

Impact of Plant Arrangement and Density on Yield and its Components of Two Faba Bean Cultivars (*Vicia faba* L.).

Dalia A. A. El Hag

Agronomy Dept., Faculty of Agric., Kafrelshiekh University



ABSTRACT

In order to study the effect of plant arrangement (2 plants hill⁻¹ on one side and plant hill⁻¹ on two side of ridge) and hill spacing (15, 30 and 45 cm between hills) on seed yield and its components of two faba bean cultivars (Sakha 1 and Giza 843), an experiment was conducted in two growing seasons 2013/14 and 2014/15 winter seasons, in the farm of the Faculty of Agriculture, Kafrelshiekh university, Kafre-Elshiekh Governorate, Egypt. A split-split plot with four replications was used. The main plots were assigned to cultivars, the sub plots to plant arrangements and the sub-sub plots to hill spacing. The data collected were: plant height, number of branches/plant, number of pods/plant, number of seeds/pod, 100 seed weight, seed yield and harvest index. Results indicated that, the cultivar Sakha 1 was superior to Giza 843 on plant height, number of branches/plant, number of pods/plant, Seeds/pod, seed weight/plant, 100-seed weight, seed yield and harvest index % .Plants arranged on one side of ridge recorded taller height and higher harvest index than those arranged on two sides of ridges. The inverse was true in the other characters. The increases in plant density by narrowing the distance between hills resulted in significant decrease in number of pods/plant, number of seeds/pod, seed weight/plant, 100-seed weight and seed yield. However, plant height was increased by increasing plant density. Seed yield was significantly increased by increasing hill space from 15 to 30 cm. It can be concluded that sowing the faba bean cultivar "Sakha 1" on two sides of ridges 60 cm apart at 30 cm space between hills is the recommended treatment for optimum seed yield in Kafre El-Sheikh area.

Keywords: Faba bean, cultivars, plant arrangement, density, yield and yield components.

INTRODUCTION

Faba bean (*Vicia faba* L.) is one of the most important legume crops in Egypt. It is considered as a cheap source of available protein for human food and animal consumption. Increasing the productivity of faba bean seed yield, in Egypt, is one of the main Egyptian Government objectives. In Egypt, (Megawer *et al.* 2017), recorded that, the cultivated area with faba bean was 81.934 thousand Fedden with an average seed yield of 1.449 t/fed. in 2014/2015 season, which is mainly spread in North Egypt governorates (54.48%) especially at Bahera, Kafre-El sheikh, and Dakahlia. Area under cultivation in middle, Upper Egypt and outside the valley in newly reclaimed soil represent 34.84%, from the total average in Egypt at 2014/2015 season Plant arrangement play a major role in faba bean productivity by its impact on the efficiency of nutrients absorption, improving crop growth and utilization of the environmental factors. Adisarwanto and Knight (1997), Turk and Tawaha (2002), Thalji (2006) and Wakweya and Meleta (2016) found that the cultivars and plant arrangement significantly affected seed and biomass yield, harvest index and 100 seed weight. And moreover seed rates had significantly affected all the tested parameters except number of pods /plant and seed yield. Plant density is an important agent that affects yield and yield components of legumes. Since, if the plant population is too high, plants compete with each other for resources and low yield was realized. On the other hand, if the population is too low, more growing space was wasted and it lowering yield. In line with these facts Kakiuchi and Kobata (2004) and Wakweya and Meleta (2016) found that lower plant density increased the pods number per plant whereas; the higher plant density decreased the parameter. Similarly, several authors; Khalil *et al.*, (1993), Abdel-Aziz *et al.*, (1999) reported that plant height increased with increasing population density up to 33.3 plant/m² or 44.4 plant/m² (El-Doubay *et al.*, (1996). Moreover, Wakweya and Meleta (2016) also reported that plant density had shining influences on plant height, biological and seed yield (kg/ha) where the parameters increased by increasing plant densities.

