EFFECT OF PLANT POPULATION DENSITY ON APHID INFESTATIONAND PRODUCTIVITY OF THREE FABA BEAN CULTIVARS

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Abstract

Faba bean *(Vicia faba* L.*)* is one of the major food legumes grown in Egypt. Though there is a recommended plant density for this pulse, small-scale farmers grow it at any convenient spacing. They do not purposely vary the spacing to evaluate any changes in yield. Knowledge of the ecological characteristics of faba bean at various population densities might suggest new ways of establishing and managing injurous pests of this pulse. The present investigation was conducted in middle Egypt region, during 2008/09 and 2009/10 seasons, to determine the effects of different plant populations on varietal response, crop productivity, and aphid abundance. Three local recommended cultivars, i.e., Masr 1, Giza 2 and G 429 grown under four plant populations (8, 16, 24 and 32 plants /m^2) were investigated in a randomized complete split block design replicated four times. Dense planting satisfactorily decreased the proportion of plants infested with cowpea aphid by 31.4 and 22.6 % in 2008/09, 47.8 and 33.8 % in 2009/10 seasons at plant population of 24 and 32 plants /m^2. It could have reduced the subsequent rate of aphid multiplication and finally the aphid population size per unit area. This probably because individual plants in dense stands are less nutritious and have a shorter maturation time than plants in sparse stands. Therefore, small-scale farmers are advised to plant faba bean at a population density ranging from 100800 to 134400 plants /fed.

Keywords: Faba bean, Cultivars, Plant Density, Aphids, Seed Yield.

INTRODUCTION

Cowpea aphid (*Aphis craccivora* Koch.) is a cosmopolitan species, it occurs abundantly only in Mediterranean, subtropical and tropical regions (Blackman & Eastop, 2000). It attacks many legume and also non-legume crops such as citrus and cotton. Damage to faba bean, *Vicia faba* L. may be caused by direct feeding or/and transmission of several viral diseases (El-Defrawi, 1987; Bos & Makkouk, 1994; Abd El-Wahab, 1998 and Srivastava *et al.*, 2010). *A. craccivora* develops best on the growing tips of plants, stems, flowers and on immature seed pods. The ecology of *A. craccivora* has also been extensively studied in Egypt (Salem, 1998; Hossni, 2004), in

relation to its role as a vector of persistant and non-persistant viruses (Abd El-Wahab, 1998 and El-Defrawi *et al.*, 2000). Cultural methods is the deliberate alteration of the production system, either the cropping system itself or specific crop production practices, to reduce pest populations or avoid pest injury to crops (Risch, 1987.). El-Defrawi, 2009, gave details of insect culture control affecting food-legume crops, comprising the regular farm operations to destroy the arthropod insect pests or to prevent them from causing injury to the faba bean crops, have been used as preventive measures against insect pests (Ferro, 1987 and López-Bellido *et al.*, 2005). For the achievement of cultural control, the phenomenon of plant spacing has been remained as focal point by certain entomologists. Practically scarce specific work has been reported to check the aphid infestation in the faba bean crop by adopting different inter row spacing in Egypt. Though, this pest can be controlled by insecticide spraying, but the indiscriminate use of chemicals have created many problems like infamous three viz., resurgence, resistance and residue aspects besides the health hazardous. The contained application of insecticides has enhanced the potential for development of secondary insect pests. An effective way to insecticides resistance management and still to maintain insect population densities below the economic threshold is to reduce the use of pesticides with the integration of other control strategies (El-Defraw, 2009). As the recommendations of the modern technology of pest control, emphasize economical and ecological considerations prior to pests management, the present investigation was under taken to manage this one of the most nefarious biotic constraints of faba bean recently obvious by the use of cultural practice. Crop varieties with improved attributes are not always sufficient to reach self-sufficiency in food. Management practices such as optimization of plant density are equally important as additional different agronomic characters for pest management. Therefore, the objective of this study was to evaluate the effects of different plant population densities on aphid infestaion and yield potentiality of three local cultivars under field conditions at ARC, Sids Research Station, Beni-Suef Governaorate, during 2008/09 and 2009/10 cropping season.

