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IMPACT OF NITROGEN LEVELS ON GROWTH AND YIELD OF SUGAR BEET INTERCROPPED WITH FABA BEAN AND WHEAT

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ABSTRACT

Two field experiments were conducted at Mansoura district (EL-Baqulia village) Dakahlia governorate, during 2003/2004 and 2004/2005. seasons, to study the impact of nitrogen levels i.e 40, 60 and 80kg N/fad. on growth and yield of sugar beet cv. "Sultan" intercropped with faba bean cv. "Giza 2" and wheat cv. "Sakha 93". A split plot design with four replications was used .

The important results could be summarized as follows:

1- Sugar beet:

It was evident that intercropping systems with sugar beet significantly reduced all studied characters of sugar beet except sucrose and purity percentages. The highest values of root fresh weight/plant, root length and diameter, TSS% and top, root and sugar yields/fad were obtained from sugar beet in pure stand, meanwhile maximum values of sucrose and purity percentages resulted from cropping 3 rows of faba bean with sugar beet in both seasons.

Increasing nitrogen level up to 80 kgN/fad significantly increased all sugar beet characters except sucrose and purity percentages which recorded the highest values with 40kg N/fad in the two seasons

The interaction between the two studied factors had a significant affect on top yield/fad in both seasons, root length in the first season as well as root fresh weight/plant and TSS% in the second season only.

2- Faba bean:

From the obtained data, all faba bean studied characters were significantly affected by intercropping systems in both seasons. 100-seed weight, seeds weight/plant and Seed and straw yields/fad gave the highest values from pure stand, whereas number of branches and pods/plant, attained maximum values under cropping 2 rows of faba bean with sugar beet. On the other hand, plant height recorded the tallest plants under cropping 3 rows of faba bean system in both seasons.

All studied characters were significantly affected by nitrogen levels in both seasons. All studied characters recorded the highest values with 40kg N/fad except plant height and straw yield/fad which resulted from 80kg N/fad.

Number of pods/plant and 100- seed weight were significantly affected only in the 2nd season by the interaction between the two studied factors.

3- wheat:

Intercropping systems had a significant effect on all wheat studied characters in both seasons. Which number of tillers and spikes/m^2, grains weight/spike,1000-grain weight and grain and straw yields/fad recorded the highest values with planting wheat in pure stand, while number of grains/spike gave the maximum values with cropping 2 rows of wheat with sugar beet, whereas the tallest plants resulted from cropping 3 rows of wheat with sugar beet system.

Concerning nitrogen levels the results revealed that increasing nitrogen levels from 40 up to 80kg N/fad. significantly increased all studied characters in both seasons.

Interaction between the two studied factors had a significant effect on grain yield/fad in both seasons and number of tillers/m^2 in the first season as well as 1000-grain weight and straw yield in the second season.

The highest values of LER and gross return were observed when cropping 3 rows of wheat with sugar beet and fertilized with 80kg N/fad. This study showed that cropping 3 rows of wheat with sugar beet gave the highest economic return for the farmers.

INTRODUCTION

Sugar beet (*Beta vulgaris*,L.) is an important crop not only in Egypt but also all over the world as a source of sugar industry, it is the second crop after sugar cane in Egypt for sugar production. Egyptian government imports large amount of sugar about 1.1million tons every year to face the rapid increase of population.

As an attempt to narrow the gab in sugar commodity. Increasing sugar yield per unit area had national interest and can be achieved by adopting suitable cultural practices such as intercropping and fertilization. Agricultural intensification could be successfully achieved by growing most important winter crops with sugar beet simultaneously without any decrease in optimum density of sugar beet per unit area.

Intercropping sugar beet with faba bean and wheat is one the most important practice as a way to maximizing productivity per unit area from through the role of legume crops in fixation of atmospheric nitrogen in soil, maximize the utilization of available resources and allow full utilization of the environmental resource with minimum competition especially for light. Farghaly *et al.* (2003) and EL-Shaikh and Bekheet (2004) recorded that different intercropping systems of faba bean with sugar beet resulted in gross return per unit area compared with growing all crops in pure stand.

Nitrogen fertilization is among the vital factors affecting growth, yield and quality of crops. Nitrogen is referred as balance wheel of plant nutrition. It has an active role to raise the efficiency of other nutrition. Saleh (2004) found that fertilizing sugar beet plants with 80kg N/fad significantly increased leaf area index, root weight/plant, root length and diameter and top, root and sugar yields/fad and decreased sucrose, TSS and purity%. Vice versa Khan *et al.* (1998) revealed that increasing nitrogen level up to 180 kg/h increased sucrose and purity%.

