

Effect of Propagation Methods and Sowing Dates on Aphid Infestation and Flower Heads Characters in Globe Artichoke Plants

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Received: 5/6/2018

Abstract: The present study aimed to evaluate the effect of three methods of propagation of globe artichoke; crown pieces, off-shoots & ovoli and three planting dates on aphid infestation, mainly (*Aphis fabae* L., *A. gossypii* Glov., *Macrosiphum euphorbiae* T., *M. solani* (Kalt.), and *Myzus persicae* (Sulzer) in the field in relation with flower head characters. Planting was carried out on July 20th, 10th and 31st of August during 2014/2015 and 2015/2016 seasons as early, ordinary and late dates of sowing, using the abovementioned three methods, at Shubramunt Village, Giza. Results showed significant differences among the weekly mean numbers of aphid as affected by the three tested methods of planting at the three tested sowing dates. Aphid infestations were generally low or moderate on *G. artichoke* when using the crown pieces comparing with the other two tested methods in both seasons under the three tested sowing dates. The lowest infestation observed with the normal date, especially by using crown pieces. As for flower head characters, results showed that neither propagation methods nor dates of sowing had significant effect on the average diameter or length of the formed head in both seasons. Also, using crown pieces gave significant increase in number and weight in flower heads compared to the other two tested methods. The greatest number of heads/ plant associated with the early date of planting, while its greatest weight correlated with the normal planting date under the three tested methods of propagation during the two studied seasons.

Keywords: Aphid infestation, propagation, sowing, globe artichoke

INTRODUCTION

Artichoke (*Cynara scolymus* L.) is an herbaceous perennial plant grown for its flower heads or flower buds. It is one of the important vegetable crops grown in Egypt for local consumption and exportation. Artichoke is usually propagated vegetatively by crown divisions or off-shoots, because plants grown from seeds generally lack uniformity (Ibrahim *et al.*, 1981; Welbaum, 1994). Artichoke is attacked by several pests including certain species of aphids in Egypt. Afify *et al.* (2004) and Fadel and Hady (2006) recording different species of aphids in Egypt causing considerable damage to plants. Similar results were also recorded by many foreign investigators such as Paitier *et al.* (1987) and Barthes *et al.* (1998). Little is known about the effect of methods of artichoke propagation and different sowing dates on the aphid infestation and population on this crop.

Therefore, this study aimed to evaluate the aphid infestation and its population on globe artichoke under various propagation methods and sowing dates to determine the suitable method and sowing date that receive the least infestation by these pests and give the high quality of flower heads. Leaves curling and turning yellow; reduced plant growth; small, deformed buds; stalks cannot support weight of buds and droop; sooty mold growing on plants due to honeydew deposits secreted by insect; insect is small, soft-bodied and pale green to yellowish green in color. Symptoms occur when aphid numbers are large; insects should be visible on underside of leaves; become more problematic in high temperatures and humidity.

MATERIALS AND METHODS

Filed experiments in this study were carried out during 2014/2015 and 2015/2016 growing seasons at Shubramunt Village, Giza Governorate, Egypt. Globe

artichoke of (El-Balady, local cultivar) was cultivated in three dates; July 20th, August 10th and 31st, which represented the early, normal and late sowing, respectively during both tested seasons. Three methods of cultivation were applied with each of these three tested sowing dates using crown pieces, off-shoots and ovoli, named (Fochok). The old crowns of g. artichoke were divided into 204 pieces, off-shoots and ovoli were soaked in fungicide solution for 10 min then put on ridges 4.5 m. Long and 1 m. wide at 90 cm. apart. The experimental unit was 13.5 m², consisted of 3 ridges and included 15 plants. The experiment was designed as simple randomized block with 3 replicates for every unit. Predominated aphids occurred in the experimental field as sucking insects on g. artichoke plants were a mixed population of *Aphis fabae* L., *A. gossypii* Glov., *Macrosiphum euphorbiae* T., *M. solani* (Kalt.), *Myzus persicae* (Sulzer) and usually showing a rather serious infestation. All the collected species of aphids were prepared and identified in the Department of Aphids Research, Plant Protection Research Institute, Agricultural Research Center, Dokki, Giza.

To evaluate the effect of the three planting methods on the aphid infestation in *G. artichoke*, Balady cv. in each sowing dates, weekly samples of 10 leaves were chosen randomly from each replicate (30 leaves from each propagations method or sowing date). The samples were examined directly in the field and the numbers of the aphid individuals were recorded. Normal agricultural practices were followed except the application of pesticides for pest control.