MATERIALS AND METHODS

A field experiment was conducted at Sids Agriculture Research Station, Beni-Suef Governorate, middle Egypt in 2008/09 and 2009/10 winter growing seasons. The present work aimed to find out the optimum plant populations of three local cultivars of faba bean (*Vicia faba* L.) viz., Masr 1, Giza 2 and Giza 429 grown under natural infestation with legume aphids. The crop was sown in the 1st. week of November in

both seasons. Four plant densities (PD1= 8, PD2= 16, PD3= 24 and PD4= 32 plants /m² by means 33600, 67200, 100800, and 134400 plants /fed.) were tested. The experimental plot was 6 x 7 m² (1/100 fed.), laid out in a randomized split block design with four replications. Spraying against insect pests or viral diseases were omitted but the whole experimental area was hand-weeded twice
and weeds were kept well controlled. The plots were harvested between 5–10 May in the two seasons. The final harvested seed yield was calculated from a net area of 25 m² /plot. At the vegetative growth stages, in any sampling date, 10 plants /plot were randomly chosen and replicated 4 times at each field plot of the respective treatment (four plant population densities) were applied on three faba bean cultivars. The activity and abundance of cowpea aphid, *Aphis craccivora* Koch., were weekly recorded starting from the 1st. week of December 2008 and 2009 until the end of the season in the 2nd. week of April 2009 and 2010. Insects on the upper most two-thirds of plants (one central shoot / plant) were checked using the inverse binomial sampling technique (Hafez, 1964 and El-Defrawi, 1987). The mean of the 4 replicates was worked out to represent population density. Data were tabulated and statistically analysed adopting the procedure of Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

A- Aphid and plant population:

Total aphid abundance on faba bean plants varied significantly ($P < 0.001$) among sampling times on the four plant densities applied on the three local cultivars Masr 1, Giza 2 and Giza 429. The population of cowpea aphid (CA), *Aphis craccivora* had an quite abundance in the two growing seasons 2008/09 and 2009/10 (Tables 1 & 2). In 2008/09 season, faba bean field plots planted at the density of 8 and 16 plants /m² confronted higher populations of CA (498.6 ± 98.3 & 487.5 ± 102.3); (740.4 ± 115.2 & 708.6 ± 101.7) and (540.2 ± 114.9 & 472.0 ± 101.6) individuals /plant shoot of the three cultivars, respectively, forming one group without significant differences. On the contrary, plots planted at the 24 and 32 plants /m², comparatively harbored lower infestations of aphids being (405.1 ± 83.7 & 392.7 ± 85.5); (651.8 ± 107.9 & 529.3 ± 104.4) and (413.4 ± 86.7 & 359.1 ± 74.5) individuals /plant shoot on the same rate of planting population of the three tested cultivars Masr 1; Giza 2 and Giza 429, respectively, and also forming one group without significant differences. During the second season 2009/10, the same trend of aphid abundance harboured faba bean plants was true. Faba bean plots planted at lower density per square meter (8 & 16 plants /m².) exhibted the highest sustained of CA populations; while those

planted at higher population densities 24 & 32 plants /m², harbored lower numbers of cowpea aphids. The four means of seasonal aphid counts harbored the faba bean cv., Masr 1; Giza 2 and Giza 429 varieties being (603.4 ± 71.8, 552.2 ± 63.4, 452.5 ± 62.2 and 408.5 ± 50.4); (728.5 ± 83.0, 704.2 ± 84.0, 633.9 ± 75.7 and 557.6 ± 67.3) and (726.3 ± 82.9, 673.5 ± 77.1, 604.9 ± 70.9 and 483.7 ± 61.5) insects /plant shoot, for the field plots cultivated at the rate of 8, 16, 24 and 32 plants /m², respectively. There were highly significant relationship between aphid number and plant densities. The higher and the lower rate of plant densities were negatively affected by *A. craccivora* population in the two successvie seasons 2008/09 and 2009/10 (r= -0.5262 and –0.7520, respectively). The lowest aphid p opulation was obtained when planting took place at higher density 24 and 32 plants /m²; meanwhile, the lower rate of plant populations 8 and 16 plants /m², sustained the maximum aphid populations in the two tested seasons.

