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Effect of Preceding Summer Crops on Yield and Quality of Sugar Beet Intercropped with Faba Bean

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ABSTRACT

A field experiment was carried out at Tag El-Ezz Research Station, Dakahlia Governorate, Egypt, during 2015/2016 and 2016/2017 seasons to determine the effect of some preceding summer crops (rice, maize and soybean) and faba bean intercropping systems *i.e.* intercropping faba bean with sugar beet in row on the back (middle) of the bed (2 plants/hill) at 30, 40 and 50 cm between hills on sugar beet *cv.* Sultan yields and its components and quality parameters. Each preceding summer crop was performed in separate experiment. Each experiment of preceding summer crops was carried out in randomized complete block design with four replications. The obtained results showed that sugar beet and faba bean preceded by soybean were superior in all studied characters, expect quality traits of sugar beet. Faba bean intercropped at 50 cm between hills of sugar beet resulted in the highest yields and its components, while faba bean intercropped at 30 cm resulted in the highest quality parameter in both seasons. Intercropping faba bean in middle of sugar beet beds of 120 cm width and 50 cm between hills was superior in number of branches, seed yield/plant and 100-seed weight, whereas the highest values of plant height and seed yield/fad were recorded with 30 cm between hills. The highest values of land equivalent ratio and total income (LE 9198.8 and 13604.4) were attained with growing both crops after soybean with intercropping faba bean with sugar beet at 30 cm between hills in the first and second season, respectively. It can be concluded that faba bean intercropped at 30 cm between sugar beet hills, after soybean crop to achieve maximum productivity and quality of both crops in addition highest land equivalent ratio and total income under conditions of Dakahlia Governorate, Egypt.

Keywords: Sugar beer, faba bean, preceding crops, intercropping systems, land equivalent ratio, total income.

INTRODUCTION

Sugar beet (*Beta valgaris* var. *saccharifera* L.) became the main source for sugar production in Egypt. The total amount of sugar produced is not adequate enough to our consumption. So, increasing the cultivated area and sugar production per unit area is considered one of the important national targets to minimize the gap between sugar consumption and production. Sugar beet is grown under a wide range of climates and soil types. Developing high yielding cultivars and improving agricultural practices such as preceding summer crop and intercropping systems are essential to enhance sugar beet production.

Faba bean (*Vicia faba* L.) is a common staple food in the Egyptian diet, eaten by rich and poor alike. It can be used as a vegetable, green, dried, fresh or canned. It is also used as fodder and forage crop for animals and for increasing available nitrogen in the biosphere.

Sugar beet production differs depending on the preceding summer crop. The legume crops are the best resources than cereals because of their ability to improve soil fertility and save mineral nitrogen. In this respect, Ibrahim and Abbas (2004) reported that cotton, maize and rice yields were higher when preceded by faba bean. Sims (2007) revealed that root yield of sugar beet was greater following wheat than following corn. He added that when sugar beet was grown following soybean, root yield was greater than when following by maize, but less than that followed by wheat. Sugar beet root quality tended to start declining when sugar beet was sown after soybean. Ibrahim (2011) reported that preceding summer crops significantly affected faba bean seed yield and its components. Seed yield of faba bean grown after maize attained an increase of 15.9 % compared to that grown after rice.

It was noticed that faba bean area has gradually decreased through the last decade due to the high competition with other winter crops such as sugar beet. It is well known that faba bean is the main strategic food crop for human and feed for animals. So, Crop Intensification Department and Sugar Crop Research Institute could solve this problem by intercropping most important winter crops like faba bean with sugar beet aiming to maximize the productivity per unit area without any change in crop rotation and structure as well as maximizing the utilization of available environmental and nutritional resources. Abd El-All (2002), Farghaly *et al.* (2003), El-Shaikh and Bekheet (2004), Mohammed *et al.* (2005), Gadallah *et al.* (2006) and Abou-Elela (2012) mentioned that different intercropping systems with sugar beet resulted in higher gross return per unit area compared with growing of both crops in pure stand. Abou-Keriasha *et al.* (2013) showed that intercropping faba bean on other winter crops such as sugar beet was important factor, which helped in increasing productivity and decreasing the gap between the local production and consumption.

Thus, this investigation was carried out to study the influence of some preceding summer crops and faba bean intercropping systems on yield and quality parameters of sugar beet under the environmental conditions of Dakahlia Governorate, Egypt.

MATERIALS AND METHODS

A field experiment was carried out at Tag El-Ezz Research Station (latitude of 30.56 ^{0}N and longitude of 31.35^{0} E), Dakahlia Governorate, Egypt, during 2015/2016 and 2016/2017 seasons. The main objective of this study was to determine the influence of some preceding summer crops and faba bean intercropping systems on sugar beet *cv.* Sultan yield and quality parameters. Each preceding summer crop (rice, maize and soybean) was performed in separate experiment.

