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EFFECT OF DIFFERENT INTERCROPPING PATTERNS AND NITROGEN FERTILIZATION ON GROWTH, YIELD AND YIELD COMPONENTS OF SUGAR BEET (*Beta vulgaris* L.) AND FABA BEAN (*Vicia faba* L.)

BY

Mahfouz, H.
Dept. of Agron., Fac. of Agric., Fayoum Univ.

ABSTRACT

Two experiments were carried out at the experimental farm, Fac. of Agric., Fayoum University during 2003/2004 and 2004/2005 seasons, to study the effect of intercropping patterns and nitrogen fertilization on growth, yield and yield components of sugar beet and faba bean. Each experiment comprised the following treatments: solid planting for both crops and two planting patterns, i.e., intercropping sugar beet: faba bean at 100%: 25% and 100%: 50%. In addition three nitrogen fertilizer rates i.e., 30, 60, 90 kg N per feddan were applied. Randomized complete block design with three replicates was used.

The obtained results revealed that:

Concerning sugar beet, pure plant stand of sugar beet showed significant higher values for root length, root diameter, fresh root yield /plant and per feddan, top length and fresh top yield per feddan. Values obtained for the previous characters affected by the two intercropping patterns were less than those obtained in case of solid planting and these differences were mostly significant. Monoculture of sugar beet showed insignificant increment of TSS % as compared to the intercropping patterns in both seasons. Different nitrogen rates had no significant effect on most of the studied characters of sugar beet, except for the average of root length where the differences were significant in the second season and fresh top yield showed significant difference in the two seasons. Plant height and yield of fresh roots and top were generally increased with applying nitrogen fertilizer up to 90 kg rate. The interaction effect of intercropping patterns (A) x nitrogen rates (B) was not significant for most of the studied characters, except for root length and fresh top yield /fed.

Regarding faba bean, data revealed that the highest values of plant height were resulted from solid planting in both seasons, as compared to the other patterns of intercropping. Increasing faba bean population in the pattern involving 100% sugar beet and 50% faba bean showed higher plants than those of the population pattern (100%: 25%). The higher values of No. of branches and No. of pods per plant were attained from the pattern of 100%: 25% of sugar beet and faba been respectively, as compared to other intercropping pattern (100%: 50%) and solid planting. The seed yield per plant of 100%: 25% intercropping pattern

exceeded that of either the solid planting of faba bean or the 100%: 50% pattern. Yet, as for the biological and seed yields per feddan, the reverse was true where solid planting ranked as the first followed by 100%: 50% pattern. Plant height and 100-seed weight showed insignificant effects by using different rates of nitrogen fertilizer. No obvious trend was noticed in the other characters where No. of branches /plant, No. of pods/plant and biological yield showed significant differences in one season of the study. Seed yield per plant showed significant difference between its obtained values in the two seasons. Adding 60 kg N /fed., produced the highest values for No. of branches, No. of pods and seed yield per plant were significantly affected by the interaction between intercropping and N fertilization in the second season only.

LER values were more than one in all intercropping patterns. the positive (A f) values for faba bean vs. the negative ones (A s) for sugar beet indicated that faba bean was the dominant intercrop component while sugar beet was the dominated.

Key words: Sugar beet, Faba bean, Nitrogen fertilizer, Intercropping

INTRODUCTION

Sugar beet crop has taken its place as a second main source of sugar industry in Egypt. This crop is widely cultivated under Fayoum conditions. On the other hand, faba been is one of the most important winter leguminous crops. It has a great importance as a source of plant protein needed for the majority of Egyptian people. The intensification of agriculture has become urgent necessity due to the limited cultivated area. Intensification, however, would maximize the utilization of unit area.

