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EFFECT OF RIDGES WIDTH AND PLANT DENSITY OF ONION ON YIELD OF INTERCROPPED SUGAR BEET AND ONION

Nawer, F.R.
Crop Intensification Res. Sci., Field Crops Res. Inst., Agric. Res. Cent., Giza, Egypt

ABSTRACT

Two field experiments were conducted at Mallawi Agric.Res.Station during two successive seasons of 2002/2003 and 2003/2004 to study the effect of ridges width (60 and 120 cm) different planting densities of onion (33 and 66%) on the root and bulb yields of sugar beet and onion . The experimental design was split plots with four replications. The important results could be summarized as follow:-

Yield and yield components of sugar beet were higher when grown on narrow ridges (60 cm) than under wide ridges (120cm).yield and its components of onion were higher under wide rides than those grown on narrow ridges .

The reduction in intercropped sugar beet yield with high onion population density (66.6%) were higher than with low population density (33.3%).The reduction percentage were 16.6 and 35.8% for root diameter,23.2 and 40% for root weight as well as 12.0 and 31.8% for root yield/fed .Bulb diameter and bulb weight of onion were higher under low density than high onion density, while bulb yield was reduced under low onion density .

The highest value for L.E.R was 1.46 when intercropped on wide ridges with high onion population density, While the total in come reached to 4316.5 L.E when intercropped with low onion density on narrow ridges.

It can be concluded that intercropping sugar beet (100% density) with low onion density (33%) on narrow ridges (60 cm) could be recommended which increased econcmic income (13.46%) per unit arua without effect on the quality and productivity of sugar beet .

INTRODUCTION

The cultivated area in ancunt valley is limited and the except food production of the newly reclaimed area will not meet the needs of the increasing population, therefore, intercropping may considered one of the most effective method followed in Egypt to investemate the limite cultivated lands. Because sugar beet takes long time in the field, about 5-6 months, which requires farmers to look for crops to grow with sugar beet without reducing its final yield.

Several investigators concluded that the final yield and yield components of sugar beet under intercropping condition due to, more factors, i.e. cropping systems, density of the intercropped *et al* crops, fertilizer, etc.. Abou keraisha *et al* (1991) Amer *et al*,(1997), Maria *et al* (2000), , Saleh,(2003), Farghaly *et al* (2003), Mare, (2004) and Ismail *et al* (2005) they indicated that monoculture gave the highest values of yield and its components of sugare beet as compared with intercropping other crops. Abou-Keraisha, *et al* (1991) domonstrated that yield and yield componts of fodderbeet grown on the same ridge with faba been comparatively less than those grown on sole ridges EL-Habbak *et al* (1993) showed that bulb

diameter and bulb weight were decreased at the highest of onion plant density and increased at low onion density under intercropping condiction Amer *et al.*1997 show that intercropping reduced. significantly beet root and sugar yield/fed; The decrease percentage in yield due to intercropping was 26.8 and 17.2% for root yields and 25.8 and 21.5% for sugar yield/fed in first and second season respectively.

Metwally *et al*,(1997) indicated that intercropping system of 3 faba been : 2 fodder beet significantly increased root length, root diameter, number of leaves as well as root and top yields/fad than the other two systems(4:2 and 5:2). Besheit *et al* (2002) found that the highest beet quality and productivity were obtained from beet planted on l00cm ridge width and intercropped with two onion rows, while intercropping onion on the other side of beet ridge 50 cm width was high and negatively affected sugar beet quality and productivity .Toaima *et al* (2001) and Farghaly *et al* (2003) found that intercropped suger beet with onion and garlic resulted in greatar yield, yield components and quality of sugar beet as well as competition relationships. Also, sowing in ridges 120 cm wide gave higher values of the same traits than those of ridges 60 cm wide. Onion in pure stand or intercropped grown on wide ridge(120 cm) gave higher values than on ridges 60 and 80 cm width . While, Saleh (2003) found that intercropping onion with sugar beet at 60 cm ridge width gave higher yield, yield components and chemical analysis (sucrose percentage, total soluble percentage sugar yield) of sugar beet than those of sole cropping or intercropping with onion ridges 120 cm wide .Onion grown in ridges 120 cm had yield and yield components than that obtained by ridges 60 cm width.