Every experiment of preceding summer crops was carried out in randomized complete block design with four replications. The faba bean and sugar beet intercropping systems were as follows:

1. Intercropping faba bean with sugar beet in row on the back "middle" of the bed "terrace" (2 plants/hill) at 30 cm between hills.
2. Intercropping faba bean with sugar beet in row on the back of the bed (2 plants/hill) at 40 cm between hills.
3. Intercropping faba bean with sugar beet in row on the back of the bed (2 plants/hill) at 50 cm between hills.

In all intercropping systems and pure stand of sugar beet was planted on both sides of beds of 120 cm width at 20 cm between hills and one plant/hill to give 35000 plants/fad. Pure stand of faba bean was planted in both sides of 60 cm ridges, at 20 cm apart and two plants/hill to give 140000 plants/fad.

Soil samples were collected from the surface layer (0-30 cm) after harvesting of the summer crops in the two growing seasons. The samples were analyzed for nitrogen using the conventional method of Kjeldahl as described by Bremner and Mulvany (1982). Available phosphorus was determined calorimetrically using Spectrophotometer as described by Olsen and Sommers (1982). Available potassium was determined using Flame Photometer according to the method of Black (1965). The soil analyses including texture and available N, P, K and pH are presented in Table 1.

Table 1. Available N, P, K and pH of soil after rice, maize and soybean during 2015/2016 and 2016/2017 seasons

Preceding crops	2015/2016				2016/2017			
	Available nutrients (ppm)			pH	Available nutrients (ppm)			pH
	N	P	K		N	P	K	
Rice	32.0	7.4	229.0	7.8	34.0	7.7	235.0	7.6
Maize	32.1	7.7	230.4	7.8	35.1	7.5	234.1	7.7
Soybean	35.4	8.3	235.2	7.7	36.8	8.2	241.1	7.5

Each experimental basic unit included 3 terraces, each of 120 cm apart and 3.0 m long, comprising an area of 10.8 m^2.

The experimental field was well prepared and calcium super phosphate (15.5 % P_2O_5) at 150 kg/fad was applied during soil preparation. Sugar beet was sown on the 5th and 10th of October, while faba bean *cv.* Sakha 1 was sown with the first irrigation (Mohayah) on the 5th and 10th of November in 2015/2016 and 2016/2017 season, respectively. Nitrogen and potassium fertilizers in the forms of urea (46 % N) and potassium sulphate (48 % K_2O) were applied at the recommended dose (80 kg N/fad and 24 kg K_2O/fad), respectively were applied as a side-dressing in two equal portions; after thinning (30 days from planting) and before the second irrigation (60 days from planting). The other recommended agricultural practices for growing sugar beet were followed.

The studied traits:

The recorded data could be divided into the following parts:

I. Sugar beet:

A. Yield components and quality characteristics:

At harvest, five plants were collected at random from each plot to determine the following:

1. Root fresh weight/plant (g).
2. Foliage fresh weight/plant (g).
3. Root length (cm).
4. Root diameter (cm).
5. Total soluble solids (TSS %) in roots was determined in juice of fresh roots using Hand Refractometer.
6. Sucrose percentage was determined polar imetrically on lead acetate extract of fresh macerated roots according to the method of Carruthers and Old Field (1960).
7. Apparent purity percentage was determined as a ratio of sucrose % divided by TSS% of roots as the method outlined by Carruthers and Old Field (1960).

B. Yields:

At harvesting, sugar beets in each plot were collected and cleaned. Roots and tops were separated and weighed in kilograms, then converted into tons/fad to estimate the following:

8. Root yield/fad (t).
9. Top yield/fad (t).
10. Sugar yield/fad (t) was calculated by multiplying root yield by sucrose%.

II. Faba bean:

At harvest, samples of 10 plants were collected randomly from each plot to determine:

1. Plant height (cm).
2. Number of branches/plant.
3. Seed yield/plant (g).
4. Hundred seeds weight (g).
5. Seed yield ardab/fad. Plants in each plot were harvested, pilled, labeled, thrashed and the seeds were separated. Seed yield was recorded in kg/plot, then it converted into ardab/fad (one ardab = 155 kg).

III. Competitive relationships and yield advantages:

Land equivalent ratio (LER): It was determined as shown by Willey and Osiru (1972) as follows:

$$LER = \frac{Ys / f}{Yss} + \frac{Yf / s}{Yff}$$

Where:

s = sugar beet. f = faba bean

Ys/f = Yield intercrop of sugar beet with faba bean.

Yf/s = Yield intercrop of faba bean.

Y ss = Yield pure of sugar beet.

Y ff = Yield pure of faba bean.

IV. Economic evaluation:

Total income (LE/fad): Total income of each treatment was calculated in Egyptian pounds, LE/ton at

market price of LE 275 and 400 for sugar beet and LE 1050 and 1070 per ardab of faba bean seeds in 2015/2016 and 2016/2017 season, respectively.