Many investigators reported that the growth and yield of both sugar beet and faba been are highly related to some agronomic factors such as the number of plants per unit area and soil fertility. Previous studies showed that intercropping patterns are suitable for small tenant farmers, since this system would increase the productivity and hence the net return, minimizing risk and ensuring subsistence farming (Panner 1975 and kanwar 1980). However, Abd El-Galil and Morsi (2004) reported that intercropping some field crops is a promising practice with main objectives to reduce labours peaks, minimize crop failure risk, reduce the adverse effects of pests and provides farmers higher returns from land and labour

Abdel-Aal *et al.* (1989) reported that intercropping faba bean at three population densities with two fodder beet varieties decreased root length and diameter and yield of top and root per plant and per fed. compared to its sole cropping. They also concluded that land equivalent ratio (LER) exceeded unity by intercropping faba bean with the fodder beet. Abou-Kresha *et al.* (1991) revealed that the yield and yield components of fodder beet grown on the same ridge with faba been were comparatively less than those grown on sole ridges. Amer *et al.* (1997) and Metwally *et al.* (1997) revealed that intercropping sugar beet with faba bean significantly increased number of branches, pods and seeds/plant as

well as seed yield of faba bean plant. However, the pure stand seed yield/fed. surpassed the intercropping one. Concerning land equivalent ratio (LER), the decreasing of faba bean ratio, in beet-bean cropping system, from 100% to 50% or 33.3% reduced the intercropping efficiency in terms of LER. Hussein and El-Deep (1999) studied the effect of intercropping sugar beet with faba bean and found that, the highest seed yield was obtained when intercropping faba bean at a rate of 6 or 8 plants/m2. Abd El-All (2002) indicated that monoculture gave the highest values of yield and its components of sugar beet as compared to the intercropping system. However, the intercropping system of sugar beet with faba bean at a hill spacing of 60 cm faba bean significantly affected number of pods, branches per plant besides 100- seed weight which showed higher values as compared to the other intercropping systems of 20 cm or 40 cm distance between hills. Besheit *et al.* (2002) revealed that intercropping onion on the other side of beet ridge of 50 cm width negatively affected beet quality and productivity. El-Shaikh and Bekheet (2004) illustrated that the pure stand of sugar beet significantly increased root characteristics except for root length in the 1st season, and also significantly increased vegetative growth and sugar yield of beet in both seasons as well as total soluble solids percentage (T.S.S. %) in the 1st season as compared to all intercropping systems in both seasons. The pure stand of faba bean significantly increased plant height as compared to all intercropping systems in both seasons. Marey (2004) indicated that intercropping sugar beet with faba bean and chick pea resulted in a significant decrease in root yield (ton/fed.) as compared to monoculture. On the other hand, number of branches and number of pods per plant of faba bean under intercropping condition were higher than those under solid planting. He added that land equivalent ratio (LER) exceeded one by intercropping faba bean at different densities with the fodder beet.

Regarding nitrogen fertilization effect, Soliman (1992) stated that a gradual significant increase in seed yield/fed., of faba bean was detected as the nitrogen level increased up to 48 kg N/fed. Metwally (1997) reported that plant height, number of branches and pods/plant, 100-seed weight as well as seed and straw yields were markedly increased with raising nitrogen rates up to 45 kg N/fed. Ramadan (1997) indicated that an adequate supply of nitrogen is essential for optimum yield. However, excess N may resulted in an increase in yield of root and top but with a reduction in sucrose content of beet roots. El-Hennaawy *et al.* (1998) reported that nitrogen is the most important agronomic variable known to affect sugar beet yield and quality, where the individual root weight of sugar beet was markedly increased with each increment of nitrogen. Increasing nitrogen level up to 100 kg N/fed., substantially improved length, diameter and weight of sugar beet root and depressed sucrose content in the roots (Mahmoud *et al.* 1999). Soheir Mokhtar (2001) indicated that increasing nitrogen from 30 to 60 kg/fed., increased yield and yield components of faba bean. Seed yield was increased by adding 45 kg N/fed., over those receiving 30 or 60 kg N/fed., by 550 and 200 kg/fed., respectively. Ramadan (2005) reported that increasing nitrogen level up to 120 kg N/fed increased root diameter, root length, root weight/plant and leaf area index (LAI), while reduced quality traits of sugar beet.

