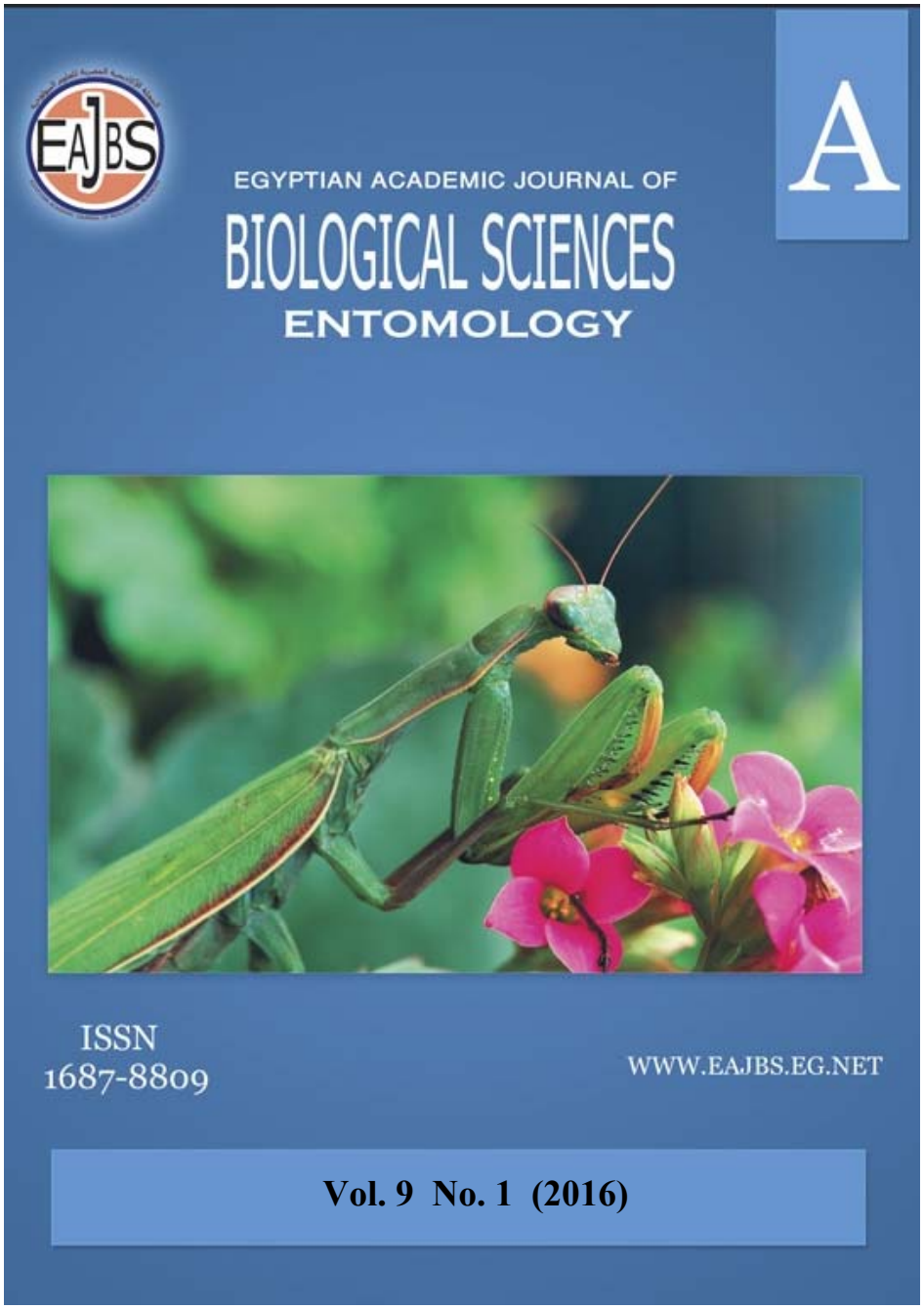

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Effect of Planting Dates and Certain Insecticides on the Lima Bean Pod Borer, *Etiella zinckenella* (Treit.) (Lepidoptera: Pyralidae) and Productivity of Cowpea Plants in Qalyoubia Governorate.