B- Aphid and faba bean cultivars:

The cowpea aphid abundance varied significantly among the studied cultivars of the faba bean (Fig, 1). The susceptible 'Giza 2' cultivar was better accepted by *A. craccivora* than 'Giza 429' and 'Masr 1' cultivars. According to the least significant differences value (57.04 at *P* 0.05), the different cultivars in this investigation can therefore be arranged exponentially based on aphid populations they harboured during the whole two growing seasons, Masr 1 (475.1 individuals), Giza 429 (534.1 individuals) and Giza 2 (656.8 individuals) per plant shoot. The effect of other factors affecting aphid abundance were not evaluated in the present work, such as environmental conditions that previously investigated by El-Defrawi, 2002. Moreover, some biotic and abiotic factors affect differently aphid biology on different cultivars (Van Lerberghe-Masutti & Chavigny, 1998 and Vorburger & Ramsauer, 2008). The negative relation between *A. craccivora* abundance and plant density /unit area observed, is in agreement with the results of Auclair (1989) that related usually higher fecundity and reproductive periods of this aphid species. Interestingly, aphid abundance was strongly correlated with plant population density on the three tested cultivars (Holt & Wratten, 1986; El-Defrawi *et al.*, 1998 and Asin & Pons, 2001).

Table 1. Fluctuations in population density of Aphis craccivora on three faba bean cultivars planted at four densities 8, 16, 24 and 32 plants/m², Sids ARC, Beni-Suef Governorate, middle Egypt. 2008/09 season.

Inspection date	Aphids /plant shoot at indicated cultivars											
	Masr 1				Giza 2				Giza 429			
	Pd1	Pd2	Pd3	Pd4	Pd1	Pd2	Pd3	Pd4	Pd1	Pd2	Pd3	Pd4
1st. w. Dec.	98.7	96.0	62.0	36.0	120.0	135.7	107.7	141.0	118.3	109.0	101.3	129.0
2nd. w. Dec.	101.7	102.3	92.7	69.7	151.7	233.7	188.3	184.7	132.7	105.7	115.3	149.7
3rd. w. Dec.	136.3	122.0	123.7	100.0	234.3	286.3	249.0	229.0	155.3	131.0	148.0	173.3
4th. w. Dec.	211.0	254.3	201.7	171.0	257.7	356.0	323.0	285.0	263.3	311.3	245.7	206.7
1st. w. Jan.	722.7	697.7	571.3	591.7	887.3	830.3	789.0	743.3	787.3	720.3	607.3	502.3
2nd. w. Jan.	348.0	399.7	347.3	321.3	575.0	456.3	453.7	389.3	491.3	479.0	448.7	418.3
3rd. w. Jan.	564.3	618.0	519.7	509.0	768.3	735.3	648.0	490.7	672.3	631.7	525.3	473.3
4th. w. Jan.	996.7	1079.3	832.0	812.0	1242.3	1207.0	1209.7	1214.3	1097.3	1005.7	856.0	797.7
1st. w. Feb.	912.0	867.0	743.7	721.0	1114.0	1050.7	999.3	982.3	925.7	868.3	798.0	679.0
2nd. w. Feb.	1240.0	1279.7	950.0	918.0	1397.0	1324.3	1283.7	1356.3	1310.7	1196.7	1007.0	866.7
3rd. w. Feb.	1218.0	1227.7	984.7	1087.7	1563.7	1439.7	1289.0	1237.0	1513.7	1353.3	1100.0	944.3
4th. w. Feb.	921.7	924.7	883.0	821.0	1426.3	1296.0	1348.3	765.7	1075.3	783.0	782.3	636.7
1st. w. Mar.	733.0	609.3	613.0	577.3	961.0	857.7	1054.3	811.3	707.3	399.3	411.3	317.0
2nd. w. Mar.	220.0	162.7	146.7	176.7	1005.7	940.3	794.7	403.3	342.0	271.0	205.3	87.7
3rd. w. Mar.	269.7	159.7	111.0	98.0	584.0	615.0	506.0	127.7	87.0	86.7	67.0	60.0
4th. w. Mar.	144.0	103.7	69.7	24.0	707.7	544.0	397.3	85.7	32.7	32.3	16.0	21.0
1st. w. Apr.	85.3	52.7	24.7	29.3	254.7	332.0	70.0	49.7	8.7	4.3	6.0	1.0
2nd. w. Apr.	51.0	18.7	15.3	4.3	77.0	114.3	21.7	31.0	3.0	6.7	0.0	0.0
Mean ± SE.	498.6 ± 98.3	487.5 ±102.3	405.1 ± 83.7	392.7 ± 85.5	740.4 ±115.2	708.6 ±101.7	651.8 ±107.9	529.3 ±104.4	540.2 ±114.9	472.0 ±101.6	413.4 ± 86.7	359.1 ± 74.5
"F" and (P)	18.26 (>0.0001)				12.15 (>0.001)				14.50 (>0.0001)			
L.S.D.(0.05)	36.43				75.85				58.08			