MATERIALS AND METHODS

Two field experiments were conducted in the two successive seasons 2003/2004 and 2004/2005 at "Dar El-Ramad" Experimental Farm, Faculty of Agriculture at Fayoum. The soil texture of the experimental site was clay loam and had the following tabulated characteristics:

Season	Organic matter %	Available			pH	EC
		N ppm	P ppm	K ppm		
2003/2004	1.83	50	24	625	8.30	5.32
2004/2005	1.85	30	11	465	8.52	4.72

In each experiment, the treatments comprised two intercropping patterns besides solid planting for each crop and three nitrogen fertilizer levels were practiced. These treatments were used to investigate their effects on yield and yield components of sugar beet (Top multigerm variety) and faba bean (Giaz 429). The four planting patterns used were; (1) pure stand of sugar beet planted on 60 cm ridges and in hill spacing 20 cm apart, (2) pure stand of faba bean planted on both sides of the 60 cm ridge in hills 20 cm apart and two plants per hill, (3) intercropping faba bean with sugar beet by planting sugar beet on one side of the ridges as in solid planting and faba bean on the other side of ridges on hills of 40 cm apart (representing 100% sugar beet: 25% faba bean), (4) intercropping faba bean with sugar beet by planting sugar beet on one side of ridges as in solid planting and faba bean on the other side of ridges on hills of 20 cm apart (represent 100% sugar beet: 50% faba bean). The three nitrogen treatments 30, 60 and 90 kg N/fed. were splitted into two equal doses, one before first irrigation while the other was added before the second one .

The experiment treatments were delineated in a randomized complete block design with three replications. Each plot size was 10.5 m2 (5 ridges, 3.5 m long and 60 cm wide). Sugar beet and faba bean were planted on October 8 and 12 in the first and second seasons, respectively. Normal agricultural practices of the two crops were followed as recommended during the two growing seasons.

At harvest, the following characters were determined:

1- Sugar beet: Root length (cm), root diameter (cm), fresh root yield per plant (kg), top length (cm) and fresh top yield per plant (kg). Fresh root yield (ton/fed.) and fresh top yield (ton/fed.) were calculated on plot basis. Total soluble solids percentage (TSS.%) was determined using hand Refractometer.

2 – Faba bean: Plant height (cm), No. of branches /plant, No. of pods /plant, seed yield /plant (g) and 100-seed weight (g). Biological yield (ton/fed.) and seed yield (ardab/fed.,) were calculated on the plot basis.
Data were subjected to the proper statistical analysis according to Gomez and Gomez (1984) and LSD was used to compare the treatment means.

3 – Competitive relationships and land use efficiency were expressed by calculation of land equivalent ratio (LER) using the equation of De Wit and Den Bergh (1965) and aggressively (A) following the equation of Mc Gilchrist (1965), using the data of seed yield /faddan of the two crops as follows:

LER = Lsu + Lfa where
Lsu = L sugar beet = intercrop yield of sugar beet/its pure stand yield
Lfa = L faba bean = intercrop yield of faba bean/its pure stand yield
Asu = [Ysu fa /(Ysu x Zsu fa)] - [Yfa su /(Yfa x Zfa su)]
Afa = [Yfa su /(Yfa x Zfa su)] - [Ysu fa /(Ysu x Zsu fa)]
Where
Ysu = pure stand yield of sugar beet, Yfa = pure stand yield of faba bean,
Ysu fa = intercropped yield of sugar beet, Yfa su = intercropped yield of faba bean, Zsu fa = sown proportion of sugar beet with faba bean,
Zfa su = sown proportion of faba bean with sugar beet.

RESULTS AND DISSCUTION

Sugar beet:

a- Effect of intercropping patterns on growth, yield and yield component characters.

The data presented in Table (1) show the effect of two intercropping patterns, beside solid planting treated with three nitrogen fertilizer levels, in two successive season. The data indicated that pure stand of sugar beet showed significant higher values for root length, root diameter, fresh root yield /plant and per feddan, top length and top fresh yield per feddan. The trend of change was consistent over the two seasons of the study. Meanwhile, values obtained for the previous characters affected by the two intercropping patterns were lower than those obtained in case of solid planting and these differences were mostly significant. However, reduction augmented was not affected by plant density of faba bean where the values obtained were mostly equal from the two intercropping systems. These results are in harmony with those obtained by Abdel- Aal *et al.* (1989) and El-Shaikh and Bekheet (2004).

Monoculture of sugar beet showed insignificant increment of TSS % as compared to the intercropping patterns in both seasons. Interpretation for these observations might be due to the relatively strong competition between the intercropped crops. The effect of the intercropping on top fresh weight per plant and per feddan followed the same course of change where solid plants significantly recorded higher values than those of the two intercropping patterns. The intercropping pattern of 50% faba bean, did not differ significantly from those of 25% faba bean pattern. It could be concluded that growth, yield and yield components of sugar beet in the two intercropping patterns were significantly reduced as compared to solid planting. Abdel- Aal *et al.* (1989), Abou-kresha *et al.* (1991), Amer *et al.* (1997) and Abd El-All (2002) supported these results, where they concluded that intercropping faba bean with sugar beet decreased mean values of root characteristics and root yield ton/fed., as compared to solid planting.

b- Effect of nitrogen fertilization.