The obtained data were statistically analyzed according to the technique of analysis of variance (ANOVA) for the randomized complete block design for each experiment (preceding summer crops), then combined analysis was done between preceding summer crops experiments as published by Gomez and Gomez (1984) using "MSTAT-C" computer software package. Least significant difference (LSD) method was used to test the differences among means of treatment at 5 % level of probability as described by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

A. Effect of preceding summer crops:

Concerning yield components of sugar beet, data in Table 2 show that the preceding summer crops had a significant effect on all studied characters in both seasons, except sugar beet foliage fresh weight/plant in the 2nd one. It was found that sugar beet preceded by soybean recorded the highest mean values of root fresh weight, length and diameter of root as well as foliage fresh weight per plant, followed by that sown after maize, while the lowest values were given by beets preceded by rice in both seasons. Meanwhile, beets sown as pure stand had higher values of yield components compared to those preceded by any of the three summer crops.

In respect to sugar beet quality characteristics, the results in Table 3 show that sugar beet grown after rice had the highest TSS, sucrose and purity percentages, followed by that sown after maize and soybean. Sugar beet sown solely recorded mostly higher values of the studied quality traits compared to those preceded by any of the three summer crops.

As for sugar beet root yield, data in Table 4 manifest that 0.69 and 1.99 t/fad were appreciably gained when sugar beet was sown after soybean compared with that grown after maize and rice, respectively in the 1st season, correspond to 2.29 and 4.06 t/fad in the 2nd one.

With regard to the studied traits of faba bean, data in Table 5 clear that plant height, number of branches/plant, seed yield/plant, 100-seed weight and seed yield/fad were significantly increased in faba beans intercropped with sugar beets grown after soybean crop in both seasons. Seed yield/fad was increased by (0.27 and 0.56 ardab/fad in the first season) and (0.27 and 0.46 ardab/fad in the second season) compared with that preceded by maize and rice successively.

These results are in coincidence with those reported by Sims (2007) and Ibrahim (2011).

The superiority in yields of sugar beet and faba bean were grown after soybean compared by preceded by rice and maize may be due to the effect of soybean root and that carry bacterial noodles in improving soil physical conditions as well as reducing its compactness and improving mechanical disturbance of soil (Ibrahim and Abbas, 2004). Additionally, increasing soil microbial biomass which led to increasing organic matter that improved soil physical properties such as availability of soil moisture to plant and good airing. This in turn leads to good rooting depth, and also increasing the vital processes for plant and free energy which necessary for different vital function of metabolism, regularly role in nutritional balance uptake and consequently improving growth and vigor which reflects on quantity and quality of the yield. On the other hand, sugar beet preceded by rice increased quality parameters compared with the two others summer crops may be due to the decrease in root weight and root diameter which leads to decreasing tissue water content and non-sucrose substance such as proteins and alpha amino nitrogen, which consequently increased sucrose% content in sugar beer roots.

Table 2. Sugar beet growth traits as affected by preceding summer crops and faba bean intercropping systems and their interaction in 2015/2016 and 2016/2017 seasons

Treatments	Root fresh weight/plant (g)		Foliage fresh weight/plant (g)		Root length (cm)		Root diameter (cm)	
	2015/ 2016	2016/ 2017	2015/ 2016	2016/ 2017	2015/ 2016	2016/ 2017	2015/ 2016	2016/ 2017
A. Preceding summer crops:								
Rice	574.2	624.2	497.5	505.8	27.70	28.17	9.45	9.60
Maize	620.0	697.5	541.7	539.8	29.70	32.50	10.55	11.20
Soybean	695.1	760.0	615.0	584.8	33.10	35.42	11.87	13.20
F. test	*	*	*	NS	*	*	*	*
LSD 5%	10.1	10.6	7.0	-	0.21	0.27	0.16	0.23
B. Faba bean intercropping hill spacing:								
30 cm	572.5	651.7	500.2	569.3	27.80	29.75	8.90	9.70
40 cm	627.5	699.2	549.4	482.6	30.10	32.17	10.60	11.30
50 cm	689.3	730.8	604.5	578.6	32.60	34.17	12.20	13.00
F. test	*	*	*	-	*	*	*	*
LSD at 5%	9.6	7.3	5.4	NS	0.45	0.57	0.22	0.33
Solid sugar beet	712.5	795.4	627.2	602.5	35.2	36.2	12.90	13.60
C. Interaction (A x B)								
AB	NS	NS	*	NS	*	*	*	NS

Table 3. Quality parameters of sugar beet as affected by preceding summer crops and faba bean intercropping systems and their interaction in 2015/2016 and 2016/2017 seasons