Pd1= 8 Plants /m².; Pd2=16 Plants /m².; Pd3=24 Plants /m².; Pd4= 32 Plants /m²; SE.= Standard Error of means.

Table 2. Fluctuations in population density of Aphis craccivora on three faba bean cultivars planted at four densities 8, 16, 24 and 32 plants/m², Sids ARC, Beni-Suef Governorate, middle Egypt. 2009/10 season.

Inspection date	Aphids /plant shoot at indicated cultivars											
	Masr 1				Giza 2				Giza 429			
	Pd1	Pd2	Pd3	Pd4	Pd1	Pd2	Pd3	Pd4	Pd1	Pd2	Pd3	Pd4
1st. w. Dec.	30.3	39.7	22.4	24.3	57.2	35.9	22.6	19.7	38.4	23.3	21.9	71.3
2nd. w. Dec.	418.7	335.7	284.0	454.8	429.8	281.8	419.0	264.8	442.4	370.1	350.7	317.2
3rd. w. Dec.	650.3	607.7	508.2	500.6	656.5	422.9	614.2	510.8	714.1	647.1	616.6	535.2
4th. w. Dec.	608.9	548.7	435.0	422.5	691.1	623.6	625.3	545.9	707.5	668.0	622.9	554.5
1st. w. Jan.	568.9	554.7	414.5	400.0	905.8	854.3	822.7	698.7	793.1	794.2	683.8	621.0
2nd. w. Jan.	566.9	546.9	410.6	381.7	918.5	927.3	793.3	702.0	728.7	794.8	683.8	554.8
3rd. w. Jan.	645.3	632.4	452.1	436.5	1060,5	1139.5	919.8	757.6	855.0	839.2	726.0	622.1
4th. w. Jan.	699.3	676.7	506.1	497.4	1034.2	1103.9	954.6	878.1	1060.2	966.2	822.9	764.2
1st. w. Feb.	1027.9	849.7	814.8	592.9	1054.5	945.6	755.5	711.0	1138.8	794.3	817.7	426.9
2nd. w. Feb.	1327.0	1038.2	1102.9	776.5	1302.2	942.9	1128.2	888.6	1303.9	1011.2	1023.4	764.2
3rd. w. Feb.	780.2	663.3	553.6	625.3	993.6	1027.2	978.7	889.7	1072.2	1025.2	934.3	796.2
4th. w. Feb.	793.7	742.3	681.1	672.2	959.3	1018.5	888.5	880.4	997.3	1054.7	1002.5	882.9
1st. w. Mar.	541.8	542.3	289.2	138.0	598.4	599.2	351.6	329.7	666.0	598.0	431.8	251.4
2nd. w. Mar.	540.5	459.5	512.7	463.7	662.5	838.7	663.6	629.0	775.6	916.0	702.1	548.4
3rd. w. Mar.	758.5	918.0	579.3	426.8	785.0	687.9	584.1	516.2	969.6	564.3	567.4	296.8
4th. w. Mar.	735.6	704.0	698.9	630.6	907.0	1077.0	916.7	815.3	860.8	1041.1	908.4	799.5
1st. w. Apr.	625.0	525.4	246.7	204.0	726.9	706.8	495.2	443.2	520.8	571.7	462.1	319.5
2nd. w. Apr.	98.9	49.1	43.1	79.0	45.3	79.3	67.8	64.9	92.9	69.1	62.0	42.8
Mean ± SE.	603.4 ± 71.8	552.2 ± 63.4	452.5 ± 62.2	408.5 ± 50.4	728.5 ± 83.0	704.2 ± 84.0	633.9 ± 75.7	557.6 ± 67.3	726.3 ± 82.9	673.5 ± 77.1	604.9 ± 70.9	483.7 ± 61.5
"F" and (P)	19.96 (>0.0001)				17.65 (>0.0001)				23.01 (>0.0001)			
L.S.D.(0.05)	57.15				52.30				62.40			