EL-Murshedy *et al.* (2002) recorded that Giza 2 at plant density 33/m^2 fertilized with 45 kgN/fad gave the highest yield/fad EL-Gandour et al (2001) found that 40 kg N/fad significantly increased yield of faba bean and its components. Srivastava and Srivastava (2000) recorded the highest yield of faba bean when fertilized by 40kgN/ha. Hammam (1995) revealed that application nitrogen fertilizer at 45kg N/fad plus 35kg P_2O_5 gave the highest seed yield of faba bean.

Singh *et al.* (1984) reported that intercropping 3 row of wheat with sugar beet gave highest net return compared with 1 and 2 rows. Gadallah *et al.* (2006) recorded that different intercropping systems of wheat with sugar beet

resulted in gross return per unit area compared with growing all crops in pure stand.

Abd EL-Razik (2002) showed that increasing nitrogen levels from 20-80 kg/fad increased plant height ,number of spikes/m^2 ,spike length grain and straw yields/fad of wheat in both season. Toaima *et al.* (2000) found that yield and yield components of wheat were improved with higher rate of N fertilizer up to 80kg N/fad. Said *et al.* (1999), Bassal *et al.* (2001) and Tammam and Tawfike (2004) recorded the maximum yield and its components of wheat when fertilized by 75kg N/fad.

This study was aimed to study the impact of nitrogen levels on growth and yield of sugar beet intercropped with faba bean and wheat.

MATERIALS AND METHODS

The present investigation was carried out at Mansoura district (EL-Baqulia village), Dakahlia governorate, during the two seasons of 2003/2004 and 2004/2005 to study the impact of nitrogen levels (40,60 and 80kg N/fad) on growth and yield of sugar beet (*Beta vulgaris,* L.) cv. Sultan (multigerm) intercropped with faba been (*Vicia faba,* L.) cv. Giza 2 and wheat (*Triticum asetivum vulgare,* L.) cv. Sakha 93 seeds of sugar beet and faba bean as well as wheat grains were obtained from Agric. Res. Center (ARC),Giza ,Egypt. The experiment was laid-out a split plot design with four replications.

The main plots were occupied at random with seven intercropping systems as follow:

1- Pure stand of sugar beet was planted in beds 120cm width, spaced 20cm between hills on both sides of beds to give 35000 plants/fad.
2- Pure stand of faba bean was planted in four rows on the back of beds,120cm width,20 cm between rows and 10cm between hills (2 plants/hill) to give 140000 plants/fad.
3- Pure stand of wheat was planted in four rows on the back of beds,120cm. width, 20cm between rows and 10cm between hills (7-10seed/hill).
4- Intercropping faba bean with sugar beet by planting sugar beet as in pure stand and planting two rows only of faba bean on the top of beds as in pure stand, this provides 150% total population i.e.100% component of sugar beet plus 50% component of faba bean .
5- Intercropping faba bean with sugar beet by planting sugar beet as in pure stand and planting three rows only of faba bean, this provides 175% total population .i.e. 100% of sugar beet plus 75% of faba bean.
6- Intercropping wheat with sugar beet by planting sugar beet as in pure stand planting two rows only of wheat on the top of beds as in pure stand, this provides 150% total population. i.e. 100% sugar beet plus 50% of wheat.
7- Intercropping wheat with sugar beet by planting sugar beet as in pure stand and planting three rows only of wheat on the top of beds, this provides 175%total population i.e. 100% sugar beet plus 75%of wheat.

The sub-plots were devoted at random with the following nitrogen levels:

1-40kg N/fad. 2-60kg N/fad. 3-80kg N/fad.

Nitrogen in forms of ammonium nitrate (33.5%) at the previously mentioned rates were added in two equal doses, the first was applied after thinning sugar beet plants (30 days after sowing) and the second dose before the second irrigation (25 day after the previous irrigation). Each experimental unit included five beds, each 120cm apart and 3.5m length ,resulted in an area of 21m^2 (1/200 fad).The preceding summer crop was rice (*Oryza sativa,* L.*)* in both seasons.

Agricultural practices:

Calcium super phosphate (15.5 % P_2O_5) was applied during soil preparation at the rate of 150 kg/fad, Potassium sulphate (48 % K_2O) at the rate of 50kg/fad was applied before the second watering (55 day from planting sugar beet).