Treatments	TSS (%)		Sucrose (%)		Purity (%)	
	2015/2016	2016/2017	2015/2016	2016/2017	2015/2016	2016/2017
A. Preceding summer crops:						
Rice	23.7	23.6	20.8	20.3	87.8	86.0
Maize	23.4	22.2	20.0	19.2	85.5	86.5
Soybean	22.5	21.9	19.3	18.5	85.8	84.5
F. test	*	*	*	*	*	*
LSD 5%	0.1	0.2	0.2	0.	0.1	0.1
B. Faba bean intercropping hill spacing:						
30 cm	23.7	23.2	21.1	19.7	89.0	84.9
40 cm	23.2	22.5	20.0	19.4	86.2	86.2
50 cm	22.6	22.1	18.9	18.9	83.6	85.5
F. test	*	*	*	*	*	*
LSD at 5%	0.2	0.1	0.3	0.2	0.1	0.1
Solid sugar beet	23.8	23.5	21.9	20.3	92.02	86.38
C. Interaction (A x B)						
AB	*	NS	NS	*	NS	NS

Table 4. Yields of sugar beet as affected by preceding summer crops and faba bean intercropping systems and their interaction in 2015/2016 and 2016/2017 seasons.

Treatments	Root yield/fad (t)		Top yield/fad (t)		Sugar yield/fad (t)	
	2015/2016	2016/2017	2015/2016	2016/2017	2015/2016	2016/2017
A. Preceding summer crops:						
Rice	22.03	23.48	18.28	20.2	4.58	4.77
Maize	23.33	25.25	19.31	21.05	4.67	4.85
Soybean	24.02	27.54	20.93	22.15	4.64	5.09
F- test	*	*	*	*	*	*
LSD at 5%	0.37	0.24	0.29	0.19	0.10	0.06
B. Faba bean intercropping hill spacing:						
30 cm	21.35	24.43	18.46	20.48	4.50	4.81
40 cm	23.03	25.33	19.45	21.08	4.61	4.91
50 cm	24.82	26.53	20.6	21.66	4.69	5.01
F. test	*	*	*	*	*	-
LSD at 5%	0.11	0.27	0.27	0.29	0.07	NS
Solid sugar beet	24.42	26.85	21.40	22.10	5.10	5.72
C. Interaction (A x B)						
AB	*	*	NS	NS	*	*

Table 5. Plant height, number of branches/plant, seed yield/plant, 100-seed weight and seed yield/fad of faba bean as affected by preceding summer crops, faba bean intercropping systems and their interaction in 2015/2016 and 2016/2017 seasons

Treatments	Plant height (cm)		No. of branches/ plant		Seed yield/plant (g)		100-seed weight (g)		Seed yield (ardab/fad)	
	2015/2016	2016/2017	2015/2016	2016/2017	2015/2016	2016/2017	2015/2016	2016/2017	2015/2016	2016/2017
A. Preceding summer crops:										
Rice	100.8	98.8	3.5	4.0	19.50	20.25	61.8	63.8	2.89	3.42
Maize	104.1	103.1	4.4	4.6	22.25	23.42	64.7	67.1	3.18	3.61
Soybean	108.8	104.6	5.0	5.7	24.75	25.70	67.2	69.2	3.45	3.88
F- test	*	*	*	*	*	*	*	*	*	*
LSD 5%	0.44	1.44	0.26	0.50	0.52	0.63	1.53	1.52	0.05	0.04
B. Faba bean intercropping hill spacing:										
30 cm	107.4	104.8	3.8	4.1	19.83	20.80	61.9	63.9	3.91	4.05
40 cm	104.7	101.2	4.2	4.7	22.08	23.00	64.6	66.7	3.10	3.63
50 cm	101.6	100.6	5.0	5.6	24.58	25.60	67.5	69.5	2.51	3.24
F. test	*	*	*	*	*	*	*	*	*	*
LSD at 5%	0.63	1.45	0.40	0.60	0.44	0.77	1.86	1.87	0.06	0.06
Solid faba bean	105.4	104.0	3.9	4.4	20.5	22.6	54.2	56.4	13.8	14.2
C. Interaction (A x B)										
AB	NS	*	*	*	*	*	NS	NS	*	*

B. Effect of intercropping systems:

Data in Table 2 reveal that widening space between hills of faba bean intercropped with sugar beet from 30 to 40 and 50 cm resulted in gradual and significant increases in all studied yield components of sugar beet in both seasons, except sugar beet foliage fresh weight/plant in the 2nd one. These results due to the reducing in the density of faba bean plants, which leads to low density for both crops per unit area, resulted in minimizing the intra and inter competition of both crops leads to high efficiency of solar radiation utilized by sugar beet, and in turn high conversion of light energy to chemical energy and consequently high accumulation of dry matter.

Regarding beet quality characteristics, the results in Table 3 point out a gradual and significant reduction in TSS, sucrose and purity percentages as the distance between hills of faba bean intercropped with sugar beet

from 30 to 40 and 50 cm in both seasons. These results due to that the decrease in root weight and diameter led to decreasing tissue and water content and non-sucrose substance such as proteins and alpha amino nitrogen, which consequently increased sucrose percentage in sugar beet roots.