Pd1= 8 Plants /m².; Pd2=16 Plants /m².; Pd3=24 Plants /m².; Pd4= 32 Plants /m²; SE.= Standard Error of means.

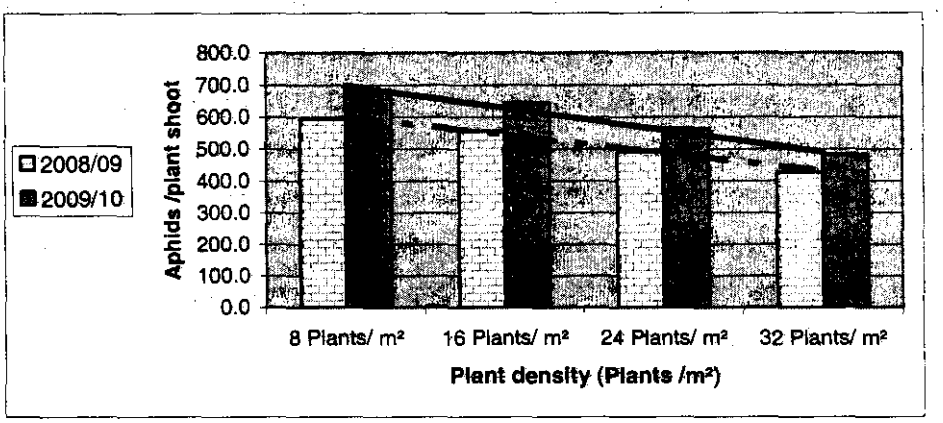

Fig. 1. The relashionship between planting densities (Plants /m².) and the corresponding infestation levels of *A. craccivora* harboured plants of faba bean (Aphids /plant shoot), Sids ARC, Beni-Suef Gover., Egypt.
(Y= -56.403 X + 657.57, R^2= 0.9864 in 2008/09 season)
(Y= -68.793 X + 766.08, R^2= 0.9826 in 2009/10 season)

The accumilated forementioned results lead to the conclusion that dense planting of faba bean satisfactorily decreases the proportion of plants infested with cowpea aphids by
(31.4 % & 22.6 %) in 2008/09; and (47.8 % & 33.8 %), in the second season 2009/10, at the plant population rate of 24 and 32 plants /m², and in turn reduces the subsequent rate of multiplication of aphids and finally the size of the population per unit area, probably because individual plants in dense stands are less nutritious and have a shorter maturation time than those in low stands as anatomized by Way & Heathcote (1966). Furthermore, in such crops of similar high density, plants with narrower spacings between hills had smaller peak numbers of aphids than those with wider spacings (A'Brook, 1977 and Muhammed *et al.*, 2006).