Sugar beet balls were hand sown 3-5 balls/hill using dry sowing method as previously mentioned on the first and 5th of October in the first and second seasons, respectively. faba bean and wheat were sown on the first and 5th of November in first and second seasons, respectively. The plots were irrigated immediately after sowing. Sugar beet plants were thinned at the age of 30 days from planting to obtain one plant/hill, plants were kept free from weeds which were manually controlled by hand hoeing at two times. Other cultural practices were performed as recommended. Harvesting took place after 170 days for faba bean and wheat, while 190 days for sugar beet. The recorded data could be divided into the following parts:

I-SUGAR BEET:

At maturity (after approximately 190 days from planting) five plants were chosen at random, from the pure stand and from intercropped plots of sugar beet to determine yield components, quality and yield characters as follows:

A-Yield components:

1- Root fresh weight (g/plant).
2- Root length (cm) it was measured from the end of tipped root to the discoidal stem.
3- Root diameter (cm) it was measured at the neck region of the root.

B-Quality:

4-Total soluble solids (TSS%) in roots was measured in juice of fresh roots by using Hand Refract meter.
5-Sucrose percentage (%) was determined polarimetrically on lead acetate extract of fresh macerated roots according to the method of ***Le-Docte*** (1927).
6-Purity percentage (%) was determined as a ratio between sucrose% and TSS% of roots.

C-Yield:

At harvest, plants that were produced from the two inner beds(8.4m^2) of each sub-plot were collected and cleaned. Roots and tops were separated and weighted in Kilograms, then converted to estimate:

7- Root yield (t/fad).
8- Top yield (t/fad).
9- Sugar yield (t/fad) was calculated by multiplying root yield by sucrose percentage.

II-FABA BEAN :

At maturity, a samples of 10 plants was chosen at random, from the pure stand or from intercropped plots of faba bean, then the following characters were calculated.

1-Plant height (cm). 2-Number of branches/plant.
3-Number of pods/plant. 4-Seeds weight/plant(g).
5-100-seed weight(g).

At harvest plants in two beds of each experimental unit were harvested, collected together, labeled, thrashed and the grains were separated. The grain and straw yields were recorded in kg/m^2, then it converted to grain yield in ardab/fad and straw yield in t/fad, then the two following characters were calculated.

6-Seed yield (ardab/fad) (ardab = 155kg). 7- Straw yield (t/fad) .

III-WHEAT :

At maturity, a sample was chosen randomly from the pure stand and from intercropped plots of wheat, to determine the following characters:

1- Plant height (cm). The average height of ten plants and measured from the soil surface to the tip spike of main stem.
2- Number of tillers/m^2. by taking one squire meter from the inner of each plot.
3- Numbers of spikes/m^2. by taking one squire meter from the inner of each plot.
4- Number of grains/spike. It was estimated from ten randomly chosen main spikes from each plot.
5- Grains weight/spike (g). It was estimated from ten randomly chosen main spikes from each plot.
6-1000-grain weight (g).

The plants in two beds (8.4m^2)of each experimental unit were harvested, collected together, labeled, thrashed and the grains were separated. The grain and straw yields were recorded in kg/m^2 converted into grain yield in ardab/fad and straw yield in t/fad, then the two following characters were calculated:

7-Grain yield (ardab/fad) (ardab=150kg)
8-Straw yield (t/fad).

IV-Competitive relationships and yield advantages:

1- Land equivalent ratio (LER): as mentioned by Willey and Osiru (1972).
2- Relative crowding coefficient (K): as mentioned by Dewit (1960).
3- Aggressivity (A): determined according to Mc. Gillchrist (1965).
4- Economic evaluation:

Gross return (LE/fad):

Gross return from each treatment was calculated in Egyptian pounds (LE) at market prices of 125 and 163 LE for ton of sugar beet roots, 320 and 325 LE for ardab of faba bean seeds, 145 and 165 LE for ardab of wheat seeds, 112 and 140 LE for ton of faba bean straw and 184 and 280 LE for ton of wheat straw for 2003/2004 and 2004/2005 seasons, respectevely.

Prices of the yields were considered according to the Ministry of Agriculture and Land Reclamation, Economic Affairs sector, Agricultural

Statistics, (Study of main indicators of Agriculture Prices Bulletin), volume 1, October 2004 and October 2005.

Statistical analysis:

The collected data on sugar beet, faba bean and wheat were statistically analyzed according to the technique of analysis of variance (ANOVA) for the split-plot design by means of " MSTAT-C Computer software package and least significant difference (LSD) method was used to test the differences between treatment means at 5% level of probability, as published by Gomez and Gomez (1984).

* and symbol used in tables indicate the significance at 5% probability, while N.S. means non significant.