Data in Table 4 elucidate that intercropping faba bean at wider space of 50 cm between sugar beet plants resulted significantly in 1.79 and 3.47 tons of sugar beet roots/fad higher than that intercropped at narrower distance of 40 or 30 cm, successively in the 1st season, being 1.20 and 2.10 tons in the 2nd season. The same tendency was observed concerning top and sugar yield/fad.

The results in Table 5 indicate that both faba bean plant height increased gradually and significantly as the distance between hills of faba bean intercropped with sugar beet decreased from 50 to 40 and 30 cm *i.e.* increasing density of faba bean in both seasons. Similarly, seed yield increased by (0.59 and 1.40 ardab/fad) and (0.39 and 0.81 ardab/fad), when hill spacing was decreased from 50 to 40 and 30 cm in 1st and 2nd season, respectively. However, number of branches/plant, seed yield/plant and 100-seed weight exhibited opposite trend in both seasons.

These findings are in concurrence with those stated by Abd El-All (2002), Farghaly *et al.* (2003), El-Shaikh and Bekheet (2004), Mohammed *et al.* (2005), Gadallah *et al.* (2006) and Abou-Elela (2012).

C. Effect of interaction:

There are many significant interaction effects between the preceding summer crops and faba bean intercropping systems on most reported characters in both seasons.

The interaction between the studied factors had a significant influence on foliage fresh weight and root diameter (in the 1st season) and root length (in both seasons) as shown from results in Table 2. The recommended treatment that produced the highest values of foliage fresh weight (g/plant) "Fig 1", root length "Fig 2" and root diameter "Fig 3" was preceded sugar beet by soybean and intercropped at 50 cm between faba bean hills.

The results in Table 3 clear that only TSS % (in the 1st season) "Fig 4" and sucrose % (in the 2nd season) "Fig 5" were markedly affected by the interaction between the preceding crops and intercropping systems of faba bean with sugar beet. The highest values of these quality parameters were resulted from preceded sugar beet by soybean and intercropped at 30 cm between faba bean hills.

Root and sugar yield/fad were significantly affected by the interaction between the studied factors, while top yield was insignificantly influenced in both seasons (Table 4). Preceding sugar beet by soybean and intercropped at 50 cm between faba bean hills produced the highest values of root yield/fad (Fig. 6) and sugar yield/fad (Fig. 7) in both seasons.

Data in Table 5 reveal that all studied traits of faba bean were significantly influenced by the interaction between studied factors in both seasons, except plant height (in the 1st season) and 100-seed weight (in both seasons). The highest values of faba bean plant height in the second season (Fig. 8) and seed yield/fad in both seasons (Fig. 11) were produced from faba bean preceded by soybean and intercropped at 30 cm between hills. While, the highest values of number of branches/plant in both seasons (Fig. 9) and seed yield/plant in both seasons (Fig. 10) of faba bean were resulted from faba bean preceded by soybean and intercropped at 50 cm between hills.

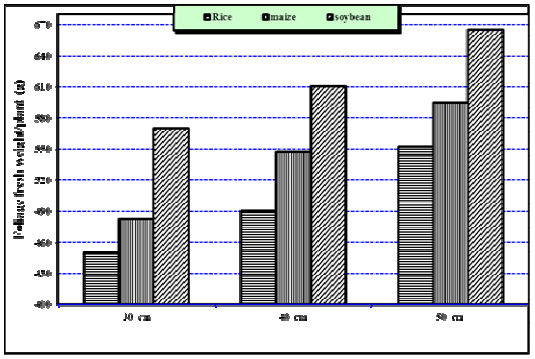

Fig. 1. Foliage fresh weight/plant (g) as affected by the interaction between the preceding summer crops and faba bean intercropping systems during 2015/2016 season

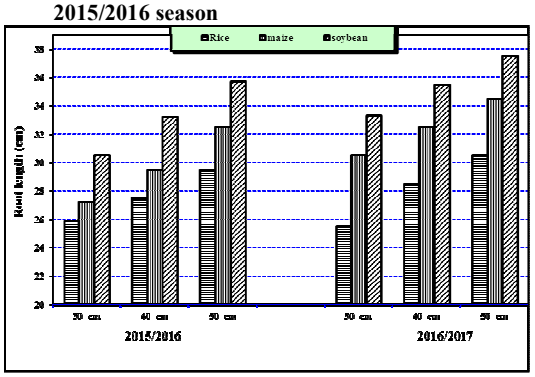

Fig. 2. Root length (cm) as affected by the interaction between the preceding summer crops and faba bean intercropping systems during 2015/2016 and 2016/2017 seasons