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ABSTRACT

Field experiments were carried out in Tahla village, Qalyoubia governorate during two successive seasons, 2014 and 2015. The first experiment was conducted to study the effect of four planting dates of cowpea seeds (March, 20th; April, 10th; May, 1st and May, 22nd.) on infestation levels of cowpea pod borer, *Etiella zinckenella* (Treit.), and effect on yield of this crop. The degree of infestation by *E. zinckenella* significantly increased by delaying planting date. Cowpea plants cultivated in the earliest planting date (March, 20th) was attacked by few numbers (2.3 & 1.5 larvae/10 pods during the two successive seasons, respectively), with the high weight of cowpea seeds (27.7 & 28.9 kg/ 100 m^2 during the two seasons, respectively). However, it was given the lowest number of both damaged pods and seeds. In contract the plants of the latest planting date (May, 22nd) was more liable to insect infestation (9.0 & 15.3 larvae/10 pods during both two seasons, respectively), with the low weight of cowpea seeds (20.2 & 19.3 kg/ 100 m^2 during 2014 and 2015, respectively), Also, it was given the highest number of damaged pods and seeds. Therefore, it was concluded that the plant date was effective on infestation rate by this pest and yield of cowpea seeds and can be avoided by planting it as early as March, 20th .

The second experiment was studied the effect of some insecticides and their efficacy against lima bean pod borer, *E. zinckenella* of cowpea. The present results showed that the mortality percentage were arranged descending as Sumithion 50% EC (62 %), Tracer 24% SC (55.3%), Radiant 12% SC (53.4%), Neemix 4.5% EC (35.7%) and finally Dipel 2x 6.4% WP (33.7%), with significant differences between the tested treatments compared with control. Also, Sumithion was the superior compound in this respect being registered 53.8 % increasing in the yield over the control value followed by Tracer (43.2 %), Radiant (40.8 %), Neemix (19.7 %) and Dipel 2x (12.7%).

INTRODUCTION

Cowpea (*Vigna unguiculata* (L)) is a member of the family Leguminosae. Out of 170 species in the genus, *V. unguiculata* is the most important grain legume of the world (Akimbo, *et al*., 2006; Onwueme and Sinha, 1991).

World cowpea production was estimated at 12.27 million tones from 70.70 million hectares in 1992 (FAO, 1993). In most developing countries the average diet is high in starch and low in protein (Rachie,1985). Cereals are excellent sources of energy but comparatively poor source of protein, whereas cowpea provides some amounts of high-quality protein. The protein of cowpea contains relatively high amount of the essential amino acids, lysine and tryptophan, and thus usefully compliments the protein supply by cereals, in which the contents of lysine and tryptophan are relatively (Singh and Singh, 1992).

Cowpea plants are subjected to attack by several insect pests, the most serious of which is the lima bean pod borer *Etiella zinckenella* (Treit.) (Oladiran and Oso, 1985 and Abdallah, *et al*.1994). The damage of *E. zinckenella* usually occurs on pods and fed on seeds only (Van Den Berg, *et al*. 1998). Thus, the whole pods are destroyed during the crop's reproductive stage resulting considerable loss of yield at harvest (Sukul, *et al*. 1989). Metwally,1993 and Helalia*, et al*., 2011; studied the effect of sowing dates on their infestation rate with cowpea pod borer *Etiella zinckenella*. Also, Gehan and Abdalla, 2006 and Mahmoud, 2011 evaluated some selected pesticides against the two pod borers *Helicoverpa armigera* and *E. zinckenella* infestation in cowpea.

The present were aimed to study the effect of planting dates and some materials on lima bean pod borer and grain yield of cowpea plants.

