 a	102.75 ab	199.50 cd
15th Oct.	82.38 a	130.13 bc	252.88 de
1st Nov.	108.38 ab	149.00 bc	300.38 ef
15th Nov.	136.75 bc	188.88 c	318.75 f

Means within each column followed by the same letter(s) are not significantly different at the 0.05 level of probability.

Table (3): Interactions effect of sowing dates and potassium fertilization levels regardless of nitrogen fertilization levels on the population density of *B. brassicae* infesting canola plants (No. aphids /10 cm of 5 apical racemes) during 2005 and 2006 growing seasons.

Sowing dates	2005 season	
	Avg. no. aphids /10 cm of 5 apical racemes	
	K levels (kg/fed.)	
	24	48
1st Oct.	195.92 b	104.58 a
15th Oct.	239.00 bc	187.67 b
1st Nov.	317.42 d	224.5 bc
15th Nov.	366.75 d	275.58 bc
	2006 season	
Sowing dates	Avg. no. aphids /10 cm of 5 apical racemes	
	K levels (kg/fed.)	
	24	48
1st Oct.	146.25 ab	98.83 a
15th Oct.	185.00 bc	125.25 ab
1st Nov.	208.00 d	163.83 bc
15th Nov.	233.92 d	195.67 cd

Means within each column followed by the same letter(s) are not significantly different at the 0.05 level of probability.

Table (4): Interactions effect of nitrogen and potassium fertilization levels regardless of sowing dates on the population density of *B. brassicae* infesting canola plants (No. aphids /10 cm of 5 apical racemes) during 2005 and 2006 seasons.

N levels (kg/fed.)	2005 season	
	Avg. no. aphids /10 cm of 5 apical racemes	
	K levels (kg/fed.)	
	24	48
30	215.38 bc	125.56 a
45	270.94 c	194.28 b
60	353.00 d	273.81 c
	2006 season	
N levels (kg/fed.)	Avg. no. aphids /10 cm of 5 apical racemes	
	K levels (kg/fed.)	
	24	48
30	119.5 ab	76.94 a
45	168.31 bc	117.06 ab
60	292.06 d	243.69 d

Means within each column followed by the same letter(s) are not significantly different at the 0.05 level of probability.

Table (5): Seed yield loss due to aphid infestation in canola plants during 2005 and 2006 growing seasons.

Season	Genotype	Avg. no. aphids /10 cm of 5 apical racemes (x)	Yield kg/fed.		Yield loss (%) (y)
			In the presence of aphid	In the absence of aphid	
2005	Pactol	270.80 a	513.12	1251.67	60.00
	Serw 4	240.35 a	800.60	1300.11	38.42
	Serw 6	220.87 a	701.45	1112.89	36.97
2006	Pactol	189.17 a	500.90	1100.70	54.49
	Serw 4	167.33 a	825.23	1325.18	37.73
	Serw 6	145.40 a	905.14	1405.12	35.58

Means within each column followed by the same letter(s) are not significantly different at the 0.05 level of probability.

3.5- Canola seed yield losses due to aphid infestation :

The results summarized in Table (5) represent the yield losses caused by aphid infestation in 3 canola genotypes during 2005 and 2006 seasons .There were insignificant differences among the 3 genotypes in both seasons. The percentage of yield loss due to aphid infestation ranged from 60 to 36.97% and 54.49 to 35.38% during both seasons.

Correlation values between average number of aphids and yield loss was (r = 0.942** (2005 season) and r = 0.913** (2006 season).

From the results in Table (5), it could be concluded that the relationship between aphid numbers and yield loss was clear, since the highest yield loss (60 and 54.49%) was obtained in the case of Pactol genotype which received the highest numbers of aphids (270.80 and 220.87 aphids/10 cm of 5 apical racemes) during 2005 and 2006 seasons, respectively. On the other hand, Serw 6 that exhibited the lowest number of aphids (220.87 and 145.40 aphids/ 10 cm of 5 apical racemes) recorded a decrease in yield (36.97 and 35.52%) during 2005 and 2006 seasons, respectively. So, it could be deduced that the aphid infestation had an important effect on the yield loss. According to the obtained data (Table 5), there is a highly significant positive correlation between aphid infestation and yield loss in the 3 genotypes (r = 0.942** and 0.913**) during both seasons, respectively. These results are in agreement with those obtained by Khattak *et al.*, (1996), who stated that aphid infestation was not significantly affected by cultivar of seed rape, while Raj *et al.* (1996) found significant differences among ten varieties of cruciferous oil seed. Beg (1982) mentioned that, in rape and mustard seeds, 50-75% reduction in yield has been attributed to aphid infestation. Buntin and Raymer (1994) and Atwal and Dhaliwal (1998) stated that in the case of severe infestation to canola plants with *B. brassicae*, yield may be reduced up to 35%.