RESULTS AND DISCUSSION

I- Sugar beet :

Data in table (1) show that, root fresh weight/plant, root length and diameter, TSS% as well as root, top and gross sugar yields (t/fad) were significantly reduced by intercropping system compared with pure stand. The lowest values of these characters were recorded when cropping 3 rows of faba bean with sugar beet. On the other hand, sucrose and purity% significantly increased by intercropping system compared with pure stand. The highest values were recorded under cropping 3 rows of faba bean with sugar beet. these results may be due to high plant population under cropping 3 rows of faba bean with sugar beat, which leades to high intra and inter row competition.

Concerning sugar beet yield/fad, the data showed the same trend as shown by growth characters in both season. The highest values was recorded with the pure stand of sugar beat. While the lowest values was obtained under cropping 3 rows of faba bean with sugar beet in both season .Root yields under cropping 2 rows of faba bean and 2, 3 rows of wheat with sugar beet were 22.066, 24.254 as well as 22.687, 24.889 and 21.513 & 23.693 ton/fad in the first and second seasons, respectively. The present result is mainly due to increasing inter and intra specific competition due to increased plant population per unit area. Similar results were reported by Singh et al (1984), Farghly *et al.* (2003) and Gadallh *et al.* (2006).

The results in table (1) stated that all sugar beet characters were significantly affected by nitrogen fertilization levels in both seasons. Increasing nitrogen levels from 40 to80 kg N/fad significantly increased root fresh weight/plant, root length and diameter, Tss%, root and top as well as sugar yields(ton/fad) in both seasons. On other hand, nitrogen level of 40kg N/fad significantly increased sucrose and purity %.Application of nitrogen at the levels 40,60 and 80kgN/fad gave averages of 16.719, 23.766 and 26. 674 in the first season and 17.982, 26.251 and 29.742 of root yield in the second season, respectively. The increase in fresh root yield/fad may be attributed to the role of nitrogen in activating the growth through stimulating cell elongation and division which increased root length and diameter and consequently root yield/fad. The previous results are in good agreement with those obtained by Saleh (2004).

Table 1: Root fresh weight(g/plant), root length (cm), root diameter (cm), total soluble solids%, sucrose%, purity %,root yield (ton/fad),top yield (ton/fad) and gross sugar yield(ton/fad) as affected by the intercropping systems and nitrogen levels in 2003/2004 and 2004/2005 seasons.

Characters	Root fresh weight (g/plant)		Root length (cm)		Root diameter (cm)		Total soluble solids%		Sucrose%		Purity %		Root yield (ton/fad)		Top yield (ton/fad)		Gross sugar yield(ton/fad)	
Seasons	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2003	2003	2004	2003	2004	2003	2004
Treatments	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2004	2004	2005	2004	2005	2004	2005
A- Intercropping systems:																		
Solid sugar beet.	763	842	28.3	29.4	12.0	12.3	23.5	23.3	17.6	17.7	75.0	76.1	27.270	29.573	16.120	16.808	4.706	5.189
2 rows faba bean + S. beet.	613	710	22.9	26.1	9.1	10.2	22.8	22.1	18.4	18.7	82.2	84.8	22.066	24.254	13.745	15.107	3.980	4.448
3 rows aba bean + S.beet.	516	615	19.0	22.7	8.3	9.0	21.3	20.9	18.7	19.7	87.9	91.6	18.396	20.883	12.892	14.280	3.409	3.990
2 rows wheat+ S. beet.	649	727	24.5	27.9	9.6	10.4	22.7	22.3	18.1	18.6	79.7	83.8	22.687	24.889	14.016	15.180	4.036	4.539
3 rows of wheat + S.beet.	598	687	20.8	24.8	8.8	10.0	22.8	22.8	18.5	19.2	81.3	84.6	21.513	23.693	13.732	14.975	3.908	4.459
LSD 5%	68	36	1.8	1.0	1.9	2.0	1.0	0.5	N.S	0.4	4.6	1.9	0.992	1.062	0.630	0.875	0.200	0.180
B- Nitrogen levels:																		
40kg N/fad.	459	531	20.5	21.7	7.1	8.0	22.1	21.9	20.3	20.9	92.0	95.0	16.719	17.982	9.797	10.940	3.399	3.739
60kg N/fad.	658	736	22.7	26.4	10.4	11.2	22.6	22.3	18.1	18.8	80.5	84.5	23.766	26.251	14.617	15.620	4.291	4.910
80kg N/fad.	767	882	26.1	30.4	11.3	12.2	23.0	22.7	16.3	16.6	71.1	73.0	26.674	29.742	17.889	19.250	4.334	4.926
LSD 5%	46	35	0.4	05	0.3	0.4	0..3	0.1	0.3	0.5	1.7	2.1	0.490	0.677	0.350	0.377	0.130	0.180
C- Interaction																		
A X B	NS	*	*	NS	NS	NS	NS	*	NS	NS	NS	NS	NS	NS	*	*	NS	NS

Table 2: Means of top yield (ton/fad),root length (cm) and root fresh weight(g/plant) as affected by the interaction between intercropping systems and nitrogen leves.