C- Seed yield:

Seed yield per unit area was increased with increasing plant density with no significant differences between 24 and 32 plants /m.² in all cultivars (Table 3). These results agreed with El-Deeb (1982) and Amer (1986) who found no reliable yield increases due to plant densities above 24 plants /m². However, Mohamed (1985), observed yield increases due to plant densities between 11 and 47 plants /m². This is expected since the maximization of seed yield is depending on the genotype and controlled environments. The number of plants per unit area at harvest followed a pattern similar to that of seed yield. Plant populations of 24 and 32 per square meter produced (29.66 & 31.85 Kg /100 m².) in 2008/09 season and (23.91 & 22.27 Kg

/100 m².), in the second season 2009/10, outyielding other densities. The seed yield of faba bean crop cultivated at the rate of 24 and 32 plants per square meter increased by (42.41 % & 44.99 %), and (3.57 & 27.03 %), over the two lower plant population densities 8 and 16 plants /m²., in the first and second season, respectively. In general, there has been a constant association between number of plants per unit area and seed yield obtained. These results indicate the possibility of increasing the productivity of faba bean yield by using a population density between (24 and 32 plants /m²), which are corresponding to 100800 and 134400 plants /fed. (1 fed = 4200 m².

Table 3. Effect of plant population density on seed yield of un-protected faba bean cultivars, 2008/09 and 2009/10 seasons.

Population density Plants /m²	Seed yield (Kg. /100 m².)							
	2008/09 season				2009/10 season			
	Masr1	Giza 2	Giza 429	Mean	Masr1	Giza 2	Giza 429	Mean
8	20.53	14.29	18.31	17.71 a	20.24	15.20	15.45	12.72 a
16	22.33	30.69	28.47	27.16 b	24.95	22.56	19.79	16.82 b
24	27.93	29.63	31.43	29.66 b	33.28	33.83	28.52	23.91 c
32	35.77	30.37	29.42	31.85 b	34.63	29.12	25.33	22.27 c
Mean	26.64	26.24	26.91	26.60	28.28	25.18	22.27	18.93
LSD.(0.05)	6.93	4.76	6.28	8.59	4.61	4.80	5.62	3.35

The aforementioned results in Tables 1, 2 & 3 revealed, that the dense canopies (32 plants /m².) harbored lower levels of aphid and significantly produced higher seed yield than sparse densities due to direct impact of insects on the physiological processes of plants. Infestation may also cause severe disruption of plant tissues or even the death of plants (Forrest *et al.*, 1973; Dantuna & Thomson, 1983 and Tosh, 1998). The relationship between aphid abundance and seed yield among cultivars in the two tested seasons was strong and linear ($r = -0.8980$ and -0.8857, $p < 0.0001$), with explained variance of 94.81 % and 78.45 %, respectively. These implying that aphid abundance on plants was the basis of genotypic differences in seed yield. Accordingly, using the change in yield potentiality and corresponding number of aphids on plants in the four plant densities as parameter, it could be predicated as the increase in aphids per plant (X) is usually followed by an increase in yield loss (Y), expressed as follows: $Y = (4.492 X + 15.365, R^2 = 0.8677)$ and $(3.574 X + 9.995, R^2 = 0.8087)$, exhibited in the two tested seasons, respectively (Fig., 2). Similar effects of infestation have been recorded in many aphid species. However, different aphid species may have different effects on the same host plant. For example, *A. fabae*

causes a reduction in the weight of seeds and the number of seeds per pod in *Vicia faba*, while *Acyrthosiphon pisum* may only reduce seed weight (Bouchery, 1977). Similar findings were obtained by Mohamed (1985), who observed yield increases due to plant densities between 11 and 67 plants / m^2. This is expected since the maximization of seed yield is depending on genotype as well the controlled environments.