MATERIALS AND METHODS

Two field experiments were carried out in Tahla village, Qalyoubia governorate on cowpea plants, *Vigna unguiculata* (L) (variety Kafr El-sheekh) during two successive seasons, 2014 & 2015. The first one was conducted to study the effect of planting dates of cowpea plants on infestation rate of cowpea pod borer. The four selected planting dates were at 21 days intervals, on March, 20th; April, 10th; May, 1st and May, 22nd , respectively. The experimental area about 1500 m^2 was divided into 12 plots (each plots was 125 m^2). The experimental plots were laid out in a randomized complete block design and each planting date was represented by three plots. Sampling of cowpea pods started 56 days after planting. Weekly samples (10 pods/plot) were randomly taken from each plot and put in paper bags and transferred to the laboratory for inspection to count the number of *Etiella zinckenella* (Treit.) larvae. Normal agricultural practices were followed without insecticides treatments. The final yield of each planting dates was weighted and estimated. Also, the study included the percentage of damaged pods, average weight/1000 seeds and damage/1000 seeds.

The second experiment was conducted during the second season 2015 to evaluate the efficiency of five insecticides (Table, l) on reducing the population density of *E. zinckenella* larvae on cowpea plants. An area, about 1000 m^2 planting on May 22nd , was divided into 18 plots (each plot was 55.50 m^2). Weekly samples (10 pods/ plot) were randomly collected during the reproductive growth stage and put in paper bags and transferred to the laboratory to count the number of *E. zinckenella* larvae. Each compound applied three times through the reproductive stage. The first spray started on July 20; 2015 and the other sprays were followed at 14 days interval, the inspection recorded before and after 7&14 days of spray applications for recorded the reduction percentage of each pesticide was calculated according to Henderson and Tilton formula,1955.

A knapsack sprayer 20L capacity was used in applying the tested compounds

as foliar treatments, the rate of applications of tested compounds listed in (Table 1). At harvest, ten random plants were labelled in each plot, where the pods were picked twice at 10 days apart. The harvest pods dry in air and the grains were separated into (intact and damage), and their weights per 10 plants were determined.

The statistical analyses of the present data were carried out using SAS program computer including f-test and L.S.D. value (SAS Institute, 2003).

Table 1: List of tested pesticides and their rates of application.

Trade name	Common name	Formulation	Concentration	Used rate /100L
Sumithion	Fenitrothion	EC	50%	250 ml
Radiant	Spinetoram	SC	12%	25 ml
Tracer	Spinosad	SC	24%	30 ml
Neemix	Azadirachtin	EC	4.5%	100 ml
Dipel 2X	*Bacillus thuringiensis*	WP	6.4%	50 gm

RESULTS AND DISCUSSION

Data in Table (2&3) showed the effect of four different planting dates on the infestation of cowpea pods by *Etiella zinckenella* (Treit.), larvae during two seasons, 2014 & 2015 and some estimation of the yield.

Effect of the different planting dates:

On *Etiella zinckenella* infestation:

Results in Table (2) revealed that the population density of *Etiella zinckenella* larvae infesting cowpea pods significantly differed according to the planting date during the two successive seasons, 2014 and 2015. During the first season, the population density of *E. zinckenella* larvae increased by delaying planting date. The cowpea plants were sown in the earliest planting date (March, 20th) significantly infested by the lowest mean number of *E. zinckenella* (2.3 larvae/10 pods).

Table 2: Mean number of pod borer, *E. zinckenella* larvae on cowpea pods at different planting dates during the summer plantation 2014 and 2015 seasons in Qalyoubia governorate.