Results presented in Table (1) indicate that different nitrogen rates had no significant effect on most of the studied characters of sugar beet, except the average of root length where the differences between the obtained values were significant in the second season, while fresh top yield showed significant difference in the two seasons. The interpretation of this finding might be due to that small difference found between

individual plants in the population per feddan accumulated and showed significant differences in the total yield per feddan. Adding 90 kg N/fed showed the tallest roots of sugar beet in the second season as compared to plants treated with 30 kg N/fed. Yield of fresh roots and fresh top were generally increased with applying nitrogen fertilizer at 90 kg rate. These results are in harmony with those obtained by Ramadan (1997), El-Hennaawy *et al.* (1998) and Ramadan (2005)

c- Effect of interaction of cropping patterns x N levels.

The interaction effect of intercropping patterns (A) x nitrogen rates (B) was not significant for most of the studied characters, except for root length and top fresh weight /fed. The significant interaction of A x B for the two aforementioned characters, indicates that the response of these characters to nitrogen fertilization treatments differed in accordance to the two intercropping systems applied.

Faba bean:

a- Effect of intercropping patterns on growth, yield and yield component characters.

The growth and yield and its components of faba bean as influenced by intercropping pattern with sugar beet and by adding different nitrogen rates are presented in Table (2). The data indicated that the intercropping patterns had a significant effect on plant height in the two seasons of the study. The highest values of this character was recorded by solid planting in both seasons, as compared to the other patterns of intercropping. Increasing faba bean population in the pattern involving 100% sugar beet and 50% faba bean showed higher plants than that of low dense in the population pattern (100%: 25%). The interpretation of this observation might be due to the encouragement of IAA (Indol acitic acid) synthesis owing to the reduction in light intensity caused by relative high density of plant population. The increase in IAA concentration in stem tissues caused cell elongation and hence, taller plants were formed. Similar results were obtained by Amer *et al.* (1997), Abd El-All (2002) and El-Shaikh and Bekheet (2004).

Number of branches per plant was significantly affected by intercropping systems in the second season. The solid cultivation of faba bean recorded the lowest values of this character. Regarding the No. of pods/plant, data in Table (2) reveal that the intercropping patterns significantly affected this character in both seasons. The highest No. of pods/plant was attained from the pattern of 100%: 25% of sugar beet and faba been respectively. The interpretation of this result may be attributed to low plant density of faba bean plants would secure better availability of production factors (light, nutrient and water). Concerning seed yield/plant, data in Table (2) obviously indicate that intercropping patterns applied, significantly affected this trait in both seasons. Planting sugar beet on one side of the ridge and faba bean on the other side in hills 40 cm distance (100%: 25%) showed highest values for this character compared to the other intercropping pattern (100%: 50%) and solid planting in both seasons of study. The superiority of the pattern (100%: 25%) may be attributed to a wide distribution of faba bean plants and less competition for the production factors, hence more pods/plant would be produced due to more light penetration and also reduced flower abscission along with the increase in mature pods and seed yield. This result is in line with those found by Amer *et al.* (1997), Metwally *et al.* (1997), Abd El-All (2002) and Marey (2004).

Table (1): Mean values of growth, yield and its components of sugar beet as affected by intercropping with faba bean and nitrogen fertilizer levels in two successive seasons.