Characters	Top yield (ton/fad)						Root length (cm)			Root fresh weight(g/plant)		
Seasons	2003/2004			2004/2005			2003/2004			2004/2005		
N-levels Treatments	40	60	80	40	60	80	40	60	80	40	60	80
Solid sugar beet	11.184	18.323	18.852	12.100	18.660	19.662	24.3	28.0	32.8	578	846	1101
Cro.2 rows faba bean+S. beet	10.188	13.635	17.412	11.398	14.935	18.988	21.0	22.4	25.3	540	740	860
Cro.3 rows faba bean+S .beet	9.200	12.821	16.658	10.600	13.677	18.563	16.8	19.0	21.3	467	633	745
Cro.2 rows wheat +S. beet	10.575	13.185	18.287	11.362	14.275	19.287	22.0	23.8	27.8	538	757	885
Cro3 rows wheat +S. beet	7.837	15.122	18.235	9.240	16.550	19.450	18.5	20.4	23.4	534	705	821
LSD 5%	1.837			0.843			0.9			76		

Table 3: Plant height (cm),number of branches/plant, number of pods/plant, 100-seed weight(g),Seeds eight/plant(g), Seed yield (ardab/fad) and Straw yield (ton/fad) as affected by the intercropping systems and nitrogen levels in 2003/2004 and 2004/2005 seasons.

Characters	Plant height (cm)		Number of branches/ plant		Number of pods/ plant		100-seed weight (g),		Seeds weight/plant (g)		Seed yield (ardab/ fad)		Straw yield (ton/fad)	
Seasons	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Treatments	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
A- Intercropping systems:														
Solid faba bean	83.5	86.0	2.4	2.9	13.4	14.7	61.7	63.9	21.3	23.1	10.27	11.25	0.990	1.178
2 rows faba bean + S. beet	78.1	81.6	3.0	3.7	16.3	17.5	60.8	61.9	17.3	21.4	4.12	5.53	0.533	0.659
3 rows faba bean + S. beet	90.3	93.2	1.9	2.2	10.4	11.8	60.3	60.2	13.3	16.4	6.42	7.51	0.823	0.951
LSD 5%	4.0	4.5	0.9	1.1	1.0	1.1	0.9	1.1	1.2	1.4	0.89	0.84	0.051	0.095
B- Nitrogen levels														
40KgN/fad	81.7	84.9	2.8	3.5	14.8	16.4	63.3	64.2	20.4	23.7	6.83	7.96	0.607	0.751
60KgN/fad	84.0	87.0	2.5	2.8	13.3	14.4	61.2	62.4	17.3	20.3	6.38	7.53	0.786	0.924
80KgN/fad	86.0	88.8	2.1	2.4	12.0	13.2	58.3	59.4	14.2	16.9	6.05	7.03	0.953	1.112
LSD 5%	1.0	0.7	0.4	0.3	0.6	0.4	0.8	0.8	0.8	1.0	0.31	0.27	0.075	0.079
C- Interaction														
Ax B	NS	NS	NS	NS	NS	*	NS	*	NS	NS	NS	NS	NS	NS

The interaction between intercropping systems and nitrogen levels had a significant effect on top yield/fad in both seasons, root length in the first season and root fresh weight/plant in the second season, the highest values in all cases were obtained with sugar beet grown in pure stand and fertilized by 80kg N/fad Table (2).

II- Faba bean.

Results in table (3) clear that intercropping systems had significant effects on plant height, number of branches and pods/plant,100-seed weight, seeds weight/plant as well as seed and straw yields/fad. The highest mean values of plant height was obtained under intercropping 3 rows of faba bean with sugar beat, while number of branches and pods/plant resulted from intercropping 2 rows of faba bean with sugar beet .On the other hand, 100-seed weight, seeds weight/plant as well as seed and straw yields/fad were the highest values when grown faba bean in pure stand, these results may be due to the high and low of intra and inter competition under different sowing systems. Similar results were reported by Farghaly *et al.* (2003) and Gadallah *et al.* (2006).