As for flower head quality, samples of 10 heads from 5 plants of each replicate were selected for harvest when they still compact and the diameter and length of the head were recorded. Together with numbers and weight of heads produced per plant.

All data were statistically analyzed by analysis of variance method according to Sendecor and Cochran (1982).

RESULTS AND DISCUSSION

Effect of propagation methods:

1. On the aphid infestation

Results for the effect of the propagation methods; crown pieces, off-shoots and ovoli on the aphid infestation in *g. artichoke*, Balady cv at Shubramunt field are discussed for each three sowing dates during the two seasons of study a following:

a. At early date (20 July)

Data in Table (1) showed that the average numbers of aphids were 41.19, 49.48 and 48.52 aphids/10 leaves for crown pieces, Off-shoots and Ovoli respectively during the period from August 4th 2014 till March, 2015 for three methods in order. While these numbers of aphids for the three fore mentioned propagation methods were 39.43, 48.89 and 49.52 during period from August 4th 2015 till March, 2016. The infestation of aphids on artichoke appeared on August 4th during the two periods of study (August - March 2014/2015) and (August 4th - March 2015/2016).

Table (1): Mean numbers of aphids on *g. artichoke* as affected by the three propagation methods at early date (20 July) during the two growing seasons of 2014/2015 & 2015/2016

Date		Mean no. /10 leaves					
		2014/2015			2015/2016		
Month	Week	Crown pieces	Off shoots	Ovoli	Crown pieces	Off shoots	Ovoli
August	4 th	4.6	7.6	8.0	2.0	9.0	8.0
	5 th	7.0	18.0	19.0	4.3	18.6	16.3
September	1 st	10.3	32.3	26.6	7.0	24.0	30.0
	2	18.0	41.0	34.0	10.0	34.0	41.0
	3	28.0	49.0	46.0	17.6	47.0	50.0
	4	41.0	44.6	48.0	38.6	51.0	57.0
October	1 st	52.0	53.0	56.0	51.0	53.0	56.0
	2	66.0	60.0	64.0	58.6	62.0	63.6
	3	59.6	68.0	71.0	64.0	74.0	69.0
	4	58.0	62.6	63.6	56.0	65.3	59.0
November	1	54.0	59.0	62.0	57.0	57.0	60.0
	2	61.0	64.0	69.0	61.0	66.0	64.6
	3	56.0	58.6	59.6	55.0	59.0	59.0
	4	53.0	56.0	57.0	53.0	55.0	58.0
	5	51.0	54.3	56.0	48.6	54.0	57.0
December	1	49.0	58.0	61.6	52.0	56.6	54.3
	2	58.6	62.0	66.0	58.0	60.0	62.0
	3	54.0	57.0	60.0	54.0	54.0	56.0
	4	47.0	56.6	58.0	51.0	53.0	54.0
January	1	45.0	55.0	56.0	48.0	56.0	53.6
	2	46.0	54.6	52.0	46.0	54.6	51.0
	3	55.0	60.0	58.3	54.0	59.0	57.6
	4	50.6	56.3	54.0	47.0	55.6	53.0
February	1	44.0	54.6	48.0	43.0	51.0	52.0
	2	37.0	55.0	43.0	37.6	48.0	50.0
	3	43.0	48.3	39.0	40.0	46.0	48.3
	4	38.6	45.6	38.0	34.6	43.0	45.0
March	1	31.0	41.0	36.6	26.0	41.0	42.0
	2	22.0	38.0	34.0	18.0	38.0	38.0
	3	19.0	34.0	31.0	15.6	37.0	36.0
	4	17.0	30.0	19.0	14.0	34.0	34.0
Mean		41.19	49.48	48.52	39.43	48.89	49.52

During 2014/2015, the numbers of aphids fluctuated to reach its maximum numbers on crown pieces during the 2nd week of October recording 66.0 individuals of aphids/10 leaves in average and during the 3rd weeks of October by 68.0 and 71.0 aphids/10 leaves on off-shoots and ovoli respectively. During the 2nd week of November the average number of aphids was 61.0, 64.0, 69.0 aphids/10 leaves for the three propagation methods respectively. Almost, the same trend of average aphid's numbers recorded during the second season of study (2015/2016) as the maximum numbers of aphids for the three propagation methods occurred during the third week of October recording 64.0, 74.0 and 69.0 for crown pieces, off-shoots and ovoli, respectively. While that observed during the second week of November by 61.0, 66.0 and 64.6 aphids/10 leaves for the three methods in order.