Marey,(2004),recoded that the intercropping resulted in a significant decrease in root length, root diameter , root weight and root yield/fed .Top root and quality characters were higher when half beet ridges. Ismail *et al* (2005), found that root diomater , root weight, root yield/fed and quality traits were maximized when more land space was left for faba bean.

MATERIALS AND METHODS

Two field experiments were carried out at Mallawi, Agriculure Research Stattion ,Minia govemorate during two successive seasons 2002/2003 and 2003/2004 to study the effect of ridges width (60 and 120 cm) as well as the onion population densities (33.3 and 66.6 % of pure stand)on root and bulb yield of suger beet and onion under intercropping condition The experimental design was split plots with four replications. The main plots were arranged to the ridges width, and the sub plots were including cropping system. The treatments used were:-

A – Ridges width:

1- Narrow ridges (60 cm) 2- Wide ridges (120 cm)

B-Cropping systems:

1-Pure stand

Sugar beet was planted on one side in the narrow ridges (60 cm) and on the two sides in wide ridges (120 cm) in hills 25 cm apart (28000 plant/fed).

Onion was transplanted on the two sides and the top of ridges (three rows) in the narrow ridges or on the two sides and four rows on the top in wide ridges (6 rows), 20 cm between rows and 10 cm between hills (21000 plant/fed) .

2- Sugar beet (100%) + Onion (33.3%)

Sugar beet was planted on one side in narrow ridges or on the two sides in wide ridges in hills 25 cm apart while onion was transplants on the other side of the row narrow ridges or on the top of the wide ridges of the two rows in spaces 20 cm between rows and 10 cm between hills .

3- Sugar beet (100% + Onion (66.6%)

Sugar beet was planted on one side in narrow ridges or on the two sides in wide ridges in hills 25 cm while onion was transplanted on the other side on two rows in narrow ridges or four rows on the top of wide ridges in spaces 20 cm between rows and 10 cm between hills.

The plot area was 10.8 m^2 (3× 3.6 m) included 6 narrow ridges (60 cm) or 3 wide ridges (120 cm). The preceding crops was maize in the two seasons. Sugar beet (c.v. Glora) planted in 10 and 15th Oct ., onion (c.v. Giza 6) was transplanted in 25th and 28th Nov. in the first and second seasons ; respectively. Normal cultural practices were applied for the two crops under study in pure stand or inter cropping as recommended .Nitrogen fertizer was applied (100 kg N/fed) in form of urea (46%N),in three equal doses; the first one was applied during sugar beet plating, the second was after sugar beet thinning and onion planting, and the third one was after month Phosphate fertilizer was applied in the form of calsium super phosphate (15.5% P_2O_5) at the rate of 30 kg P_2O_5/fed at seed bed preparation. Potassium fertilizer was appliced as potassium sulphate (48 K_2O_5) at the rate of 24 kg K_2O/fed with the first N-dose .

Onion and sugar beet were harvested in 25th April , 22th May in the first season and in 20th April, 23th May in second season respectively

At harvest, ten plants from each crop (beet and onion)were chosen randomly to determine yield parametes .While the yield/fed was estimated from the whole plot area in kg/plot and it was calculated as ton/fed.

Characters studied:

Onion : bulb diameter (cm), bulb weight (g) and balb yield per faddan (ton).

Sugar beet: top length(cm)top forag , yield/fed(ton), root length(cm), root diameter(cm),root weight(g), root yield/faddan(ton), Sucros % and sucros yield(ton).

Quality attributed: A sample 25 g of fresh weight from root of sugar beet/ plant was taken from each treatmeat to determine the following,characters:

Total soluble solid% (T.S.S) using refractometer according to A.O.A.C. (1984)and sucrose percentage using Saccharameer to Le- Doct,(1927).

3- Competitive relationships and Economical evaluation:

1- Land Equivalent Ratio (LER) was determined for sugar beet (Ls) Onion) (Lo) according to Willey (1979)

$$LER = (Yso / Yss) + (Yos / Yoo)$$

Where :

Yso = Intercrop yield of sugar beet with onion.