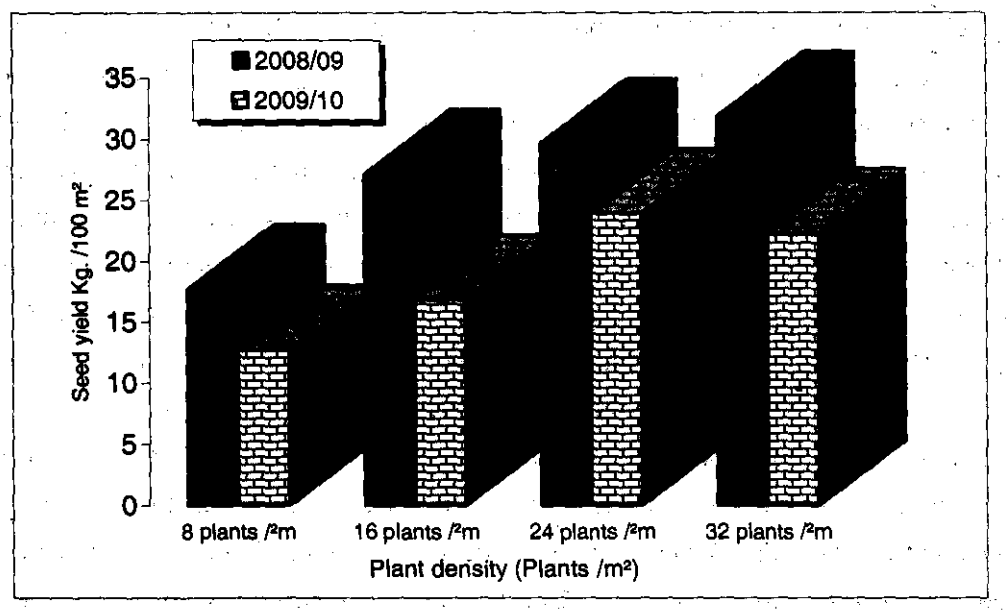

Fig. 2. Effect of plant population densities (Plants /m^2.) on seed yields of faba bean (Kg. /100 $m.^2$), Sids ARC, Beni-Suef Gover., Egypt.

(Y= 4.492 X + 15.365, R^2= 0.8677) in 2008/09 season)

(Y= 3.574 X + 9.995, R^2= 0.8087) in 2009/10 season)

Many authors (Sprent *et al.*, 1977; Abo El-Zahab *et al.*, 1981 and Poulain, 1984) recorded that increases in plant density lead to reductions in branching and pod numbers / plant without much change in either seed size or seeds / pod.

Yield losses in faba bean due to *A. craccivora* have also been shown to depend on the timing and intensity of colonization (Salem, 1998 and Hossni, 2004). They also pointed out that Infestated cultivars of faba bean by relatively low aphid numbers (few per plant shoot) showed a stimulative effect on plant growth and reduced their susceptibilty to aphids. Fewer crops stand (lower plant population) harboring higher number of insect pests that could lead to increased damage to crop leaves, stems and yield components. Eventually, crop yield is inversely affected at lower plant populations attracting increased number of insect pests. El-Defrawi, 2009 reported that faba bean seed and straw yield damages by cowpea aphid increased when plant populations decreased from 33, 25 to 11 plants /m^2 in sole cropping close to legume crops such as fenugreek, chickpea and lentil. Plant population density,

nevertheless, contributed to the total seed yield of the crop. The results of this experiment showed a positive response of seed yield with higher plant population densities, 24 and 32 plants /m². These results were in agreement with the findings of El-Deeb, 1982; Mohamed, 1985; Amer, 1986 and Hossni, 2004. Many authors pointed out that physiological changes have been recorded in plants following aphid infestation. These included a reduction in water permeability and the level of carbohydrate reserves (Putritch and Talmon-del'Armee, 1971 and Christine *et al.*, 2005) and higher and lower levels of growth-inhibiting and growth-promoting substance, respectively, in the radish, *Raphanus sativus*, after infestation by *M. persicae* (Hussain *et al.*, 1974). As cowpea aphid, deliver toxic substances by salivary secretions, it is generally assumed that their effect on growth is mainly due to removal of phloem sap from their host plants. Thus, aphid infestation reduces the mass flow of nutrients into the primary growth zone (Mittler and Sylvester, 1961; Pollard, 1973). The overall results of the present work indicate that seeds yields of faba bean cv. Masr 1, Giza 2 and Giza 429 varieties under environment of infestation with cowpea aphid, *A. craccivora* in Beni-Suef Governorate, middle Egypt, could be successfully maximized or reduce the reductions caused by insect pest attack faba beans by planting the crop at 24-32 plants /m² plant density (sowing at 2 seeds / hill in double rows or one seed /hill in three rows, 20 cm hill to hill distance on ridges 60 cm apart) proved to tolerate and overcome the cowpea aphids damage.