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تأثير بعض العمليات الزراعية على إصابة نباتات الكانولا بمنّ الكرنب *Brevicoryne brassicae* فى مصر العليا مع تقدير الفقد فى المحصول لثلاثة أصناف

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ملخـــــص

دُرس تأثير أربعة مواعيد زراعة (١ أكتوبر, ١٥ أكتوبر, ١ نوفمبر و١٥ نوفمبر) وثلاثة مستويات مختلفة منّ التسميد النيتروجينى (٣٠, ٤٥ و٦٠ كجم/فدان) ومستويين مختلفين من التسميد البوتاسى (٢٤ و٤٨ كجم/فدان) على إصابة نباتات الكانولا بمنّ الكرنب ا بمحطة البحوث الزراعية بجزيرة شندويل ــ محافظة سوهاج ــ مصر العليا, خلال موسمى ٢٠٠٤/٢٠٠٥ و ٢٠٠٥/٢٠٠٦م. كما تم تقدير الفقد فى المحصول لثلاثة أصناف هى باكتول ، سرو ٤ ، سرو ٦ خلال نفس المواسم . وقد أظهرت النتائج زيادة الإصابة بحشرة منّ الكرنب معنوياً عند التأخير فى الزراعة . كما تزداد الإصابة بحشرة المنّ معنوياً بزيادة الجرعات المستخدمة من السماد النيتروجينى وعلى العكس من ذلك فقد وجد أن الإصابة بحشرة المنّ تقل بزيادة الجرعات المرتفعة من التسميد البوتاسى وذلك خلال موسمي الدراسة ٢٠٠٤/٢٠٠٥ ، ٢٠٠٥/٢٠٠٦م. أظهرت نتائج التفاعلات المشتركة بين المعاملات المختلفة بين مواعيد الزراعة × مستويات التسميد النيتروجينى ، مواعيد الزراعة × مستويان التسميد البوتاسى ، المستويات المختلفة من التسميد النيتروجينى مع المستويين المختلفين من التسميد البوتاسى ، التفاعل بين مواعيد الزراعة × المستويات المختلفة من السماد النيتروجينى × المستويان المختلفان من السماد البوتاسى تأثيرا معنوياً على كثافة أعداد المنّ على نباتات الكانولا خلال موسمي الدراسة . تم تسجيل اقل كثافة عددية للمنّ فى حالة التفاعل بين ميعاد الزراعة المبكر (١ أكتوبر) × مستوى التسميد النتروجينى (٣٠ كجم/فدان) وميعاد الزراعة المبكر (١ أكتوبر) × مستوى التسميد البوتاسى (٤٨ كجم/فدان) ومستوى التسميد النتروجينى (٣٠ كجم/فدان) × مستوى التسميد البوتاسى (٤٨ كجم/فدان) بالإضافة إلى التفاعل المشترك بين ميعاد الزراعة المبكر × مستوى التسميد النتروجينى (٣٠ كجم/فدان) × مستوى التسميد البوتاسى [$\sum y^2 - (\sum y)^2 / n$] ٤٨ كجم/فدان). ووفق ما تم الحصول عليه من نتائج فإنه يجب إتباع توصيات وزارة الزراعة والتى توصى بزراعة نباتات الكانولا فى نصف أكتوبر مع التسميد النيتروجينى بالمعدل ٤٥ كجم نتروجين/فدان مع إضافة ٤٨ كجم بوتاسيوم/فدان وذلك لخفض الإصابة بحشرة منّ الكرنب وإعطاء محصول عالى من البذرة للفدان بمصر العليا. ولقد لوحظ عدم وجود فروق معنوية للإصابة بمنّ الكرنب على ثلاثة أصناف من الكانولا هى باكتول ، سرو ٤ وكذلك سرو ٦ . و كان هناك إرتباط موجب عالى المعنوية بين أعداد المنّ والفقد فى المحصول خلال عامى ٢٠٠٥ ، ٢٠٠٦م.

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