Sampling Schedule	Mean no. of *E. zinckenella* larvae / 10 pods							
	2014				2015			
	1st Planting March,20th	2nd Planting April,10th	3rd Planting May, 1st	4th Planting May,22nd	1st Planting March,20th	2nd Planting April,10th	3rd Planting May, 1st	4th planting May,22nd
May, 15	0.0	----	----	----	0.3	----	----	----
22	1.0	----	----	----	1.3	----	----	----
29	1.3	----	----	----	1.0	----	----	----
June, 5	3.3	2.7	----	----	1.7	2.3	----	----
12	4.0	5.3	----	----	2.7	3.7	----	----
19	4.3	5.7	----	----	2.3	3.7	----	----
26	----	5.7	5.0	----	----	4.3	6.3	----
July, 3	----	8.3	5.0	----	----	4.3	6.7	----
10	----	8.3	7.7	----	----	5.7	6.7	----
17	----	----	10.7	7.3	----	----	8.0	9.0
24	----	----	11.7	12.0	----	----	9.7	12.7
31	----	----	13.7	15.0	----	----	14.7	18.0
August, 7	----	----	----	16.7	----	----		16.7
14	----	----	----	15.7	----	----		17.0
21	----	----	----	15.3	----	----		18.3
Mean	**2.3±0.73^{d}**	**6.0±0.87^{c}**	**9.0±1.5^{b}**	**13.7±1.4^{a}**	**1.5±0.36^{d}**	**4.0±0.45^{c}**	**8.7±1.3^{b}**	**15.3±1.5^{a}**
L.S.D	2.14				1.78			

On the contrary, the plants of the last planting date (May, 22nd) harbored the highest number of *E. zinckenella* (13.7 larvae/10 pods).

During the second season, results took the same trend as obtained in the first season. The seasonal mean numbers of *E. zinckenella* found in this season were (1.5, 4.0, 8.7 and 15.3 larvae/10 pods) on March, 20th; April, 10th; May, 1st and May, 22nd planting date respectively.

The present were agreement with the findings of Helaly *et al*. (1990), they reported that the population density of some pests infesting cowpea varied significantly according to the time of planting during summer plantation season. Also, Ekesi *et al*. (1996) recorded that the population density of pod-borer was significantly affected by the time of planting. He concluded that planting date is an important factor for crop production as well as pod-borer infestation level. Helalia *et al*. (2011) stated that early plantation could be involved in reducing *E. zinckenella* infestation and subsequently increase the cowpea yield.

On yield:

In both studied seasons, 2014 and 2015 data indicated that the cowpea seeds yield increased by early planting date (Table 3). The highest seasonal mean weight of seeds was obtained from cowpea plants cultivated in the first planting date being 27.7 and 28.9 Kg /100m^2 with the highest average weight /1000 seeds 143.5 and 145.6 gm /1000 seeds during the two successive seasons, respectively. However, the lowest number (8 & 6.7 pods/ 100 pods and 177 & 170 damaged/ 1000 seeds) of both damaged pods /100 pods and damaged /1000 seeds during to both seasons, respectively. On the contrary, cowpea plants cultivated in the latest planting date were produced the lowest weight of cowpea seeds being 20.2 and 19.3 Kg /10m ^{2} with the lowest average weight /1000 seeds, 105.5 and 97.3 gm /1000 seeds during 2014 and 2015 seasons, respectively. The highest number of both damaged pods /100 pods and damaged /1000 seeds were 20.5 &19.3 damaged pods and 310 & 336 damaged seeds during both seasons, respectively (Table 3).

The present results agree with those of Ekesi *et al*. (1996) and Helalia *et al*. (2011), they stated that the earliest planting date produced significantly high weight of yield. Singh (1999) indicated that cowpea pod borer, *E. zinckenella* was an important pest and was the main causes of yield losses.

It could be concluded that the earliest planting date (March, 20th) gave higher yield than the other three tested planting dates and this may be related to the lowest numbers of pod borer *E. zinckenella* were present and convenience of dominated climatic factors during this planting date for growth of cowpea plants.

Table 3: Effect of planting dates on grain yield of cowpea plants during the summer plantation 2014 and 2015 seasons in Qalyoubia governorate.