In other words it could be seen that, this study revealed 7 peaks of aphid's activity were recorded during the first season (2014/2015) for the three methods. The 1st peak was recorded during the 4th week of September (41.0, 44.6 and 48 aphids/10 leaves) for crown pieces, off-shoots and ovoli respectively. The 2nd peak was observed during the 2nd week of October (66.0, 60.0 and 64.0 aphids/10 leaves) for the mentioned three methods in order. The 3rd had been recorded during the 2nd week of November (61.0, 64 and 69 aphids/10 leaves respectively). The 4th peak was during the 2nd week of December (58.6, 62.0 and 66.0 individuals/10 leaves) for the three propagation methods in order. The 5th peak was during the 3rd week January (55.0, 60. And 58.3 aphids/10 leaves). The 6th peak was during the 1st week of February for crown pieces (44.0 aphids/10 leaves) and ovoli (48.0 aphids/10 leaves) and during the 2nd week for off-shoots (55.0 aphids/10 leaves). The 7th peak was during the 1st week of March recording (31.0, 41.0 and 36.6 aphids/10 leaves) for crown pieces, off-shoots and ovoli respectively. Also, during the second season (2015/2016) of study 7 peaks had been recorded. The periods of these peaks were the same of the 1st season of study (Table 1).

Results of statistical analysis showed significant differences between weekly numbers of the aphid infestation on plant leaves in the three methods of propagation for both seasons and showed also that either off-shoots or ovoli methods had more significant effects on the aphid infestation than crown pieces at the early date in the two seasons. The seasonal means in off-shoots and ovoli methods recorded high numbers, being 49.48, 48.52 aphids in the first season and 48.89, 49.52 aphids in second season compared to the respective content of 41.19, 39.43 aphids in the crown pieces (Table 1).

b. At normal date (10 August)

Data in Table (2) showed that the aphid infestation started in the 2nd weeks of September in both seasons but with low number, being 2.0, 3.6, 4.0 aphids in the first season and as 1.0, 3.6, 4.0 aphids in the second one per leaf sample for three methods, respectively.

Statistical analysis cleared significant differences among weekly numbers of the aphids for the three propagation methods in both seasons. Two peaks of aphids activity by highly numbers occurred during the 2nd week of November by (54.0, 62.0, 63.0 aphids/10 leaves) and the 2nd week of December recording (52.0, 60.0, 59.0 aphids/10 leaves), for the three methods respectively. During 2015/2016, similar two peaks occurred in the 2nd week of November and December being 58.0, 61.0, 60.0 and 51.0, 59.6, 58.3 aphids/10 leaves, for the three methods respectively.

Also, results showed significant effects for the three propagation methods on aphid infestation at the normal date (10 August) of sowing in both seasons. The seasonal means recorded respective counts of 28.61 & 28.78 aphids/10 leaves under crown pieces method, for both seasons (2014/2015 & 2015/2016), respectively, 36.48 & 35.79 aphids in off-shoots and ovoli methods during the first season (2014/2015) to opposed to 37.32, 36.93 aphids for the same two methods during the second one (2015/2016).

These results came in agreement with Afify *et al.* (2004), recorded three seasonal peaks of for *Aphis gossypii* on g. articholke during November, December and January. Fadel and Hady (2006), also recorded this aphid species on g. artichoke throughout the normal season and recorded a peak in December-January at Zeinean, Giza.

c. At Late date (31 August)

Data obtained in Table (3) showed that the aphid appeared on plant leaves at the late sowing date (31 August) during the 3rd week of September with numbers of 8.0, 8.6, 10.0 aphids/10 leaves during the first growing season (2014/2015) and 7.3, 9.0, 10.0 aphids/10 leaves during the second growing season (2015/2016) for three methods respectively. However, statistical analysis showed significant differences between the weekly means of aphids on plant leaves under three methods during the tow seasons. During 2014/2015, three peaks of the aphid infestation occurred in the 2nd week of November, December and in the 3rd week of January, being 59.0, 66.0, 63.0 aphids, 50.0, 61.0, 60.0 and 46.3, 58.0, 56.0 aphids per leaf sample, respectively for three methods. During 2015/2016, the peaks occurred in the 3rd of November, being 55.6, 64.6, 68.0 aphids and in the 2nd week of December and January, being 48.0, 62.0, 64.0 aphids and 46.6, 58.6, 60.0 aphids per leaf sample, respectively for three methods.