The objective of the present study was to recognize the suitable combination for plant arrangement and spaces between hill (densities) for maximizing faba bean seed yield and its components in kafre El-Shiekh Governorate, Egypt.

MATERIALS AND METHODS

A field trial was carried out during winter seasons of 2013/14 and 2014/15 in order to evaluate the yield of two faba bean cultivars grown in the Researches Farm of Faculty of Agricultural – Kafrelshiekh University , Kafre El-Shiekh Governorate, Egypt. The experiments were laid out in split split plot design with four replications in RCBD. Where faba bean cultivars (Sakha 1 and Giza 843) were randomly assigned in main plots, while plant arrangement (sowing on one side –southern direction and on both side of the ridge - southern and northern directions). After 15 days from sowing, two plants are left in each hill in the case of sowing, on one side of the ridge, while one plant is left in the case of cultivation on both sides of the line ridge. The spac between ridges were 60 cm. plant densities (s) were allocated in sub-sub plots: S1=15 cm, S2=30 cm and S3=45 cm between plants or hills in row on the ridges. The preceding crop was rice (*Oryza Sativa*, L) in both seasons.

The experimental unit area was 10.5 m² = (1/400 fed., one feddan =4200 m²) 3 m width and 3.5 m long which formed of 5 ridges, 60 (cm) between ridges. Seeds of faba bean cultivars were planted in 15th and 25th November in 2013 and 2014 growing seasons, respectively. During seed bed preparation P2O₅ and K₂O fertilizers were added at the rate of 31.0 and 24.0 (kg/fed), respectively, while nitrogen fertilizer as ammonium nitrate (33.5%) was added at the rate of 33.5 kg N/fed. Normal irrigation was used.

Composite soil sample was randomly collected from the site at the depths of 0 to 30 cm with the help of 5 cm diameter auger before soil preparation in both seasons. These samples were analyzed for physical and chemical characteristics by standard methods of analysis. Results of physical and chemical analysis in both seasons are shown in Table 1.

At harvest time the following characters were recorded on a random sample of ten guarded plants from

each plot: plant height, Number of branches/plant, Number of pods/plant, Number of seeds/pod, 100 seed weight (g), Seed yield (Ton/fed). and Harvest index. %.

The whole plot was harvested to determine seed yield/fed. then calculated harvest index by divided seed yield/biological yield.

Table 1. chemical and Physical properties of soil at the experimental site during 2013/14 and 2014/15 seasons.

season	Chemical properties			PH	Organic matter %	Particle size			Soil texture
	Available N (ppm)	Available P (ppm)	Available K (ppm)			Sand %	Silt %	Clay %	
2013/14	20	19.7	295	8.1	2.2	17.1	37.3	42.6.	clay
2014/15	18	21.3	343	7.8	2.1	18.5	37.2	42.2	clay

Statistical analysis:

All data collected for the two seasons were subjected to analysis of variance and means of treatments were compared Duncun Multiple Range Test (Duncun, 1955).. All statistical analysis was performed using analysis of variance technique by “MSTAT-C” computer software package.

might be due to the genetically and environmental interaction effects. Varietal differences in plant height were frequently recorded by Abdalla *et al.*(2000), Dahmardeh *et al.* (2010), Bakry *et al.* (2011), Abbas *et al.* (2014) and Megawer *et al.* (2017).

RESULTS AND DISCUSSION

Plant height (cm)

Data in Table (2) Show varietal difference in plant height in the second season only. Plants of the cultivar Sakha 1 were taller than those of Giza 843 in this season. This

Plant arrangement significantly affected plant height in the second season. Sowing on one side of ridges resulted in a significant increase in plant height compared with sowing on two sides. This may be attributed to increase in number of plants per hill which increased the completion and in turn increased plant height.

Table 2. Mean of plant height (cm), number of branches/plant, number of pods/plant and number of seeds/pod as affected by faba bean cultivars, plant arrangement, density and there interaction in 2013/14 and 2014/15 seasons.