Yss = Pure stand of sugar beet.
Yos = Intercrop yield of onion with sugrar beet.
Yoo = purstand yield of onion

2- Relative Crowding Coefficient (K) as proposed by De Wit (1960) was calculated as follows

$$K = Ks \times Ko$$

Where:-

$Ks = (Yso \times Z_2\ \%) / (Yss - Yso) \times Z_1\%$
$Ko = ((Yos \times Z_1\ \%) / (Yoo - Yos) \times Z_2\%$
$Z_1\%$ = Sown proportion of sugar beet with onion
$Z_2\%$ = Sown proportion of onion beet with beet

3- Aggressivity (Ag) was determind according to MC-Gilchrist (1974) as follows:-

Agg = A1 – A2 for sugar beet , A2 – A2 for onion
$As = [Yso/ (Yss \times Z_1\%)] - [(Yos/ (Yoo \times Z_2\%)]$
$Ao = [Yos/ (Yoo \times Z_2\%)] - [Yso/ (Yss \times Z_1\%)]$

4- Economical Evalution :

It was estimated by Egytion pound (LE) according to Ministry of Agricultural and land Reclamation Economic Affairs sector .

Total income = Sugar beet revenue + onion revenue

Where : sugar beet revenue = suger beet yield (ton) × price of ton (130 LE).
Onion revenue = bulb yield (ton) × (200 LE)

Statical analysis :

The collected data was statical analysis by the technique of analysis of variance for combined experiment according to Snedecor and Cochran(1981) LSD was used at 5% level to compare between means

RESULTS AND DISCUSSION

1- Sugar beet :

1-1-Effect of wide of ridges on yield and yield component of sugar beet

Results in Table 1. show that effect of ridges width was not significant on most studied characters in first and second seasons,while in the average of two seasons observed significant effect on all characters except root length and sucrose% However,these charactere were higher when sugar beet were grown on narrow ridges than wide ridges expect root length and sucrose percentage. The increases in characters of sugar beet grown on narrow ridges were 2.0,8.6 and 5.3% for top length 6.0,15.6 and 7.2% for top yield 11.0,11.0 and 8.5% for root weight,7.9 , 3.6 and 8.1% for root yield /fed and 12.0 , 4.8 and 8.9% for sucros yield /fed over those grown on wide ridges in first, second season and the average of the two seasons respectively. The increases in root yield/fed due to the inceases in yield componets cheacters (root length, root diameter and root weight).These results are in harmony with those obtained by Toaime *et al* (2001)and Saleh (2003).

Table 1: Effect of ridge width of yield and yield components of sugar beet (First, Second season and the average)

Characters / Treatments	Top Length (cm)	Top Forage (ton)	Root Length (cm)	Root Diameter (cm)	Root Weight (g)	Root Yield (ton)	Sucrose %	Sucrose yield (ton)
Ridge width	First Season							
60 cm	35.13	8.99	15.78	13.17	0.98	28.48	16.44	4.66
120 cm	34.83	8.42	15.24	12.27	0.95	26.36	16.24	4.18
L.S.D :5%	N.S	N.S	N.S	N.S	N.S	0.71	N.S	0.27
Second season								
60 cm	37.44	9.22	14.77	14.56	1.04	25.78	16.52	4.27
120 cm	35.88	7.97	15.36	12.71	0.95	24.91	16.83	4.07
L.S.D :5%	N.S	N.S	0.32	0.81	N.S	N.S	0.15	N.S
Average								
60 cm	36.86	9.04	15.28	13.80	1.02	27.10	16.48	4.61
120 cm	35.33	8.43	15.33	12.62	0.95	25.07	16.56	4.23
L.S.D :5%	0.94	N.S	N.S	0.71	N.S	1.40	N.S	N.S

1-2- Effect of cropping systems

Results presented in Table 2 indicate that yield, yield components and chemical characters of sugar beet were significantly effected by cropping systems.