The seasonal averages of the aphid population at late date of sowing (31 August) were higher under the two methods; off-shoots and ovoli, (45.90 and 45.38 aphids/10 leaves) during the first season (2014/2015) and (45.62, 47.22 aphids/10 leaves) during the second season (2015/2016). While average population of aphids under crown pieces method were (39.10 & 36.55 aphids/10 leaves) during the two seasons of study, respectively.

Table (2): Mean numbers of aphids on g. artichoke as affected by the three propagation methods at normal date (10 August) during two growing seasons Of 2014/2015 & 2015/2016 seasons

Date		Mean no. /10 leaves					
		2014/2015			2015/2016		
Month	Week	Crown pieces	Off shoots	Ovoli	Crown pieces	Off shoots	Ovoli
September	2 nd	2.0	3.6	4.0	1.0	3.6	4.0
	3 rd	6.6	7.0	8.6	4.0	10.0	11.0
	4 th	15.0	18.0	17.0	13.0	19.0	18.6
October	1 st	24.0	34.0	37.0	26.6	36.6	38.0
	2	41.0	58.0	54.3	39.0	53.0	52.0
	3	37.0	44.0	46.0	34.0	48.3	46.0
	4	34.6	49.6	51.6	36.0	46.3	48.0
November	1	39.0	56.0	54.0	44.0	55.0	53.3
	2	54.0	62.0	63.0	58.0	61.0	60.0
	3	46.0	58.6	57.0	45.0	56.0	54.0
	4	47.0	54.0	53.0	43.6	51.0	52.3
	5	49.0	48.0	52.3	44.0	46.6	47.0
December	1	49.3	53.0	51.0	46.0	50.0	54.0
	2	52.0	60.0	59.0	51.0	59.6	58.3
	3	44.0	52.3	53.0	42.0	53.0	51.6
	4	36.3	47.0	46.0	36.0	49.0	50.0
January	1	28.0	44.0	37.0	27.0	42.0	43.0
	2	31.0	37.6	36.6	34.0	38.6	36.6
	3	34.0	46.0	38.3	39.0	41.0	40.0
	4	30.0	39.0	33.0	33.3	42.0	44.0
February	1	24.3	31.0	26.0	23.0	33.0	34.3
	2	17.0	24.3	21.0	19.6	31.0	30.0
	3	14.0	27.0	22.0	17.0	36.0	29.3
	4	12.0	21.0	19.6	15.0	24.0	26.0
March	1	10.0	15.0	17.0	11.0	20.0	18.0
	2	9.0	11.0	16.0	10.0	16.0	14.0
	3	8.0	10.6	15.0	7.0	12.6	11.
	4	7.0	10.0	14.0	7.0	11.0	10.0
Mean		28.61	36.48	35.79	28.78	37.32	36.93

Table (3): Mean numbers of the aphids on g. artichoke as affected by three propagation methods at late date (31 August) during two growing seasons of 2014/2015 & 2015/2016 seasons

Date		Mean no. /10 leaves					
		2014/2015			2015/2016		
Month	Week	Crown pieces	Off shoots	Ovoli	Crown pieces	Off shoots	Ovoli
September	3 rd	8.0	8.6	10.0	7.3	9.0	10.0
	4 th	14.6	12.6	16.0	13.6	14.0	18.0
	1 st	28.0	24.3	34.0	25.6	31.6	28.0
October	2 nd	46.0	42.0	45.0	41.0	38.0	44.0
	3 rd	44.6	46.3	48.6	34.0	46.6	48.0
	4 th	48.6	48.0	51.0	36.0	49.0	53.0
	1	52.0	56.0	53.6	43.0	56.3	58.0
November	2	59.0	66.0	63.0	45.0	59.6	62.0
	3	47.0	59.6	57.0	55.6	64.6	68.0
	4	44.0	55.0	55.0	46.0	56.0	59.0
December	5	42.0	52.6	54.6	38.6	54.0	57.6
	1	46.3	53.0	56.0	44.0	58.0	57.0
	2	50.0	61.0	60.0	48.0	62.0	64.0
	3	44.3	56.6	55.0	42.6	57.0	58.6
January	4	41.0	54.3	52.3	41.0	54.0	55.0
	1	42.6	51.6	46.0	43.6	53.0	52.0
	2	40.6	55.0	47.0	46.6	58.6	60.0
	3	46.3	58.0	56.0	41.0	54.0	45.3
February	4	43.6	50.3	49.6	43.0	51.3	50.0
	1	41.6	46.0	45.3	40.6	50.0	48.0
	2	38.3	44.6	38.6	34.3	44.0	46.0
	3	39.6	49.0	44.0	37.6	41.0	44.6
March	4	33.6	43.6	40.6	31.6	40.3	42.0
	1	30.6	41.0	37.0	29.0	37.0	38.0
	2	29.0	38.0	34.6	28.3	34.6	36.6
	3	28.6	36.3	33.0	26.0	31.0	33.0
	4	26.0	30.0	32.0	24.0	28.0	30.3
Mean		39.10	45.90	45.38	36.55	45.62	47.22