Treatments	plant height		Branches (no /plant)		Pods (no/plant)		Seeds (no/pod)	
	2013/14	2014/15	2013/14	2014/15	2013/14	2014/15	2013/14	2014/15
Cultivar C								
Sakha 1	82.0	84.8	3.2	3.1	15.98	13.79	2.9	3.3
Giza 843	78.8	80.2	2.b	2.9	15.52	12.98	2.8	3.1
F test	NS	**	**	NS	NS	*	NS	**
Plant arrangement (A)								
one side	81.3	83.8	2.9	2.9	14.08	11.52	2.7	3.1
Two sides	79.5	81.2	3.1	3.1	17.42	15.25	3.0	3.3
F test	NS	*	*	*	**	*	**	NS
Hill space, cm (S)								
15	83.4a	85.9a	3.1	3.0	12.69c	10.78c	2.6c	3.1c
30	80.9b	82.1b	2.8	2.9	16.34b	13.63b	2.9b	3.2b
45	77.1c	79.6c	3.0	3.0	18.22a	15.75a	3.1a	3.4a
F test	*	**	NS	NS	**	**	**	**
Interaction effects								
C x A	NS	NS	NS	NS	*	**	NS	NS
C x S	NS	*	NS	NS	**	*	NS	NS
A x S	NS	NS	NS	NS	**	**	NS	NS
C x A x S	NS	NS	NS	NS	NS	**	NS	NS

*, ** and NS indicated P< 0.05, 0.01 and not significant, respectively.

Means designated by the same letter are not significantly different at 5 % level according to Duncan’s Multiple Range Test.

These results was agreement with Abbas *et al.* (2014). In this connection, Thalji (2006), demonstrated that narrow spacing, in their works, lead to a reduction of light.

(Table 3). The cultivar Sakha 1 surpassed Giza 843 in plant height at any hill space. The highest plant 89.4 cm was achieved by planting Sakha 1 at 15cm between hills. The shortest plants 79.0 cm were recorded when Giza 843 cultivar was sowing at 45 cm between hills.

Plant height was significantly increased by decreasing hill space in both seasons. The hill distance of 15 cm produced the tallest plants (83.4 and 85.9 cm) as compared with (77.1 and 79.6 cm) when the distance between hill increased to 45 cm. This increase in plant height may be attributed to competition in the higher density treatments. Dahmardeh *et al.* (2010), Mokhtar (2001) and Bakry *et al.* (2011) reported that changing the plant density had shining influences on plant height, where it was increased by a decreasing space between plants. Thalji (2010), Yucel (2013), Derogar *et al.* (2014) and Mekkei (2014) who indicated that the denser plant population increased the plant height due to competition among plants. However, Dahmardeh *et al.*(2010) reported that plant height was not affected by increasing plant density.

Number of branches /plant:

Data in Table (2) Show varietal difference in number of branches/plant in the first season only. Plants of the cultivar Sakha 1 were surpassed than those of Giza 843 in this season. This might be due to the genetically and environmental interaction effects

Interaction effects:

The interaction between cultivars and hill spaces had a significant effect on plant height in the second season

Plant arrangement significantly affected number of branches/plant in the both seasons. Sowing on two sides of ridges resulted in a significant increase in number of branches/plant compared with sowing on one side. Plant arrangement in two sides produced more branches (3.1 and 3.1) compared with one sides (2.9 and 2.8) in both seasons, respectively. Turk and Tawaha (2002) and Thalji (2006) reported that increases spaces between rows increased number of branches/plant.

Hill spaces had insignificant effect on number of branches/plant in both seasons. On the other hand, Mokhtar (2001) Thalji (2010) Bakry *et al.* (2011) and Derogar *et al.*

(2014) recorded that increasing plant density vestige negatively influences numbers of branches per plant.

Table 3. Mean of plant height in 2014/15 seasons and number of pods /plant in 2013/14 and 2014/15 season 100 seed weight in 2014/15 season as affected by interaction between faba bean cultivars and hill spaces.