Season	2003/2004				2004/2005			
N level (B)	30	60	90	Mean	30	60	90	Mean
Planting Patters (A)								
Sugar beet: Faba bean	Root length (cm)							
Sole planting	27.67	33.75	27.20	29.53	23.57	24.03	26.10	24.570
100: 25	25.53	21.87	23.93	23.78	21.07	23.20	22.83	22.37
100: 50	23.53	24.60	23.87	24.00	20.83	23.33	24.67	22.94
Mean	25.58	26.73	25.00	——	21.82	23.52	24.53	——
L.S.D. 5% for	A=2.58	B=n.s.	AxB=4.46		A =n.s.	B=2.18	AB= n.s.	
	Root diameter (cm)							
Sole planting	11.93	11.73	11.40	11.69	9.13	9.23	9.67	9.34
100: 25	9.20	10.20	10.33	9.91	8.07	7.97	8.10	8.04
100: 50	9.33	10.67	9.93	9.98	7.47	7.20	6.80	7.16
Mean	10.16	10.87	10.56	——	8.22	8.13	8.19	——
L.S.D. 5% for	A=1.29	B= n.s.	AB = n.s.		A = 0.85	B= n.s.	AB = n.s.	
	Fresh root yield/ plant (kg)							
Sole planting	1.222	1.271	1.044	1.179	0.677	0.743	0.960	1.793
100: 25	0.694	0.986	0.820	0.833	0.635	0.700	0.737	0.691
100: 50	0.594	0.826	0.874	0.765	0.437	0.533	0.550	0.507
Mean	0.837	1.028	0.913	——	0.583	0.659	0.749	——
L.S.D. 5% for	A= 0.293	B= n.s.	AB = n.s.		A = 0.162	B= n.s.	AB = n.s.	
	Fresh root yield/ (ton/fed.)							
Sole planting	22.006	24.033	23.839	23.292	21.313	21.960	29.47	24.240
100: 25	14.935	17.107	18.639	16.893	18.503	21.169	22.182	2.618
100: 50	14.370	16.721	17.212	16.101	14.853	17.067	17.600	16.507
Mean	17.104	19.287	19.896	——	18.223	20.065	23.076	
L.S.D. 5% for	A= 2.104	B= 2.104	AB = n.s.		A = 3.596	B= 3.596	AB = n.s.	
	Top length (cm)							
Sole planting	38.47	38.47	33.67	36.87	31.20	3.13	41.07	35.07
100: 25	38.60	40.73	45.80	41.71	38.67	37.53	42.60	39.60
100: 50	39.87	41.53	43.27	41.56	32.80	39.27	39.60	37.22
Mean	38.98	40.24	40.91	——	34.22	36.98	41.09	——
L.S.D. 5% for	A= 4.18	B= n.s.	AB = n.s.		A = n.s.	B= n.s.	AB = n.s.	
	Fresh top yield/(kg)							
Sole planting	0.494	0.468	0.376	0.44	0.183	0.213	0.307	0.234
100: 25	0.356	0.397	0.443	0.399	0.211	0.217	0.277	0.235
100: 50	0.319	0.461	0.333	0.371	0.137	0.197	0.183	0.172
Mean	0.388	0.442	0.384	——	0.177	0.209	0.256	——
L.S.D. 5% for	A= n.s.	B= n.s.	AB = n.s.		A = n.s.	B= n.s.	AB = n.s.	
	Fresh top yield (ton/fed.)							
Sole planting	8.173	9.079	8.415	8.556	5.543	6.013	9.813	7.123
100: 25	6.096	6.785	8.014	6.965	7.763	6.073	6.974	6.270
100: 50	5.746	6.351	6.885	6.327	4.253	5.242	5.533	5.010
Mean	6.671	7.405	7.771	——	5.186	5.776	7.440	——
L.S.D. 5% for	A= 0.483	B= 0.483	AB = 0.837		A = 1.243	B= 1243	AB = n.s.	
	T.S.S. %							
Sole planting	20.03	20.20	18.27	19.50	21.03	21.13	20.33	20.83
100: 25	14.83	16.93	16.60	16.12	21.03	21.13	20.33	20.83
100: 50	20.03	17.40	17.83	18.42	22.73	20.93	21.73	21.90
18.30	18.30	18.18	17.57	——	21.88	21.04	20.22	——
L.S.D. 5% for	A = n.s.	B= n.s.	AB = n.s.		A = n.s.	B= n.s.	AB = n.s.	

Regarding 100-seed weight, data in Table (2) indicated that neither solid planting of faba bean nor the two intercropping patterns showed different values in the two seasons.