Planting Dates	Yield parameters							
	2014				2015			
	Grain yield /100m^2 (kg)	Percentage of Damaged pods	Average weight /1000 seeds (gm)	Damagd /1000 seeds	Grain yield /100m^2 (kg)	Percentage of Damaged pods	average weight /1000 seeds (gm)	Damaged /1000 seeds
March,20th	27.7^a	8^d	143.5^a	177^d	28.9^a	6.7^d	145.6^a	170^d
April, 10th	26.5^a	12.7^c	134.8^b	203^c	27.1^b	10.5^c	142.3^a	191^c
May, 1st	22.4^b	17^b	118.3^c	264^b	22.5^c	15.7^b	115.5^b	270^b
May, 22nd	20.2^b	20.5^a	105.5^d	310^a	19.3^d	19.3^a	97.3^c	336^a
L.S.D	2.67	3.35	5.38	20.9	1.22	1.43	6.16	8.47

Effect of some pesticides on *E. zinckenella*:

Date in Table (4) indicated the efficiency of five insecticide over three applications against *E. zinckenella* larvae infestations. In the first spray, Dipel 2x was the lowest reduction % (24.4), while Sumithion had the highest reduction % (45.2) of *E. zinckenella* larvae. In the second and third sprays the reduction % was 30.8 and 46% after the 2nd & 3rd sprays, respectively in case of Dipel 2x, but Sumithion pesticide was recorded 61.7 and 79.0 reduction % in 2nd & 3rd spray, respectively.

Generally, the results showed that the pesticides were arranged as Sumithion (62%) followed by Tracer (55.3%), Radiant (53.4%), Neemix (35.7%) and finally Dipel 2x (33.7%) with significant differences between the tested treatments compared with control (Table, 4).

Azadirachtin and *B. thuringiensis* gave low reduction percentage after three sprays. Subhasree and Mathew (2014) stated that Azadirachtin and *B. thuringiensis* recorded larval population below economic threshold level (ETL) starting from 14th day after first spraying till the end of cropping period. However, Praveen *et al*. (2014) indicated that Chlorpyriphos (0.05% a.i.) was proved superior activity against the larval population of pea pod borer as compared to other treatments. Dhaka *et al.* (2011) showed that Spinosad, *B. thuringiensis* and Neemarin, were sprayed on vegetable pea against pod borer, *E. zinckenella*, had lower number of larvae as well as pod and seed infestation than untreated control. While, Adel and Maimoon (2006) recorded that Tracer 22.8%(a.i. Spinosad) gave 66.7% mortality of *S. littoralis* larvae. Kumar *et al*. (2014) indicated that Spinetoram 12% SC was significantly effective when sprayed three time at 15 days interval in minimizing *E. zinckenella* larvae populations on pigeonpea plants and increasing the grain yield.

Finally, Sumithion, Spinosad, Spinetoram, were recorded the highest reduction percentage of *E. zinckenella* larvae and high yield of cowpea seeds.

Table 4: Efficacy of some pesticides against the pod borer, *E. zinckenella* larvae on cowpea plants.

Treatment		Before Spray	Average no. larvae/10 pods and reduction percentage after sprays									General mean
			1st spray		Mean	2nd spray		Mean	3rd spray		Mean	
			7 day	14 day		7 day	14day		7 day	14 day		
Sumithion (Fenitrothion)	**Mean (R%)**	6.3	5.3 (36.1)	5.7 (54.4)	5.5 (45.2)	3.7 (51.1)	2.3 (72.4)	3 (61.7)	0.7 (69.6)	0.3 (88.5)	0.5 (79)	3.0[ed] (62)
Radiant (Spinetoram)	**Mean (R%)**	4.7	4.3 (30.5)	4.3 (53.9)	4.3 (42.2)	3.3 (43.7)	2.3 (64.3)	2.8 (54)	1.0 (55.2)	0.7 (72.8)	0.8 (64)	2.7[e] (53.4)
Tracer (Spinosad)	**Mean (R%)**	5.7	4.7 (37.3)	5.7 (49.6)	5.2 (43.5)	4.0 (48.5)	2.7 (68.6)	3.3 (58.5)	1.3 (50.7)	0.7 (76.8)	1 (63.7)	3.1[d] (55.3)
Neemix (Azadirachtin)	**Mean (R%)**	6.7	7.3 (17.2)	8.7 (34.5)	8 (25.8)	8.3 (30)	8.0 (40.5)	8.1 (35.2)	4.7 (41.3)	4.3 (51.9)	4.5 (46.5)	6.9[b] (35.7)
Dipel 2x (*Bacillus thuringiensis*)	**Mean (R%)**	5.0	5.3 (19.4)	7.0 (29.4)	6.6 (24.4)	7.3 (23.5)	6.7 (38.1)	7 (30.8)	4.0 (41.3)	3.7 (50.6)	3.8 (46)	5.7[c] (33.7)
Control	**Mean**	5.7	7.5	11	8.8	15	16.5	15.8	17.3	18.7	18	14.3[a]
L.S.D												0.46