Faba bean cultivar	Hill spaces	Plant height (cm)		Number of pods/plant		100 seed weight	
		2014-15	2013-14	2014-15	2014-15		
Sakha 1	15	89.4a	12.63d	11.5d	71.5e		
	30	85.0b	16.5c	13.69c	76.6b		
	45	80.1cd	18.81a	16.19a	78.6a		
Giza 843	15	82.5bc	12.75d	10.06e	73.5d		
	30	79.1cd	16.19c	13.56c	75.1c		
	45	79.0d	17.63b	15.31b	75.9c		
F test		*	**	*	**		
LSD0.05		3.2	0.46	0.58	1.1		

*, ** and NS indicated P< 0.05, 0.01 and not significant, respectively.

Means designated by the same letter are not significantly different at 5 % level according to Duncan’s Multiple Range Test.

Interaction effects:

The interaction between cultivars, plant arrangement and hill spaces were insignificant effect on number of branches/plant.

Number of pods /plant:

Data in Table (2) Show varietal difference in number of pods/plant in the second season only. Plants of the cultivar Sakha 1 were produced more pods than those of Giza 843 in this season. This might be due to the genetically and environmental interaction effects. Varietal differences in number of pods/plant were frequently recorded by Such varietals differences in pods number were previously reported by Khalil *et al.* (1993), Abdalla *et al.* (2000), Dahmardeh *et al.* (2010), Bakry *et al.* (2011), Abbas *et al.* (2014), AL-Shamma and Sahib (2014) and Wakweya and Meleta (2016).

Plant arrangement highly significant and significantly affected number of pods/plant in the first and second seasons respectively. Sowing on two sides of ridges resulted in a significant increase in number of pods/plant compared with sowing on one side. This may be attributed to increase in number of plants per hill which increased the completion and in turn increased plant height. These results was agreement with Abbas *et al.* (2014).

Number of pods/plant was highly significantly increased by increasing hill space in both seasons. The hill distance of 45 cm produced the highest number of pods/plant (18.22 and 15.75) as compared with (12.69 and 10.78) when the distance between hill decreased to 15 cm. These results are in agreement with those obtained by Mokhtar (2001), Dahmardeh *et al.* (2010), Thalji (2010), Bakry *et al.* (2011) and Yucel (2013), Derogar *et al.* (2014) and Mekkei (2014) who reported that pods number/plant decreased with increasing plant density. This increase in pods number plant-1 could be related to branch number.

Interaction effects:

The interaction between cultivars and plant arrangement had a significant and highly significant effect on number of pods/plant in the first and second seasons (Fig. 1). The cultivar Sakha 1 surpassed Giza 843 in number of pods/plant at plant arrangement in both sides of ridges. The highest number of pods/plant (17.54 and 16.58) pods/plant was achieved by planting Sakha 1 at both sides.

The interaction between cultivars and hill spaces had a highly significant and significant effect on number of pods/plant in the first and second seasons (Table 3). The

cultivar Sakha 1 surpassed Giza 843 in number of pods/plant at 45 cm hill space. The highest number of pods/plant (18.81 and 16.19) pods/plant was achieved by planting Sakha 1 at 45cm between hills.

The interaction between plant arrangement and hill spaces had a highly significant effect on number of pods/plant in the both seasons (Table 4). Hill spaces (45 cm) in plant arrangement two sides recorded the highest number of pods/plant (19.75 and 17.13) compared with hill space 15 cm which recorded (10.69 and 8.81) at one side.

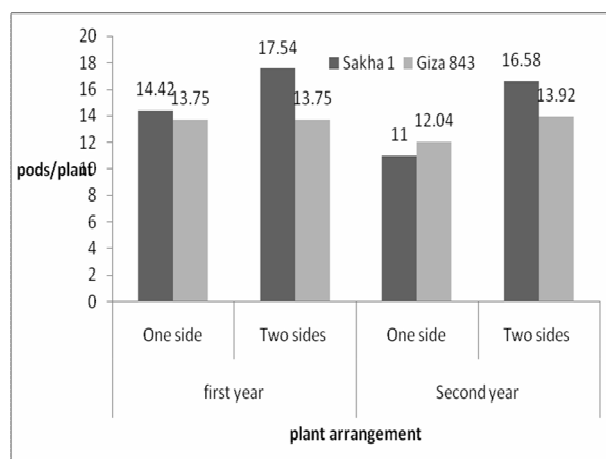


Fig. 1. Interaction effect between faba bean cultivar and plant arrangement in 2013/14 and 2014/15 seasons