Table (4) indicated the effect of planting dates on percentages of the aphid population on g. artichoke during the two growing seasons of 2014/2015 and 2015/2016, under three propagation methods. Obtained results indicated that crown pieces method decreased the aphids population on g. artichoke leaves throughout the normal sowing date, by -21.18% during (2014/2015 season) and -17.58% during (2015/2016 season) also, using off-shoots decreased aphids population by -16.99 & 15.06% during the two seasons of 2014/2015 and

2015/2016 in order. The ovoli method decreased aphids population by -17.21 and -17.1% during the two seasons of (2014/2015) & (2015/2016) at the normal sowing date respectively. Under the early and late sowing dates in this study had increased the aphids population during the two growing seasons of (2014/2015) and (2015/2016) under the three methods of propagation. Statistical analysis showed that aphid population significantly affected by propagation methods in sowing dates under the present study.

Table (4): Effect of propagation methods and sowing dates on seasonal means and percentages of increasing and decreasing in the aphids population

Propagation methods	Sowing date	2014/2015 Season		2015/2016 season	
		Mean No.	Infestation %	Mean No.	Infestation %
Crown pieces	Early	41.19	+ 13.47	39.43	+ 12.91
	Normal	28.61	- 21.18	28.78	- 17.58
	Late	39.10	+ 7.71	36.55	+ 4.66
Off shoots	Early	49.48	+ 1.58	48.89	+ 11.26
	Normal	36.48	- 16.99	37.32	- 15.06
	late	45.90	+ 4.43	45.62	+ 3.82
Ovoli	Early	48.52	+ 12.23	49.52	+ 11.15
	Normal	35.79	- 17.21	36.93	- 17.10
	late	45.38	+ 4.97	47.22	+ 5.99

2. On flower head quality:

a. Head diameter and Length

Data presented in Table (5) showed that there were no significant differences among the diameter or length of flower heads under each of three propagation methods and sowing dates during the both seasons of the study (2014/2015) and (2015/2016).

Results were observed in the season of (2014/2015) regarding head diameter as general mean of the three sowing dates of 7.8, 7.8 and 7.7 cm. under the three propagation methods of crown pieces, off-shoots and ovoli respectively. The means of diameter were 7.9, 7.8 and 7.6 cm during the second season (2015/2016) for the three propagation methods in order. While general means of head length through the three sowing dates were, 8.8, 8.7, 8.4 cm. during (2014/2015 season) and 9.0, 8.8, 8.9 cm during (2015/2016 season) for three methods respectively. There were no significant differences between treatments. These results

are in agreement with those obtained by Abd El-Al and Moustafa (1974) and Agwah *et al.* (1990) who found that flower head diameter and length were not significantly affected by any propagation methods of artichoke.

b. Number of heads/ plant

Data in Table (5) showed significant differences among number of heads per plant of g. artichoke during the two seasons as affected by propagation methods at three sowing dates under this study. The highest number of head/plant was produced by crown pieces, 11.0, 12.0 heads at the early date and was 10.6, 10.0 heads at normal date, followed by off-shoots, 10.0, 10.3 heads in early date and 9.0, 10.0 heads at normal date whereas, 10.0, 10.0 heads and 9.6, 9.0 heads/plant by using other hand, plants at the late date produced the lowest number of heads/plant in both experimental seasons by crown pieces, 8.6, 8.6 heads, by ovoli, 8.0, 7.3 heads and by off-shoot was 7.0, 8.0 heads/plant, respectively.