R%= reduction percentage

Effect of some pesticide application on grain yield:

The data of grain yield /10 plants obtained after different insecticidal treatments Sumithion, Radiant, Tracer, Neemix and Dipel 2x were presented in Table (5).

As mentioned before, most of the treatments suppressed the pest populations

and thus positive effects on the yield were gained compared to the unsprayed control. However, the grain harvest was higher when spraying the pesticide Sumithion recorded the first arrangement in grain yield 266 gm /10 plants followed by Tracer (247.8 gm /10plants), Radiant (243.5 gm /10plants), Neemix (207 gm /10 plants) and finally Dipel 2x (195 gm /10plants) compared to weight of 173 gm /10plants in the untreated control. Also, Sumithion was the superior compound in this respect being registered 53.8 % increasing in the yield over the control value followed by Tracer (43.2 %), Radiant (40.8 %), Neemix (19.7 %) and Dipel 2x (12.7%). Since majority of the Egyptians often consume cowpea as dry grains after cooking, the incidence of the grain damage was considered in present study. The results in Table (5), indicate remarkable elevation in the percentages of damaged grain in majority of treatments. In the spraying Dipel 2x was the highest damaged grains (37.9 %), while, Sumithion had the lowest damaged grains (21.1%), compared to 38.4% in the untreated control.

Table 5: Effect of various insecticidal treatments on grain yield of cowpea plants.

Treatment	Average grain yield (gm/10 plants)			% increase over control	% Damaged grains
	Intact	Damaged	Total		
Sumithion (Fenitrothion)	210^{a}	56^{c}	266^{a}	53.8	21.1^{d}
Radiant (Spinetoram)	176^{b}	67.5^{b}	243.5^{b}	40.8	27.7^{c}
Tracer (Spinosad)	172.3^{b}	75.5^{a}	247.8^{b}	43.2	30.5^{b}
Neemix (Azadirachtin)	129.7^{c}	77.3^{a}	207^{c}	19.7	37.3^{a}
Dipel 2x (*Bacillus thuringiensis*)	121^{d}	74^{a}	195^{d}	12.7	37.9^{a}
Control	106.5^{e}	66.5^{b}	173^{e}	----------	38.4^{a}
L.S.D.	5.9	4.2	5.8	---------	1.7

Similarly Kumar *et al*. (2014) indicated that Spinetoram 12% SC was significantly effective in minimizing *E. zinckenella* larval population on pigeonpea plants and increasing the grain yield. Dhaka *et al.* (2011) showed that Spinosad, *B. thuringiensis* and Neemarin, was recorded the best yield comparable untreated control against *E. zinckenella* larval. Gehan and Abdalla, (2006) concluded that Chlorpyrifos was the superior compound being registered (45.9%) increase in yield over the untreated control value. Abdullah *et al*. (2001) recorded that the highest yield was regristed in Cypermethrin treated plot (9.83 t/ha) followed by Neem extract (8.39 t/h), *B. thuringiensis.* (7.98 t/ha) and control (6.22 t/ha) in dry season whereas yields were 5.8, 4.8, 4.0 and 2.8 t/ha for Cypermethrin, Neem extract, *B. thuringiensis* and control in wet season, respectively. Singh (1999) indicated that cowpea pod borer (*Etiella zinckenella*) was an important pest and was the main causes of yield losses.