The interaction between faba bean cultivars, plant arrangement and hill spaces was highly significant effect in 2014/15 growing season. Sakha 1 recorded the highest number of pods at plant arrangement two sides with hill spaces 45 cm (18.0) Fig. 2.

Number of seeds/pod:

Data in Table (2) Show varietal difference in number of seeds/pod in the second season only. Plants of the cultivar Sakha 1 were produced (3.3) more number of seeds/pod than those of Giza 843 (3.1) in this season. This might be due to the genetically and environmental interaction effects. Varietal differences in number of seeds/pod were frequently recorded by Bakry *et al.* (2011) and Abbas *et al.* (2014).

Plant arrangement highly significant affected number of seeds/pod in the first season. Sowing on two sides of ridges resulted in a significant increase in number of seeds/pod (3.3) compared with sowing on one side (3.1).

This may be attributed to increase the completion and in turn decreased number of seeds/pod. These results are agreement with those reported by Turk and Tawaha (2002), Bakry *et al.* (2011) and Abbas *et al.* (2014).

Table 4. Mean of number of pods/plant in 2013/14 and 2014/15 seasons seeds and seed yield/feddan in 2013/14 season as affected by interaction between plant arrangement and hill spaces.

Plant arrangement	Hill spaces	Number of pods/plant		seed yield t/fed.
		2013-14	2014-15	2013-14
one side	15 cm	10.69e	8.81f	1.555c
	30 cm	14.88d	11.38e	1.736b
	45 cm	16.69c	14.38c	1.691b
two side	15 cm	14.69d	12.75d	1.769b
	30 cm	17.81b	15.88b	1.905a
	45 cm	19.75a	17.13a	1.659c
F test		**	**	*
LSD0.05		0.46	0.28	0.113

*, ** and NS indicated P < 0.05, 0.01 and not significant, respectively. Means designated by the same letter are not significantly different at 5 % level according to Duncan's Multiple Range Test.

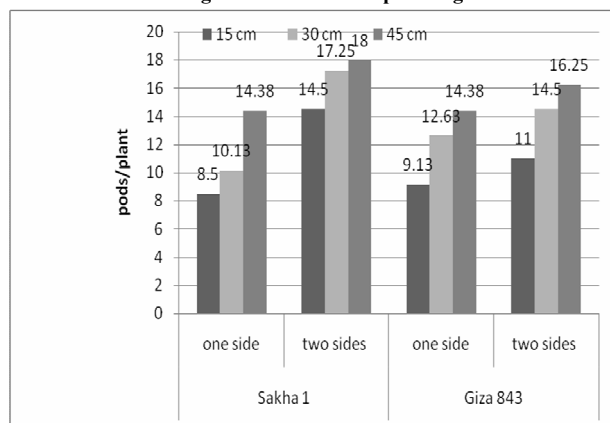


Fig. 2. interaction between faba bean cultivars, plant arrangement and hill spaces on number of pods/plant in 2014/15.

Number of seeds/pod was highly significantly increased by increasing hill space in both seasons. The hill distance of 45 cm produced the highest number of seeds/pod (3.1 and 3.4) as compared with (2.6 and 3.1) when

Table 5. Mean of 100 seed weight (g), seed yield/plant, seed yield/feddan and harvest index as affected by faba bean cultivars, plant arrangement, density and there interaction in 2013/14 and 2014/15 growing seasons.