Table 2: Effect of cropping systems on yield and yield components of sugar beet (First, Second season and average of the two seasons)

Characters / Treatments	Top Length (cm)	Top Forage (ton)	Root Length (cm)	Root Diameter (cm)	Root Weight (g)	Root Yield/ fed (ton)	Sucrose %	Sucrose yield/ fed (ton)
First Season								
Solid	35.25	11.32	17.81	14.00	1.30	32.84	16.81	5.30
100% beet+ 33% onion	38.50	9.15	15.38	13.60	0.92	29.31	16.20	4.76
100% beet+66% onion	24.00	5.65	13.35	10.58	0.66	20.12	16.01	3.20
L.S.D :5%	1.32	0.59	1.36	0.54	0.10	0.81	N.S	0.25
Second season								
Solid	44.00	11.42	17.42	18.05	1.2	28.23	17.45	4.67
100% beet +33% onion	40.16	8.75	15.33	13.18	0.99	26.40	16.60	4.23
100% beet +66% onion	28.16	5.63	12.43	9.67	0.80	21.53	15.98	3.61
L.S.D :5%	2.47	1.07	0.77	0.65	0.06	1.48	0.29	0.33
Average								
Solid	43.33	11.32	17.23	16.02	1.25	30.55	17.16	5.24
100% beet +33% onion	39.33	9.36	15.63	13.35	0.96	26.88	16.40	4.67
100% beet +66% onion	26.17	5.53	12.84	10.27	0.75	20.83	15.99	3.36
L.S.D :5%	6.19	0.43	0.85	0.38	0.06	1.16	0.39	0.29

except sucrose% in first season. The results whowed that all studied chracteres of sugar beet were more effected when intercropped onion population density at 66.6% of solid as compared when density of onion was 33.3% of solid in first, second and average of the two seasons.The reduction in characters of intercropped sugar beet with onion under both density 33.3 and 66.6% of pure stand onion was 9.0 and 39.5% for top length, 17.24 and

51.2% for top forage yield,8.1 and 25.4% for root length, 16.6, and 35.8% for root diameter,23.2 and 40% for root weight, 12.0, and 31.8% for root yield/fed ,4.4 and 6.8% for sucras percentage and 10.8 and 35.8% for seed yield/fed in average of the two seasons, respectively. The high reduction in beet characters under high onion population density due to the competition between plants of sugar beet and onion was higher than with low onion population density: These result is in agreement with that obtained by Amer *et al*(1997)and Forghaly *et al* (2003) .

1-3- Effect of interaction on sugar beet :-

The interaction between ridges width and cropping systems (Table 3) had significant effects on top length, top forge yield, root diameter; root weight and root yield /fed only. (Average of two seasons.).The highest values of top length and top forage yield were observed when sugar beet grown pure stand on narrow ridges (60cm) followed by those grown on wide ridges not reached to significant different while the highest values of root diameter, root weight and root yield/fed were observed when pure stand was grown on wide ridges followed by those grown on narrow ridges., The lowest values of top characters (top length, weight and forage yield/fed) were observed when grown with hight onion density on narrow ridges while the lowest values for root characters (root diameter weight and root yield/fed were observed when grown with hight onion density on wide ridges. The results clear that sugar beet grown on narrow ridges (60 cm) and intercropped with low onion population density (one row on the other side) resulted in low reduction percentage compared to high onion density.

Table 3: Effect of interaction (ridges width × cropping systems) on top length, top forage, root diameter, Root wt, rot yield. sucrose%,sucrose yield (average of the two seasons).

	Top length (cm)			Top Forage (ton)			Root diameter (cm)			Root wt (g)		
	solid	one	two	solid	one	two	solid	one	two	solid	one	two
60cm	43.67	42.17	25.83	11.35	10.39	5.38	15.8	13.67	11.93	1.2	1.09	0.76
120cm	43.00	36.5	26.5	11.28	8.33	5.68	16.23	13.03	8.6	1.29	0.82	0.73
L.S.D	1.68			0.61			0.54			0.08		

2- Onion :

2-1- Effect of ridges width on onion

Results in Table 4 show effect of ridges width on onion characters were significantly on bulb weight in first season and on bulb diameter and bulb yield/fed in the average of the two seasons only. Onion characters grown on wide ridges were higher than those grown on narrow ridges except bulb weight in second season The increased percentage, were 8.8, 3.7 and 6.1% for bulb diameter, 20.0, 2.1 and 17.1% for bulb yield/fed in first, second season and the average of the two season .The increased percentage of bulb weight was 7.3 and 2.3% in the first season and the average of the two season. The increased in onion characters under narrow ridges was high, that may be due to higher competition between onion and sugar beet as compared under wide ridges (120cm) Similar results were observed by Amer *et al* (1997) Toaima *et al* (2001) .