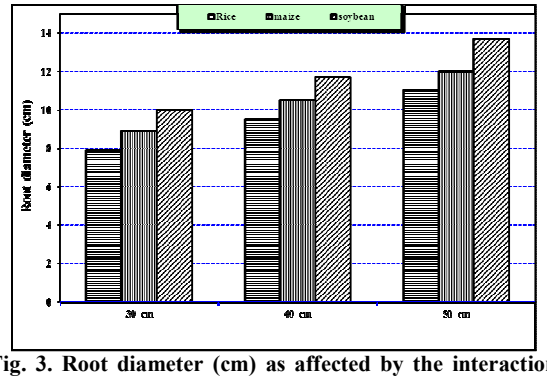

Fig. 3. Root diameter (cm) as affected by the interaction between the preceding summer crops and faba bean intercropping systems during 2015/2016 season

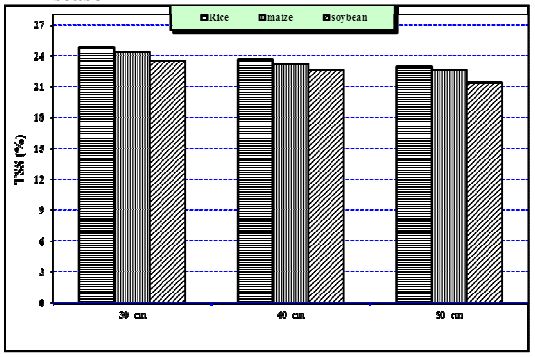

Fig. 4. TSS (%) as affected by the interaction between the preceding summer crops and faba bean intercropping systems during 2015/2016 season

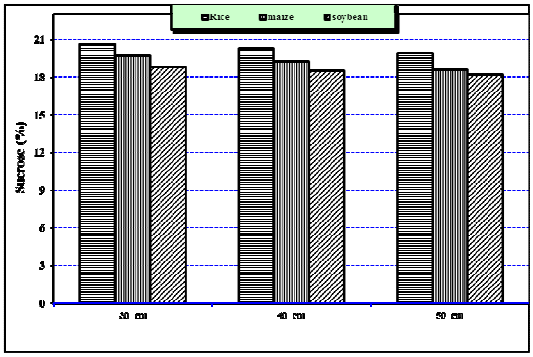

Fig. 5. Sucrose (%) as affected by the interaction between the preceding summer crops and faba bean intercropping systems during 2016/2017 season

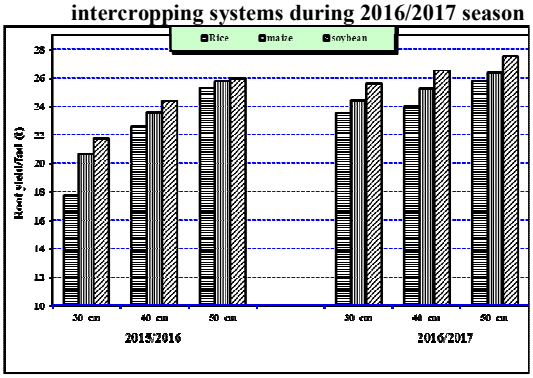

Fig. 6. Root yield/fad (t) as affected by the interaction between the preceding summer crops and faba bean intercropping systems during 2015/2016 and 2016/2017 seasons

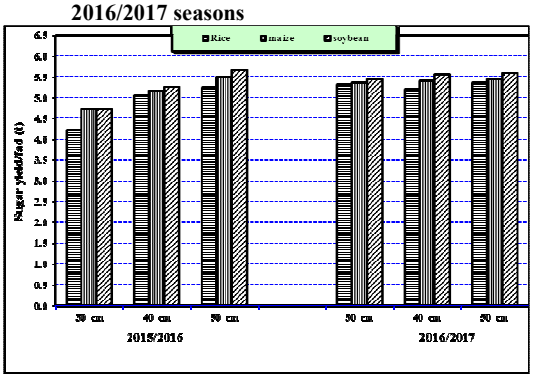

Fig. 7. Sugar yield/fad (t) as affected by the interaction between the preceding summer crops and faba bean intercropping systems during 2015/2016 and 2016/2017 seasons

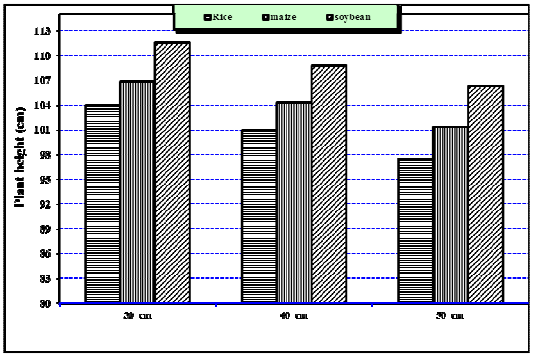

Fig. 8. Plant height (cm) as affected by the interaction between the preceding summer crops and faba bean intercropping systems during 2016/2017 season