Biological yield (ton/fed.) and seed yield (ardab/fed.) followed the same trend where solid planting showed the highest significant values in both yields as compared to the intercropping patterns. The pattern of 100%: 50% ranked the second in this respect. Regarding intercropping patterns, results obtained showed that the biological and seed yields per feddan were significantly affected by the previously mentioned factor (intercropping). Meanwhile, higher values of biological and seed yields in the two seasons were obtained from the intercropping pattern of 100% sugar beet: 50% faba bean as compared with pattern of 100%: 25% on the previous basis. It is worth to mention, however, that the seed yield per plant of 100%: 25% intercropping pattern exceeded those of either the solid planting of faba bean or the 100%: 50% pattern. Yet, as for the biological and seed yields per feddan the reverse was true where solid planting ranked the first followed by 100%: 50% pattern. This finding implies that the number of faba bean plants existing in the field would be the most important factor determining both biological and seed yield. These results are similar to those obtained by Amer *et al.* (1997), Hussein and El-Deep (1999) and Abd El-All (2002), who found that intercropping sugar beet with faba been significantly increased number of branches, pods, and seeds/plant as well as seed yield of faba been plant. However, the seed yield/fed., of pure stand surpassed the intercropping patterns.

b- Effect of nitrogen fertilization.

The growth and yield and its components of faba bean as influenced by nitrogen fertilization in the two seasons are presented in Table (2). Plant height and 100-seed weight showed insignificant response to the different rates of nitrogen fertilizer. No obvious trend was noticed in the other characters where No. of branches /plant, No. of pods/plant and biological yield showed significant differences in one season of the study. Seed yield per plant showed significant difference between the obtained values in the two seasons. It is worthy to notice that the level of 60 kg N /fed., produced the highest values. This may be due to that this level was sufficient to meet plant requirements through increasing the capacity of plants in building metabolites and consequently increase growth characters and seed yield per plant and its components (Table 2). Similar results were obtained by Soliman (1992), Metwally (1997) and Ramadan (1997).

c- Effect of interaction of cropping patterns x nitrogen levels .

The interaction effect of intercropping patterns x nitrogen rates was not significant for most of the studied traits (Table 2). However, No. of branches, No. of pods and seed yield per plant showed significant interactions in the second season only. The significant interaction indicated that the response of these characters to nitrogen fertilization treatments differed in accordance with the intercropping pattern applied.

Table (2.): Mean values of yield and its components of faba bean as affected by intercropping on sugar beet and nitrogen fertilizer in two successive seasons

Season	2003/2004				2004/2005			
N level (B)	30	60	90	Mean	30	60	90	Mean
Planting Patters (A)								
Sugar beet: Faba bean	Plant height (cm)							
Sole planting	97.07	110.13	109.27	105.49	96.87	97.47	100.40	98.24
100: 25	86.87	81.00	86.00	84.62	88.07	88.20	85.27	87.18
100: 50	89.47	88.27	93.07	90.27	93.13	87.13	92.60	90.96
Mean	91.13	93.13	96.11	——	92.69	90.93	92.76	——
L.S.D. 5% for	A=6.44	B=n.s.	AxB=n.s.		A = 6.07	B=n.s.	AB= n.s.	
	Number of branches/plant							
Sole planting	2.93	2.87	3.07	2.96	3.07	3.27	3.53	3.29
100: 25	3.13	3.67	2.73	3.18	3.87	4.20	3.13	3.73
100: 50	3.20	3.20	2.73	3.04	3.07	3.93	3.00	3.33
Mean	3.09	3.25	2.84	——	3.43	3.80	3.22	——
L.S.D. 5% for	A=n.s.	B= n.s.	AB = n.s.		A = n.s.	B= n.s.	AB = n.s.	
	Number of pods/plant							
Sole planting	11.33	9.47	9.73	10.18	11.40	12.27	10.40	11.36
100: 25	11.07	13.80	13.73	12.87	11.67	16.87	15.60	14.71
100: 50	11.53	13.00	10.47	11.67	14.13	15.93	9.40	13.16
Mean	11.31	12.09	11.31	——	12.40	15.02	11.80	——
L.S.D. 5% for	A= 0.92	B= n.s.	AB = 1.60		A = 1.20	B= 1.20	AB = 2.07	
	Seed yield /(g)							
Sole planting	22.677	2.907	29.610	25.731	31.033	30.567	31.433	31.011
100: 25	44.188	48.053	42.830	45.024	44.500	46.533	34.967	42.00
100: 50	27.819	40.984	27.719	32.17	38.233	43.20	21.833	34.422
Mean	31.561	37.981	33.386	——	37.922	40.100	29.411	——
L.S.D. 5% for	A= 5.285	B= 5.285	AB = n.s.		A = 3.871	B= 3.871	AB = 6.704	
	100-seed weight (g)							
Sole planting	87.97	88.70	83.90	86.86	80.88	76.27	74.08	77.08
100: 25	93.83	90.23	86.30	90.12	79.87	82.37	82.00	81.41
100: 50	89.17	90.90	84.73	88.27	78.00	77.87	82.19	79.35
Mean	90.32	89.94	84.98	——	79.58	78.84	79.42	——
L.S.D. 5% for	A= n.s.	B= n.s.	AB = n.s.		A = n.s.	B= n.s.	AB = n.s.	
	Biological yield (ton/fed.)							
Sole planting	10.400	7.667	8.133	8.733	7.133	5.833	6.133	6.367
100: 25	4.800	3.933	4.333	4.356	4.700	3.967	3.233	3.967
100: 50	5.667	5.900	6.400	5.989	5.067	4.600	3.867	4.511
Mean	6.956	5.833	6.289	——	5.633	4.800	4.411	——
L.S.D. 5% for	A= 1.013	B= n.s.	AB = n.s.		A = 0.636	B= 0.636	AB = n.s.	
	Seed yield (Ardab/ fed.)							
Sole planting	10.01	10.50	9.51	10.01	13.14	12.69	12.99	12.94
100: 25	5.64	6.09	5.11	5.61	8.79	6.99	8.397	8.06
100: 50	7.24	8.90	7.53	7.89	9.64	9.33	8.77	9.25
Mean	7.63	8.50	7.38	——	10.52	9.67	10.05	——
L.S.D. 5% for	A= 0.95	B= 0..95	AB = n.s.		A = 0.931	B= n.s.	AB = n.s.	