Treatments	100 seed weight		seed yield/plant		seed yield t/fed		HI%	
	2013/14	2014/15	2013/14	2014/15	2013/14	2014/15	2013/14	2014/15
Cultivars C								
Sakha 1	72.8	75.6	32.89	37.89	1.817	1.545	30.9	30.3
Giza 843	72.3	74.9	33.05	38.12	1.622	1.473	29.7	29.1
F test	NS	NS	NS	NS	*	**	*	NS
Plant arrangement A								
one side	71.7	73.0	30.47	34.28	1.661	1.467	29.7	30.2
Two sides	73.3	77.4	35.48	41.72	1.778	1.550	30.9	29.1
F test	*	**	**	**	*	**	*	**
Hill space, cm (S)								
15	70.8c	72.5c	30.61c	32.49c	1.662b	1.470b	30.1	28.9
30	73.0b	75.9b	31.85b	37.95b	1.821a	1.581a	30.8	30.3
45	73.8a	77.3a	36.45a	43.57a	1.675b	1.476b	30.0	29.9
F test	**	**	**	**	**	*	NS	NS
Interaction effect								
C x A	NS	NS	NS	NS	NS	NS	NS	NS
C x S	NS	**	NS	NS	NS	NS	NS	NS
A x S	NS	NS	NS	NS	*	NS	NS	NS
C x A x S	NS	NS	NS	NS	NS	NS	NS	NS

*, **, and NS indicated P < 0.05, 0.01 and not significant, respectively. Means designated by the same letter are not significantly different at 5 % level according to Duncan's Multiple Range Test.

the distance between hill decreased to 15 cm. This results agreement with Mokhtar (2001), Dahmardeh *et al.* (2010), Thalji, (2010), Bakry *et al.* (2011), Yucel (2013), Derogar *et al.* (2014) and Mekkei (2014).

Interaction effects:

The interaction between cultivars, plant arrangement and density were insignificant effect on number of seeds/pod.

One hundred seed weight (g):

Data in Table (5) show varietal did not difference in number of one hundred seed weight in the both seasons. Plants of the cultivar Sakha 1 were produced higher weight (72.8 and 75.6) without differences with Giza 843 (72.3 and 74.9) in both seasons, respectively. Meanwhile Bakry *et al.* (2011), Abbas *et al.* (2014, and AL-Shamma and Sahib (2014) reported that there were a significant differences among varieties for this trait.

Plant arrangement significant and highly significant affected one hundred seed weight in the first and second seasons, respectively. Sowing on two sides of ridges resulted in a significant increase in one hundred seed weight (73.3 and 77.4) compared with sowing on one side (71.7 and 73.0). This may be attributed to increase the completion and in turn decreased one hundred seed weight. These results are on line with those reported by Al-Rifae (1999) Thalji (2010) and Abbas *et al.* (2014).

One hundred seed weight was highly significantly increased by increasing hill space in both seasons. The hill distance of 45 cm produced the highest one hundred seed weight (73.8 and 77.3) as compared with (70.8 and 72.5g) when the distance between hill decreased to 15 cm. These results are on line with those reported by Al-Rifae (1999), Dahmardeh *et al.* (2010), Thalji (2010), Bakry *et al.* (2011), Dordas and Lithourgidis (2011), Yucel (2013), Derogar *et al.* (2014) and Mekkei (2014).

Interaction effects:

The interaction between cultivars and density was highly significant effect for this trait in the second season. Table 3 show that Sakha 1 produced (78.6 g) with hill spaces at 45 cm between hills comparing (71.5g) with 15 cm between hills.

Seed yield / plant (g):

Data in Table (5) show varietal did not difference in seed yield/plant in both seasons. On the other hand, Bakry *et al.* (2011), Abbas *et al.* (2014) and AL-Shamma and Sahib (2014) found that seed yield/plant was affected by varietal difference.

Plant arrangement highly significant affected seed yield/plant in both seasons. Sowing on two sides of ridges resulted in a significant increase in seed yield/plant (35.4 and 41.72) compared with sowing on one side (30.47 and 34.28). This may be attributed to increase the completion and in turn decreased seed yield/plant. These results are in agreement with those reported by Turk and Tawaha (2002), Thalji (2006), Thalji (2010) and Abbas *et al.* (2014).