The data collected in table (3) indicted that nitrogen leves had a significant effect on all studied characters. The highest values of plant height and straw yield were recorded with 80kg N/fad. Whereas number of branches and pods/plant,100-seed weight, seeds weight/plant and seed yield/fad attained the maximum values with 40kg N/fad .these results are in agreement with results of EL-Gandour *et al.* (2001), EL-Murshedy *et al.* (2002) and Srivastava and Srivastava (2000).

The data presented in table (4) clear that the interaction between intercropping systems and nitrogen levels had a significant effects on number of pods/plant in the second season which resulted from cropping 2 rows of faba bean with sugar beet and fertilized by 40kg N/fad with an average of values 19.5 and 100-seed weight in the second season which resulted from pure stand and fertilized by 40kg N/fad with an average of values 66.0 (g).

Table 4: Means of pods/plants and 100-seed weight (g) as affected by the interaction between intercropping systems and nitrogen fertilizer levels.

Characters	Number of pods/plant			100-seed weight(g)		
Seasons	2004/2005			2004/2005		
N- levels Treatments	40	60	80	40	60	80
Solid faba bean	16.8	14.0	13.3	66.0	64.1	61.8
2 rows faba bean + S.beet	19.5	17.3	15.8	63.7	62.1	60.0
3 rows faba bean + S.beet	13.0	11.8	10.5	63.0	61.0	56.5
F test.		*			*	
LSD 5%		0.8			1.4	

III- Wheat :

Data in Table (5) show that yield and yield components of wheat were significantly affected by intercropping systems in both seasons.

Table 5: Plant height (cm),number of tillers/m^2,number of spikes /m^2, number of grains/spike, grains weight/spike (g), 1000-grain weight (g),grain yield (ardab/ fad) and Straw yield (ton/fad) of wheat as affected by the intercropping systems and nitrogen levels in 2003/2004 and 2004/2005 seasons.

Characters	Plant height (cm)		Number of tillers/m^2		Number of spikes/m^2		Number of grains/ spike		grains weight/spike (g)		1000-grain weight (g)		grain yield (ardab/fad)		Straw yield (ton/fad)	
Seasons	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Treatments	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
A- Intercropping systems:																
Solid wheat	84.7	89.1	318.3	328.7	279.0	307.6	51.8	52.8	2.49	2.57	47.4	48.7	20.04	21.11	1.940	2.150
2 rows wheat + S. beet	83.9	86.9	149.5	159.2	137.4	141.9	53.2	55.5	2.31	2.39	46.7	47.1	6.45	6.95	0.810	1.042
3 rows wheat + S. beet	87.3	92.0	199.3	201.3	175.4	186.0	47.8	50.2	2.02	2.22	42.6	44.4	10.33	11.31	1.147	1.367
LSD 5%	1.4	1.0	14.6	20.8	15.3	15.7	1.2	1.8	0.11	0.12	2.1	0.6	1.45	1.57	0.580	0.310
B- Nitrogen levels																
40KgN/fad.	82.6	85.6	211.9	221.0	193.5	202.4	47.8	50.1	2.13	2.26	41.6	42.7	10.88	11.89	1.031	1.342
60KgN/fad.	84.5	89.4	221.7	228.5	201.3	211.1	50.4	52.6	2.24	2.37	45.9	46.7	12.55	13.25	1.342	1.542
80KgN/fad.	88.9	93.1	234.1	239.6	214.8	223.0	54.6	55.8	2.44	2.55	49.2	50.8	13.39	14.24	1.519	1.675
LSD 5%	1.4	0.9	8.3	8.5	6.7	6.9	0.9	0.6	0.09	0.06	2.7	1.0	0.42	0.37	0.118	0.151
C- Interaction																
Ax B	N.S	N.S	*	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	*	*	*	N.S	*

Table 6 : Means of Number of tillers/m^2, 1000-grain weight(g), grain yield (ardab/fad) and Straw yield (ton/fad) and as affected by the interaction between intercropping systems and nitrogen levels.