Effect of intercropping on the competitive relationship.

Land equivalent ratio (LER) is the most frequently used index of biological advantage which place the component crops on a relative and directly comparable basis. It is defined as the relative land area that would be required for solid crops to produce the yields achieved in intercropping (Weil and McFadden, 1991). Data on the competitive relationship as shown in Table (3) indicate that sugar beet gave advantage in land use more than the faba been under the intercropping pattern of 100%: 25% (sugar beet: faba bean). The reverse trend was observed where faba bean gave advantage in land use efficiency more than sugar beet in intercropping pattern 100%: 50% (sugar beet: faba bean). It is clear that land use efficiency increased to a maximum of 29 % in the first season and to 47% in the second season by planting the full stand of sugar beet and faba bean in hill 40 cm apart (100% sugar beet: 25% faba bean). While the intercropping pattern of 100% sugar beet: 50% faba bean, land use efficiency increased to 48% and 40% in the two seasons respectively, which existed the maximum land utilization. The data obtained on aggressivity indicated that faba bean in both intercropping system did not show any competitive pressure on the sugar beet. It is also evident from Table (3) that faba bean grown in intercropping pattern of 100%: 50% was more aggressive than when grown in pattern 100% sugar beet: 25% faba bean. Also the positive (A f)values for faba bean vs. the negative ones (A s) for sugar beet indicated that faba bean was the dominant intercrop component while sugar beet was the dominated.

Table (3): Effect of intercropping patterns of faba bean on sugar beet under nitrogen fertilization on the competitive relationships and yield advantage in two successive seasons.

Season	2003/2004				2004/2005			
N level (B)	30	60	90	Mean	30	60	90	Mean
Planting Patters (A)								
Sugar beet: Faba bean	Land equivalent ratio of sugar beet (LER_s)							
100: 25	0.679	0.712	0.782	0.725	0.868	0.964	0.753	0.851
100: 50	0.653	0.696	0.722	0.691	0.697	0.777	0.598	0.681
	Land equivalent ratio of faba bean (LER_f)							
100: 25	0.563	0.580	0.537	0.560	0.669	0.551	0.646	0.623
100: 50	0.723	0.848	0.792	0.788	0.734	0.735	0.675	0.715
	LER ($LER_s + LER_f$)							
100: 25	1.242	1.292	1.319	1.286	1.537	1.515	1.400	1.473
100: 50	1.376	1.543	1.51	1.479	1.431	1.512	1.273	1.396
	Sgrgressivity of sugar beet (A_s)							
100: 25	-0.394	-0.402	-0.342	-0.379	-0.452	-0.310	-0.458	-0.410
100: 50	-0.397	-0.500	-0.431	-0.443	-0.385	-0.347	-0.376	-0.374
	Aggressivity of faba bean (A_f)							
100: 25	0.394	0.402	0.342	0.379	0.452	0.310	0.458	0.410
100: 50	0.397	0.500	0.431	0.443	0.385	0.347	0.376	0.374