Seed yield/plant was highly significantly increased by increasing hill space in both seasons. The hill distance of 45 cm produced the highest seed yield/plant (36.45 and 43.57 g) as compared with (30.6 and 32.49 g) when the distance between hill decreased to 15 cm. Similar results were reported by Thalji (2010), Derogar *et al.* (2014), Yucel (2013), and Mekkei (2014).

Interaction effects:

The interaction between cultivars, plant arrangement and density were insignificant effect on seed yield/plant.

Seed yield (t /feddan):

Data in Table (5) Show varietal difference show significant and highly significant difference in seed yield/fed. in the first and second seasons, respectively. Plants of the cultivar Sakha 1 were produced higher yield (1.817 and 1.545 t/fed.) as compared with Giza 843 (1.622 and 1.473t/fed.) in the first and second seasons, respectively. The increases in seed yield were 12 and 5 % than Giza 843 in both seasons respectively. The increments induced in component traits such as number of pods per plant, number of seeds per pod, seed yield/plant and one hundred seed weight caused an increase in seed yield/feddan. Several workers, and amongst them are Khalil *et al.* (1993), El-Douby *et al.* (1996), Hassan and Hafiz (1998), Abdalla *et al.* (2000), Dahmardeh *et al.* (2010), Bakry *et al.* (2011), AL-Shamma and Sahib (2014) and Wakweya and Meleta (2016) who established the present findings.

Plant arrangement significant and highly significant affected seed yield/feddan (Table5)in the first and second seasons, respectively. Sowing on two sides of ridges resulted in a significant increase in seed yield (1.778 and 1.550 t/fed.) compared with sowing on one side (1.661 and 1.467 t/fed.). Such significant difference between the two plant arrangement could be attributed to the different plant densities for both treatments. Similar results were obtained by Thalji (2010), Derogar *et al.* (2014), Yucel (2013), and Mekkei (2014)

Seed yield/feddan was highly significantly and significant increased by increasing hill space in both seasons. The hill distance of 30 cm produced the highest seed yield/feddan (1.821 and 1.581 t/fed.) as compared with (1.662 and 1.470t/fed.) when the distance between hill decreased to 15 cm, and (1.675 and 1.476 t/fed.) when the distance between hill increased to 45 cm. Raising seed yield by increasing plant density was frequently reported by several workers, and amongst them are El-Douby *et al.* (1996), Hassan and Hafiz (1998), Mokhtar (2001), Dahmardeh *et al.* (2010), Bakry *et al.* (2011), Yucel (2013),

Derogar *et al.* (2014) and Mekkei (2014), who established the present findings.

Interaction effects:

The interaction between plant arrangement and density was significant effect on seed yield in 2013/14 season. Planting in two sides with D2 recorded the highest seed yield (1.905 t/fed). Other interaction not reach to significant effects Table 4.

Harvest index %

Data in Table (5) Show varietal difference show significant difference in harvest index% in the first season only. Plants of the cultivar Sakha 1 were produced higher harvest index (30.9%) while Giza 843 recorded (29.7%). this variation was due to the increases of Sakha 1 for seed yield and component , which sakha 1 recorded the highest values for plant height, number of branches/plant, number of seeds/plant and seed yield The same results were found by Bakry *et al.* (2011).

Plant arrangement significant and highly significant affected harvest index in the first and second seasons, respectively. Sowing on two sides of ridges resulted (30.9 and 30.2) % in the first season and on one side in the second season, respectively. Similar results were obtained by Thalji (2010), Derogar *et al.* (2014), Yucel (2013), and Mekkei (2014)

Hill spaces were insignificant effect on harvest index in both seasons. On the other hand, Thalji (2010), Yucel (2013), Derogar *et al.* (2014) and Mekkei (2014) reported that densities affected harvest index.

Interaction effects:

The interaction between cultivars, plant arrangement and density were insignificant effect on harvest index.