Characters	Number of tillers/m^2			1000-grain weight(g)			Grain yield (ardab/fad)						Straw yield (ton/fad)		
Seasons	2003/2004			2004/2005			2003/20004			2004/2005			2004/2005		
N- levelsTreatments	40	60	80	40	60	80	40	60	80	40	60	80	40	60	80
Solid wheat	306.5	317.5	331.5	42.8	46.8	53.6	17.9	20.3	21.9	19.3	21.2	22.8	1.825	2.175	2.450
2 rows wheat + S. beet	144.8	152.0	151.8	43.6	49.0	51.4	5.6	6.7	7.1	6.2	7.1	7.6	0.975	1.000	1.150
3 rows wheat + S. beet	184.5	196.0	219.0	41.3	44.5	47.3	9.2	10.6	11.2	10.2	11.4	12.3	1.225	1.450	1.425
F. test.		*			*			*			*			*	
LSD 5%		8.3			1.8			0.7			0.7			0.3	

Number of tillers/m^2, number of spikes/m^2, grains weight/spike, 1000- grain weight and grain and straw yields/fad gave the highest values from pure stand, while number of grains/spike was highest with cropping 2 rows of wheat with sugar beet. On the other hand, plant height recorded the tallest plants under cropping 3 rows of wheat with sugar beet, this increase in plant height may be due to the inter and intra plants competition under dense planting. Similar results were obtained by Singh *et al.* (1984) .

The results in Table (5) show that all wheat characters were significantly affected by nitrogen fertilization levels in both seasons. Increasing nitrogen levels from 40 to 80 kgN/fad. significantly increased all studied characters and this due to the important role of nitrogen in enhanced and activation in vegetative growth which led to increase in plant height, no. of tillers and spikes/ m^2, number of grains/spike, grains weight/spike, 1000-grain weight as well as grain and straw yields/fad.Similar results were obtained by Toaima *et al.* (2000) and Abed EL-Razik (2002)

The interaction between the two studied factors had a significant affect on number of tillers/m^2 in the first season, 1000-grain weight and straw yield/fad in the second season, grain yield/fad in both seasons, The highest seed yield/fad (21.9 and 22.8 ardab) were recorded from pure stand and fertilized by 80kg N/fad Table (6).

Competitive relationships and yield advantage of intercropping .

Land Equivalent Ratio (LER):

Data presented in Table (7) indicated clearly that LER showed considerable yields advantage with intercropping faba bean and wheat with sugar beet in the two successive seasons. The highest values of LER 1.30 and 1.33 with cropping 3 rows of wheat with sugar beet followed by 1.20 and 1.31 with cropping 2 rows of faba bean with sugar beet in the first and second season respectively.

Relative crowding coefficient (RCC).

The best values of (K) 4.43 and 4.97 were achieved by cropping 3 rows of wheat with sugar beet in the first and second seasons, respectively Table(7).

Aggressively (Agg):

Data in table (7) show that aggressively of faba bean and wheat (intercropped crops) were negative while values of sugar beet were positive. This mean that sugar beet was the dominant intercrop where as faba bean and wheat were the dominated ones in both seasons.

Economic evaluation:

The data in table (7) show the advantage of intercropping faba bean and wheat with sugar beet as economic evaluation . the highest values of total income (LE/fad) 5073.5 and 7161.7 followed by 4661.4 and 6524.0 LE could be achieved when intercropping 3 rows of wheat and 2 rows of faba bean with sugar beet fertilized by 80 kg N/fad in the first and second seasons respectively.

It can be concluded that intercropping 3 rows of wheat and 2 rows of faba bean with sugar beet systems fertilized by 80kg N/fad. are

recommended treatments for maximizing productively of faba bean and wheat intercropped with sugar beet under the same conditions of this study.

Table 7: Land Equivalent Ratio(LER), Relative crowding coefficient (Rcc), Aggressively (Agg) and total income (2003/2004 and 2004/2005) seasons.

Seasons	2003- 2004								
Characters	Land Equivalent Ratio (LER)			Relative Crowding coefficient (K)			Aggressively (A)		Total income
Treatments	Lf/w	Ls	LER	Kf/w	Ks	K	Aw	As	
2 rows faba bean S. beet	0.40	0.80	1.20	0.69	4.47	2.92	-0.79	+0.79	4661.4
3 rows faba bean S.beet	0.48	0.71	1.19	0.93	2.14	2.00	-0.47	+0.47	4244.0
Solid faba bean									3497.6
2 rows wheat S. beet	0.32	0.83	1.15	0.49	5.58	2.88	-1.01	+1.01	4628.3
3 rows wheat S. beet	0.51	0.79	1.30	1.09	3.91	4.43	-0.55	+0.55	5073.5
Solid wheat									3577.2
Solid sugar beet									4022.5
Seasons	**2004- 2005**								
2rows faba bean+S beet	0.49	0.82	1.31	0.99	4.70	4.69	-0.66	+0.66	6524.0
3 rows faba bean +S beet	0.51	0.70	1.21	1.06	2.46	2.38	-0.41	+0.41	6042.8
Solid faba bean									3982.5
2 rows wheat +S. beet	0.33	0.84	1.17	0.49	5.33	2.64	-1.02	+1.02	6496.6
3 rows Wheat S. beet	0.53	0.80	1.33	1.17	4.13	4.97	-0.53	+0.53	7161.7
Solid wheat									4496.3
Solid sugar beet									5723.1

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تأثير مستويات النيتروجين على نمو ومحصول بنجر السكر المحمل مع الفول البلدى والقمح.