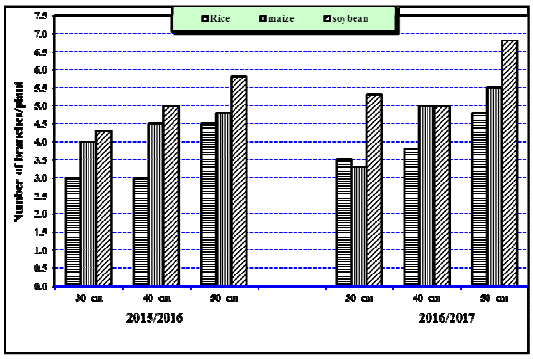

Fig. 9. Number of branches/plant as affected by the interaction between the preceding summer crops and faba bean intercropping systems during 2015/2016 and 2016/2017 seasons

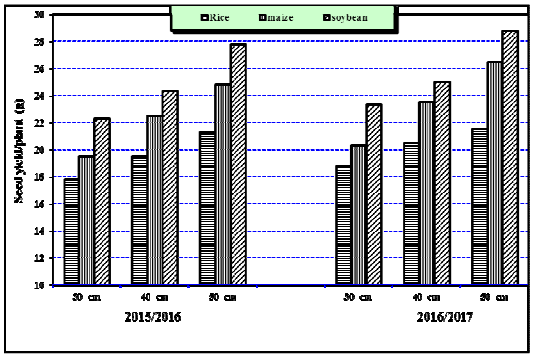

Fig. 10. Seed yield/plant (g) as affected by the interaction between the preceding summer crops and faba bean intercropping systems during 2015/2016 and 2016/2017 seasons

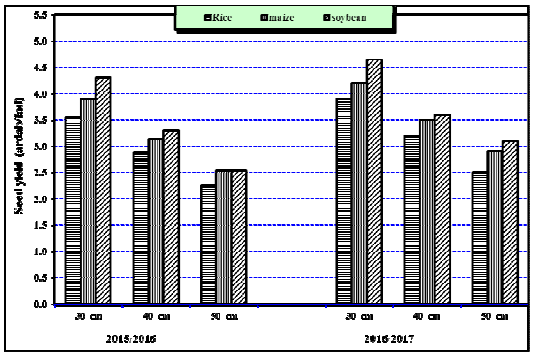

Fig. 11. Seed yield (ardab/fad) of faba bean as affected by the interaction between the preceding summer crops and faba bean intercropping systems during 2015/2016 and 2016/2017 seasons

Competitive relationships and economic evaluation:

Data in Table 6 show that the highest values of land equivalent ratio "LER" and total income were obtained with growing sugar beet after soybean and intercropping it with faba bean in hills spaced at 30 cm, in the 1st and 2nd seasons, while the lowest values of LER and total income were recorded by growing both crops after rice with intercropping faba bean at 50 cm between hill.

Table 6. Land equivalent ratio (LER) and total income as affected by the preceding crops and intercropping systems of faba bean with sugar beet in 2015/2016 and 2016/2017

Seasons	2015/2016						2016/2017					
Characters	LER			Total income			LER			Total income		
Treatments	Rice	Maize	Soy-bean	Rice	Maize	Soy-bean	Rice	maize	Soy-bean	Rice	maize	Soy-bean
30 cm	1.08	1.23	1.32	7513.0	8629.5	9198.8	1.21	1.22	1.27	13173.3	13151.1	13604.4
40 cm	1.06	1.18	1.26	7356.3	8189.5	8676.3	1.16	1.17	1.22	12480.0	12736.0	13029.3
50 cm	1.06	1.16	1.19	7240.8	7906.3	8134.5	1.13	1.15	1.17	12184.0	12352.9	12586.7
Solid sugar beet					6715.5						10739.6	
Solid faba bean					11040.0						12070.0	

CONCLUSION

Sowing sugar beet intercropped with faba bean at 30 cm between hills, after soybean is recommended to achieve maximum productivity and quality of both crops the highest land equivalent ratio and total income under Dakahlia Governorate, Egypt.

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تأثير المحاصيل الصيفية السابقة على حاصل وجودة بنجر السكر المحمل بالفول البلدي