CONCLUSION

The present study demonstrated that Sakha 1 cultivar recorded more seed yield (12 and 5 %) higher than Giza 843 in both seasons, respectively. The main sources for the yield difference between the two cultivars were number of branches/plant, number of pods/plant and number of seeds/pod which was recorded by Sakha 1. The experiment also revealed that the highest yield and yield components especially seed yield (7.0 and 5.6%) was obtained from sowing on both sides of ridge as compared to planting on one side of the ridge method. On the other hand, seed density D2 (30cm) had highly significant effect on seed yield (9.5 and 7.6%) more than D1(15 cm). Planting Sakha 1 on both sides of ridges or planting with 30 cm apart between plants was recorded the highest seed yield.

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تأثير طرق الزراعة والكثافة على المحصول والمحصول ومكوناته لبعض أصناف الفول البلدي داليا عبدربه عبد العزيز الحاج قسم المحاصيل- كلية الزراعة جامعة كفر الشيخ

أجريت تجربة حقلية بالمزرعة البحثية - كلية الزراعة - جامعة كفر الشيخ ، خلال موسمي الزراعة 2013/14 و 2014/15 وتهدف التجربة لدراسة تأثير نظم الزراعة والكثافة النباتية لصنفين من الفول البلدي على محصول الفول البلدي والمحصول ومكوناته. واستخدام تصميم القطع المنشقة مرتين في أربعه مكررات في تصميم قطاعات كاملة العشوائية . وكانت المعاملات كالاتي : وزع الصنفين في القطع الرئيسية (سحا 1 و جيزة 843)، طرق الزراعة (على جانب واحد من الخط من جهة الجنوب او على جهتي الخط من جهة الجنوب ووجه الشمال) في القطع الشقية. وتم توزيع مسافات الجور (الكثافات) في القطع الشقية الثانية (جور على مسافة 15، 30، 45 سم). وتم دراسة الصفات التالية ارتفاع النبات، عدد الأفرع لكل نبات ، عدد القرون لكل نبات، عدد البذور لكل قرن، وزن 100 بذرة، محصول بذور النبات، محصول البذور/فدان و معامل الحصاد% ويمكن تلخيص نتائج البحث كالتالي:- تأثير الاختلاف بين الأصناف:- أثر الاختلاف بين الأصناف معنويا على ارتفاع النبات في الموسم الثاني وتوقع الصنف سحا 1 في كل من : عدد الأفرع لكل نبات ، عدد القرون لكل نبات ، وزن 100 بذرة ، وزن محصول النبات، محصول البذور/فدان و معامل الحصاد % في الموسم الأول وعدد البذور لكل قرن في الموسمين. وتوقع الصنف جيزة 843 في صفة وزن 100 بذرة في الموسم الثاني. تأثير طرق الزراعة: أثرت نظم الزراعة في جهة واحدة معنويا على زيادة ارتفاع النبات معنويا في الموسم الأول. بينما سجلت نظم الزراعة على الجهتين زيادة معنوية على كل من عدد الأفرع لكل نبات ، عدد القرون لكل نبات، عدد البذور لكل قرن، وزن 100 بذرة، وزن محصول النبات، محصول البذور/فدان في الموسمين و معامل الحصاد % في الموسم الأول. تأثير الكثافة : أثرت الكثافات على كل الصفات تحت الدراسة. بزيادة الكثافة زاد ارتفاع النباتات. وبنقص الكثافة زاد عدد الأفرع لكل نبات ، عدد القرون لكل نبات ، عدد البذور لكل قرن، وزن 100 بذرة و محصول البذور لكل نبات. بينما كانت الكثافة المتوسطة هي الأعلى محصول لكل فدان في الموسمين. وأيضا زاد معامل دليل الحصاد بتقليل الكثافة في الموسم الأول. يمكن زراعته الصنف سحا 1 على جانبي الخط وعلى مسافة 30سم للحصول على أعلى إنتاج تحت نفس ظروف التجربة.