Table (5): Flower head characters of g. artichoke, (Balady cv.) affected by propagation methods and sowing dates during the two studying seasons

Propagation method	Sowing date	Mean no./10 leaves							
		2014/2015				2015/2016			
		Diameter (cm.)	Length (cm.)	No. of heads/plant	Av. Weight of head/plant (g.)	Diameter (cm.)	Length (cm.)	No. of heads/plant	AV. Weight of head/plant (g.)
Crown pieces	Early	8.0	9.3	11.0	215.0	8.1	9.5	12.0	204.0
	Normal	7.9	8.8	10.6	225.0	8.1	8.9	10.0	228.0
	Late	7.5	8.5	8.6	176.0	7.6	8.6	8.6	169.0
Mean		7.8	8.8	10.0	205.3	7.9	9.0	10.2	200.3
Off shoots	Early	8.0	9.5	10.0	199.0	7.9	9.1	10.3	200.0
	Normal	8.0	8.3	9.0	218.0	8.0	8.8	10.0	210.0
	Late	7.6	8.3	7.0	177.0	7.7	8.5	8.0	170.0
Mean		7.8	8.7	8.6	198.0	7.8	8.8	9.4	193.3
Ovoli	Early	7.9	8.9	10.0	201.0	7.8	9.6	10.0	199.6
	Normal	8.0	8.6	9.6	204.0	7.6	8.5	9.0	210.0
	Late	7.4	7.9	8.0	171.0	7.5	8.6	7.3	167.0
Mean		7.7	8.4	9.2	192.0	7.6	8.9	8.7	192.2
LSD at 5%		NS	NS			NS	NS		

c. Weight of head /plant

As regard to average weight of head per plant, data in Table (5) showed significant differences among three methods of propagation in sowing dates of study during the two growing seasons. In 2014/2015, crown pieces produced the greatest weight of head, 225.0 g. at the normal date followed by off-shoots and ovoli, 218.0, 204.0 g., respectively as affected under the same normal date. Whereas, crown pieces at the early date produced, 215.0 g., followed by ovoli, 201.0 g and off-shoots 199.0 g. during the mentioned first season. Similar results were observed in the second; 2015/2016 (Table 5) in which crown pieces produced the best average weight of head/plant, as 228.0 g. at the normal date followed by off-shoots and ovoli, 210.0, 210.0 g., respectively, whereas at the early date; crown pieces, off-shoots and ovoli produced, 204.0, 200.0, 199.6 g. in average, respectively. At the late date, the plants under three methods of propagation produced the lowest in the average weight of head/plant, being 176.0, 169.0 g by crown pieces, 177.0, 170.0 g. by off-shoots and 171.0, 167.0 g. by ovoli, respectively in both seasons.

These results agreed with those by Abd El-Al and Moustafa (1974) and Abdalla and Abou E-Nasr, (1995) who reported that stem pieces of artichoke gave better and higher yield as well as head characters than offshoots propagation. This perhaps due to numerous buds in stem pieces and furthermore the pest infestation especially aphid species are low on vegetative growth of this pieces as shown in the present study.

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تأثير طرق ومواعيد زراعة الخرشوف على الإصابة بحشرات المن وعلى بعض صفات محصول النورات

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الهدف من الدراسة الحالية كان تقييمًا لتأثير ثلاثة طرق لزراعة نباتات الخرشوف الصنف (بلدي) وهي قطع من ساق النبات الأم والخلفات والفكوك وكذلك ثلاثة مواعيد للزراعة مبكر ٢٠ يوليو، المعتاد ١٠ أغسطس، متأخر ٣١ أغسطس وذلك على إصابات من الخرشوف بالحقل، كما تم تقييم مواعيد وطرق الزراعة المختبرة على الصفات البستانية لمحصول الرؤوس الناتج وذلك خلال عامين متتاليين ٢٠١٤/٢٠١٥، ٢٠١٥/٢٠١٦ بإحدى قري شبرامنت بمحافظة الجيزة. وأظهرت النتائج وجود فروق معنوية واضحة بين متوسطات الإصابة الأسبوعية بحشرات المن (مجموعة الأنواع المتواجدة) على أوراق نبات الخرشوف متأثرة باختلاف طرق ومواعيد الزراعة المختلفة موضحة أن أقل متوسطات إصابة كانت على النباتات المنزوعة باستخدام قطع من ساق الأم وكذلك ميعاد الزراعة الثاني (المعتاد) وذلك خلال عامين الراعية المختبرين. وفيما يخص محصول رؤوس الخرشوف (النورات) لم تلاحظ تأثيرات معنوية واضحة على قطر أو طول الرؤوس الناتجة عند اختبار طرق الزراعة أو مواعيد الزراعة المختبرة خلال موسمي الزراعة بينما كان أعلا عدد للرؤوس/ نبات سجل في حالة الزراعة المبكرة للخرشوف وأعطى ميعاد الزراعي الثاني (المعتاد) أعلا وزن للثمار تحت ظروف الطرق الثلاثة المختلفة للزراعة.