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أقيمت تجربتان حقليتان بمحطة البحوث الزراعية بتاج العز بمحافظة الدقهلية خلال الموسمين 2015/2016 و 2016/2017 لدراسة تأثر المحاصيل الصيفية السابقة (أرز، ذرة و فول صويا) وبعض نظم تحميل الفول البلدى (الصنف سخا 1) مع بنجر السكر(الصنف سلطان) كالآتي: 1- زراعة الفول البلدي علي مصطبة البنجرعلي مسافة 30 سم بين الجور (2 نبات/جورة). 2- زراعة الفول البلدي علي مصطبة البنجرعلي مسافة 40 سم بين الجور (2 نبات/جورة). 3- زراعة الفول البلدي علي مصطبة البنجرعلي مسافة 50 سم بين الجور (2 نبات/جورة). نفذت التجربة في تصميم القطاعات كاملة العشوائية فى أربع مكررات ، حيث نفذت ثلاث تجارب منفصلة عقب المحاصيل الصيفية المذكورة - وتم التحليل بطريقة التحليل التجميعى. تتلخص أهم النتائج فيما يلي: بنجر السكر: أوضحت النتائج التفوق المعنوي لبنجر السكر المنزرع بعد فول الصويا فى كل الصفات المدروسة خلال عامى الدراسة عدا صفات الجودة (المواد الصلبة الكلية الذائبة - النسبة المئوية للسكروز - النسبة المئوية للنقاوة) والتي تفوقت بزراعة البنجر بعد الارز خلال عامي الدراسة. حقق بنجر السكر المنزرع بعد فول الصويا زيادة فى انتاجية المحصول بلغت 0.69 و 1.99 طن للفدان في الموسم الأول و2.29 و4.06 طن للفدان في الموسم الثانى بالمقارنة بالزراعة عقب أرز وذرة شامية. تفوق بنجر السكر المنزرع محملاً بالفول البلدي علي مسافة 50 سم بين جور البنجر معنوياً في كل الصفات المدروسة عدا صفات الجودة (المواد الصلبة الكلية الذائبة - النسبة المئوية للسكروز- النسبة المئوية للنقاوة) بزراعة البنجر بعد الارز خلال عامي الدراسة، حيث حقق بنجر السكر المحمل مع الفول البلدى المنزرع على مسافة 50 سم بين الجور زيادة فى محصول الجذور بلغت 1.79 و 3.47 طن للفدان في الموسم الأول و 1.20 و2.10 طن للفدان في الموسم الثانى بالمقارنة بالزراعة على مسافة 30 و 40 سم . سجلت نتائج التفاعل بين عاملى الدراسة تأثيراً معنوياً على بعض صفات الوزن الغض للعرش (في الموسم الأول) ، طول الجذر (في كلا الموسمين) ، قطر الجذر (في الموسم الأول) ، النسبة المئوية للمواد الصلبة الذائبة الكلية (في الموسم الأول) ، النسبة المئوية للسكروز (في الموسم الثانى) ، محصول الجذور والسكر (في كلا الموسمين). تم الحصول على أعلى محصول جذور بزراعة البنجر بعد فول الصويا وتحميل الفول البلدى عند مسافة 50 سم . الفول البلدى: أوضحت النتائج التفوق المعنوي للفول البلدى المنزرع بعد فول الصويا فى كل الصفات المدروسة خلال عامى الدراسة، حيث حقق الفول البلدى المنزرع بعد فول الصويا زيادة فى محصول البذور للفدان بلغت 0.27 و0.56 أردب للفدان في الموسم الأول و0.27 و0.46 أردب للفدان في الموسم الثاني بالمقارنة بالزراعة بعد الأرز وذرة شامية. أظهرت النتائج التفوق المعنوي للفول البلدي المحمل علي مصطبة البنجر علي مسافة 30 سم بين الجور فى محصول البذور للفدان وارتفاع النبات. كما تفوق عدد الافرع/نبات ومحصول البذور للنبات ووزن 100 بذرة بتحميل الفول البلدى علي مصطبة البنجر علي مسافة 50 سم بين الجور. حقق الفول البلدى المحمل مع بنجر السكر المنزرع على مسافة 30 سم بين الجور زيادة فى محصول البذور للفدان بلغت 0.59 و1.40 أردب للفدان في الموسم الأول و0.39 و0.81 أردب للفدان في الموسم الثانى مقارنة بالزراعة على مسافة 40 و 50 سم. سجلت نتائج التفاعل بين عاملى الدراسة تأثيراً معنوياً على صفات ارتفاع النبات (في الموسم الثانى) ، عدد الأفرع للنبات (في كلا الموسمين) ، محصول البذور للنبات والفدان (في كلا الموسمين). حيث نتجت أعلى القيم لمحصول البذور للفدان بزراعة الفول البلدى بعد فول الصويا وتحميله عند مسافة 30 سم. أشارت النتائج إلى زيادة نسبة المكافئ الارضى (0.32 ، 0.27 في الموسم الاولى والثانى على الترتيب) بالزراعة عقب فول الصويا وتحميل صف فول بلدى مع بنجر السكرعلى نفس المصطبة على 30 سم بين الجور ، والتى حققت أعلى عائد كلى بالجنيه لوحدة المساحة (9198.8 ؛ 13604.4 جنيه فى الموسم الاول والثانى على التوالى). أظهرت النتائج المتحصل عليها إن أعلي محصول لبنجر السكر تحقق بزراعته عقب محصول فول الصويا على مصاطب عرضها 120 سم المحمل عليه الفول البلدى والمنزرع في وسط المصطبة على مسافة 50 سم بين الجور وترك 2 نبات/جورة وذلك تحت ظروف محافظة الدقهلية.