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تأثير نظم التحميل والتسميد الأزوتى على النموالمحصول ومكوناته لبنجر السكر والفول البلدى

حمدى محفوظ

قسم المحاصيل -كلية الزراعة -جامعة الفيوم

أجريت تجربتان حقليتان فى مزرعة كلية الزراعة – جامعة الفيوم بمنطقة دار رماد خلال موسمى ٢٠٠٣/٢٠٠٤، ٢٠٠٤/٢٠٠٥ لدراسة تأثير نظم التحميل المختلفة والتسميد الأزوتى على النموالمحصول ومكوناته لبنجر السكر والفول البلدى. واشتملت كل تجربة على المعاملات الآتية: الزراعة المنفردة لمحصول البنجر والفول البلدى – زراعة الفول البلدى محملا على خطوط بنجر السكر بكثافات نباتية مختلفة -معدلات تسميد آزوتى ٣٠، ٦٠، ٩٠ كجم ن/فدان . أضيفت على دفعتين للمعاملات السابقة، وكان التصميم المستخدم هوالقطاعات الكاملة العشوائية فى ثلاث مكررات . وقد أوضحت النتائج:

بالنسبة لمحصول بنجر السكر:

- تفوقت الزراعة المنفردة لبنجر السكر على الزراعة المحملة فى صفات طول، وقطر الجذر، والوزن الطازج للجذر، والعرش للنبات ومحصول الفدان من الجذور والعرش.
- أدت الزراعة المنفردة لبنجر السكر الى زيادة غير معنوية فى نسبة المواد الصلبة الكلية (TSS%) خلال موسمى الدراسة .

- لم تتأثر معنويا الصفات المدروسة للبنجر بالمعدلات المختلفة للتسميد الآزوتى، فيما عدا طول الجذر فى الموسم الثانى، ومحصول العرش للفدان فى كلا الموسمين حيث كانت الفروق معنوية.
- إضافة ٩٠ كجم ن/فدان أنتجت أطول الجذور فى الموسم الثانى مقارنة بالمعاملة ٣٠ كجم ن/فدان، كما زاد محصول العرش والجذور للفدانبزيادة التسميد الآزوتى.
- لم تتأثر الصفات المدروسة لبنجر السكر بالتفاعل بين نظم التحميل والتسميد الآزوتى فيما عدا طول الجذر ومحصول الفدان من العرش.

بالنسبة لمحصول الفول البلدى:

- أعطت الزراعة المنفردة أطول النباتات مقارنة بنظم التحميل المختلفة، كما تفوقت المعاملة ١٠٠% بنجر: ٥٠% فول على المعاملة ١٠٠% بنجر: ٢٥% فول فى هذه الصفة.
- تفوقت معاملة التحميل ١٠٠% بنجر: ٢٥% فول على باقى المعاملات لصفات عدد الفروع، وعدد القرون على النبات، ومحصول النبات الفردى.
- أعطت الزراعة المنفردة أعلى قيم لصفتى المحصول البيولوجى ومحصول البذور للفدان مقارنة بنظامى التحميل .
- لم تتأثر معنويا صفتا ارتفاع النبات، ووزن ١٠٠ بذرة بمعدلات التسميد الآزوتى، بينما تأثرت معنويا صفات عدد الفروع، وعدد القرون للنبات، والمحصول البيولوجى للفدان فى الموسم الثانى فقط، وصفتا محصول البذور للنبات والفدان فى الموسمين بمعدلات التسميد الأزوتى المستخدمة
- تفوقت معاملة إضافة ٦٠ كجم ن للفدان على باقى معاملات التسميد الآزوتى لجميع الصفات المدروسة فيما عدا المحصول البيولوجى حيث نتجت أعلى قيمة بالمعاملة ٣٠ كجم ن للفدان.
- زادت قيمة المكافئ الأرضى عن الواحد الصحيح فى نظامى التحميل المستخدمين، كما كان محصول الفول هوالسائد فى نظم التحميل.