It could be concluded that application every two weeks of the Compounds used in this study during podding and maturation stage of cowpea plants were necessary in controlling *E. Zinckenella* populations, also causes yield increasing

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ARABIC SUMMERY

تأثير مواعيد الزراعة وبعض المبيدات على دودة قرون اللوبيا والمحصول الناتج على نباتات اللوبيا بمحافظة القليوبية

هشام صالح شعلان

معهد بحوث وقاية النباتات – مركز البحوث الزراعية- دقي –جيزة

أجريت التجارب الحقلية في قرية طحلة بمحافظة القليوبية خلال موسمين متتاليين 2014 و 2015. وقد أجريت التجربة الأولى لدراسة تأثير أربعة مواعيد لزراعة بذور اللوبيا (20 مارس- 10 ابريل- 1 مايو- 22 مايو.) على مستويات الإصابة لدودة قرون اللوبيا، *Etiella zinckenella*، وأثر ذلك على إنتاجية المحصول و درجة الإصابة بدودة قرون اللوبيا.

واوضحت النتائج ان التبكير ميعاد الزراعة (20 مارس) كان له تأثير معنوى فى زيادة الاصابة بدودة قرون اللوبيا حيث كان متوسط الاصابة باليرقات هو (2.3 و 1.5 يرقة/ 10 قرون خلال موسمى الدراسة 2014 و 2015 على التوالى)، بالاضافة الى زيادة الوزن من محصول بذور اللوبيا الناتج (27.7 و 28.9 كجم / 100 م2 خلال موسمي الدراسة على التوالي). ومع ذلك اعطت أقل عدد من النسبة المئوية للقرون التالفة (8 و 6.7 %) وكذلك اقل عدد من البذورالتالفة (177 و170 بذرة / 1000 بذرة) بينما التأخير فى ميعاد الزراعة (22 مايو) كان أكثر عرضة للإصابة بالحشرة (9.0 و 15.3 يرقة / 10 قرون خلال موسمي الدراسة 2014 و 2015 على التوالي) مع انخفاض الوزن من محصول بذور اللوبيا الناتج (20.2 و 19.3 كجم / 100 م2 خلال موسمى الدراسة على التوالي) أيضا فقد اعطى أكبر عدد من النسبة المئوية للقرون التالفة والبذور التالفة/ 1000 بذرة (20.7 و 19.3% قرون تالفة و 310 و 336 بذور تالفة خلال عامي 2014 و 2015، على التوالي). ولذلك، يمكن القول أن تاريخ الزراعة كان فعالا في معدل الإصابة بهذه الآفة والعائد من محصول بذور اللوبيا.

وفى التجربة الثانية تم دراسة تأثير بعض المبيدات الحشرية وفعاليتها على دودة قرون اللوبيا وأظهرت النتائج أن المبيدات المستخدمة يمكن ترتيبها تنازليا على النحو التالى السوميثيون 50 % EC (62٪ نسبة خفض) يليه التريسر 24% SC (55.3٪) ، الرادينت 12% SC (53.4٪) ، النيمكس 4.5% EC (35.7 %) وأخيرا الدايبل 2x 6.4% WP (33.7%) مع وجود فروق معنوية كبيرة بين جميع المعاملات مع المقارنة. وكذلك اعطى السوميثيون اكبر زيادة فى المحصول (53.8% زيادة عن المقارنة) يليه التريسر ، الرادينت ، النيمكس ، الدايبل 2x حيث اعطت زيادة عن المقارنة 43.2 ، 40.8 ، 19.7، 12.7% وذلك على الترتيب.