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تأثير الكثافة النباتية على مستوى الإصابة بحشرات المن وإنتاجية ثلاثة أصناف من الفول البلدي

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تعتبر الكثافة النباتية في وحدة المساحة لأصناف الفول البلدي من أهم التوصيات الفنية المرتبطة بتعظيم الإنتاج لدى المزارعين، وحيث لا تتوافر معلومات علمية كافية يمكن الاعتماد من خلالها في إمكانية تعديل كثافات زراعة الفول البلدي بهدف درأ الإصابات الوبائية المتكررة بحشرات المن الناقلة للأمراض الفيروسية، لذا أجريت هذه الدراسة في محطة سدس للبحوث الزراعية – محافظة بنى سويف – إقليم مصر الوسطي خلال موسمي ٢٠٠٨/٢٠٠٩ و ٢٠٠٩/٢٠١٠ باستخدام ثلاث أصناف محلية من الفول البلدي هي: مصر ١ و جيزة ٢ و جيزة ٤٢٩ بهدف دراسة تأثير أربعة كثافات نباتية ٨، ١٦، ٢٤ و ٣٢ نبات في المتر المربع أي (٣٣٦٠٠، ٦٧٢٠٠، ١٠٠٦٠٠ و ١٣٤٤٠٠ نبات في الفدان) على قابلية هذه الأصناف للاصابة بحشرة من اللوبيا *Aphis craccivora* ومدى قدرتها على إنتاج محصول البذرة تحت هذه الظروف وكذا أيجاد انسب كثافة نباتية تعمل على خفض الإصابة إلى أدنى حد وتحقق إنتاجية عالية دون استخدام مبيدات حشرية أو كيماويات ملوثة للبيئة.

- أظهرت النتائج وجود اختلاف معنوي لتعداد حشرة من اللوبيا التي أصابت نباتات أصناف الفول البلدي الثلاثة مصر ١، جيزة ٢ وجيزة ٤٢٩.حيث تميزت نباتات الفول تحت الكثافات العالية بنقص شدة إصابتها بحشرة من اللوبيا.
- انخفاض شدة الإصابة بحشرات المن بنسبة ٣١,٤ % و ٢٢,٦ % خلال الموسم الأول وبنسبة ٤٧,٨ % و ٣٣,٨ % في الموسم الثاني في القطع التجريبية ذات الكثافات النباتية العالية ٢٤ و ٣٢ نبات في المتر المربع على الترتيب.
- تفوقت الكثافات النباتية العالية ٢٤ و ٣٢ نبات في المتر المربع على الزراعات ذات الكثافة المنخفضة ٨ و ١٦ نبات في كمية المحصول بوحدة المساحة بنسبية ٤٢,٤١ و ٤٤,٩٩ % في الموسم الأول و ٣,٥٧ و ٢٧,٠٣ % في الموسم الثاني على التوالي.
- وبناء على هذه النتائج، يمكن التوصية بزراعة محصول الفول البلدي في منطقة مصر الوسطي بكثافة نباتية تتراوح بين ١٠٠٨٠٠ و ١٣٤٤٠٠ نبات في الفدان أى بمعدل ٢٤-٣٢ نبات في المتر المربع لتقليل الإصابة بحشرات المن في تلك المنطقة ولضمان إنتاج وفير من البذور بوحدة المساحة تحت هذه الظروف.