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أجريت تجربتان حقليتان بقرية البقلية مركز المنصورة محافظة الدقهلية خلال الموسمين ٢٠٠٣/٢٠٠٤و٢٠٠٤/٢٠٠٥ لدراسة ثلاثة مستويات من النيتروجين ٨٠،٦٠،٤٠كم نيتروجين للفدان على بنجر السكر صنف سلطان المنزرع على مصاطب عرضها ١٢٠سم بكثافة مثلى (٣٥٠٠٠ نبات/فدان)المحمل عليها خطين وثلاثة خطوط من الفول البلدى (جيزة٢) والقمح (سخا ٩٣) على ظهر المصطبة حيث صممت التجربة بنظام القطع المنشقة فى أربع مكررات وتتلخص النتائج المتحصل عليها فيما يلي:

١. اظهر نظام الزراعة المنفردة للبنجر زيادة معنوية فى كل الصفات المدروسة عدا صفتي نسبة السكر ونسبة النقاوة فى المائة فقد أعطت اعلى قيم لها تحت نظام تحميل ثلاث خطوط من الفول البلدى على بنجر السكر وذلك خلال موسمى الزراعة.
٢. أعطت نباتات القمح أطول النباتات تحت نظام تحميل ثلاث خطوط من القمح على بنجر السكر بينما عدد الحبوب السنبلة اعطت اعلى قيم لها تحت نظام تحميل ٢ سطر من القمح مع بنجر السكر فى حين أن زراعة القمح بنظام الزراعة المنفردة اعطت اعلى قيم معنوية لكل من عدد الاشطاء/م^2 وعدد السنابل/ م^2 ووزن السنبلة بالجرام ووزن ألف حبة بالجرام ومحصول الحبوب والقش للفدان خلال موسمى الزراعة.
٣. اظهر نظام تحميل ثلاث خطوط من الفول البلدى على بنجر السكر زيادة معنوية فى صفة طول نباتات الفول البلدى بينما أظهرت الزراعة تحت نظام خطين من الفول البلدى مع بنجر السكر الى زيادة فى صفات عدد الاشطاء و القرون للنبات بينما سجلت صفات وزن ١٠٠ حبة ووزن الحبوب للنبات ومحصول الحبوب والقش للفدان اعلى قيم مع زراعة الفول البلدى بنظام الزراعة المنفردة.
٤. أدت زيادة التسميد النيتروجينى حتى ٨٠ وحدة أزوت للفدان إلى زيادة فى جميع صفات القمح وبنجر السكر تحت الدراسة عدا صفتي نسبة السكر والنقاوة في المائة فى محصول بنجر السكر فقد اعطت اعلى قيم لها عند مستوى تسميد ٤٠ وحدة أزوت للفدان خلال موسمى الزراعة بينما أدت التسميد بمستوى ٨٠ وحدة ازوت إلى زيادة معنوية فى صفة طول النبات ومحصول القش فى الفول البلدى بينما التسميد بمعدل ٤٠ وحدة أزوت للفدان أدى زيادة معنوية فى باقى صفات الفول تحت الدراسة بالمقارنة بمستويات التسميد الأخرى وذلك خلال موسمى الزراعة.
٥. أوضح التفاعل بين نظم التحميل والتسميد النيتروجيني إلى أن اعلى محصول من القمح وجنور بنجر السكر الغضة سجل اقصاة عند الزراعة بصورة منفردة والتسميد بمعدل ٨٠كم نيتروجين للفدان خلال موسمى الزراعة.
٦. أشارت النتائج إلى زيادة كلا من معدل استغلال الأرض ومعامل الحشد النسبي والدخل الكلى وذلك تحت نظام زراعة ثلاث خطوط من القمح على ظهر مصطبة بنجر السكر والتسميد بمعدل ٨٠ كم نيتروجين للفدان يليه نظام زراعة خطين من الفول البلدى على ظهر مصطبة بنجر السكر والتسميد بمعدل ٨٠كم نيتروجين للفدان خلال موسمى الزراعة وكان محصول بنجر السكر هو السائد بينما محصول الفول البلدى والقمح هما المسود.