Table 4: Effect of ridge width of yield and yield components of onion characters (the average of the two seasons).

Characters / Treatments	Diameter of bulb (cm)	Weight of bulb (g)	Yield of bulb/fad (ton)
First season			
60 cm	4.51	107.44	4.50
120 cm	4.93	115.33	5.39
L.S.D :5%	N.S	4.54	N.S
Second season			
60 cm	5.33	118.44	4.83
120 cm	5.51	113.44	4.93
L.S.D :5%	N.S	N.S	N.S
Average			
60 cm	4.72	112.33	4.65
120 cm	5.42	115.00	5.45
L.S.D :5%	N.S	N.S	0.37

2-2- Effect of cropping systems :-

Results in Table 5 clear that studied onion characters were significantly affected by cropping systems in first, second and the average of the two seasons .The highest values of these characters was observed in pure stand .Bulb diameter and bulb weight were higher under low onion population density (33.3%) than under high density (66.6% pure stand).The reduction percentage of intercropped bulb yield/fed was 52 and 25% in first season, 49 and 26% in second season and 54 and 30% in the average of the two season under low and high onion population density respectively. as compared to per stand.

The current data indicated that the incresing in bulb weight under low density could not compensate the reduction in number of plants/fed in respect to bulb yield /fed compared with under high density (66.6%).The reduction in intercropped onion yield is due to the reduction in the numbers of plants/fed as compared to pure stand and for the severe competition between beet and onion plants for light, water and nutritive elements These results are in agreement with these obtained by EL-Habbak et al 1993 and Saleh 2003.

2-3-Effect the interaction :

Results in Table 5 included the interaction effect between ridges width and cropping system, was significant on the onion characters (bulb diameter, bulb weight and bulb yield/fed) in both seasons and the average of the two seasons. The highest values of these characters were recorded by grown onion pure stand on narrow ridges (60cm), while the lowest values of bulb diameter and bulb weight were obtained when grown two rows onion on other side of beet narrow ridges. The lowest bulb yield was observed when transplanted one row onion on the other side of narrowe beet ridges (60cm) .

Table 5: Effect cropping systems on yield and yield components of onion characters (average of the two season).

Characters / Treatments	Diameter of bulb (cm)	Weight of bulb (g)	Yield of bulb/fad (ton)
First season			
Solid	5.27	129.00	6.67
One row	4.72	106.50	3.16
Tow rows	4.18	98.67	5.02
L.S.D :5%	0.38	4.28	1.25
Second season			
Solid	5.62	133.17	6.48
Tow rows	5.38	107.50	3.33
Four rows	5.27	107.17	4.83
L.S.D :5%	0.17	6.01	0.36
Average			
Solid	5.17	130.91	7.03
One row	5.05	109.00	3.21
Tow rows	4.89	101.08	4.91
L.S.D :5%	0.20	3.98	0.38

Table 6 Effect of interaction of wide ridges × cropping systems on yield and yield components of onion (Average of the two seasons).

	Diameter of bulb (cm)			Weight of bulb (g)			Yield of bulb /fed (ton)		
	Solid	Onion 33.3%	Onion 66.6%	Solid	Onion 33.3%	Onion 66.6%	Solid	Onion 33.3%	Onion 66.6%
60 cm	5.05	4.76	4.46	135.50	101.67	99.83	7.23	2.83	3.90
120 cm	5.30	5.33	5.33	126.33	116.33	102.33	6.83	3.60	5.93
L.S.D:5%	0.29			5.63			0.54		

3- competitive relation ships and Economical evaluation :-

3-1- Land Equivalent Ratio (LER)

Results presented in Table 6 showed the effect of inter cropping sugar beet with onion on land equivalent ratio (LER). Land equivalent ratio values was greater than one by intercropping sugar beet with onion (the average of the two season).Its cleared that the actual productivity was higher than expected productivity .Inter cropping sugar beet with low onion population density (33.3%)had the highest sugar beet relative yield (RYs) and the lowest onion relative yield (RYo),while intercropping beet with high onion density (66.6%) had the lowest beet relative (RYs) and highest onion relative yield (RYo).

LER value in wide ridges was higher (1.38) than under narrow ridges (1.29).Also, inter cropping sugar beet with high onion population density (66.6%) had the high LER values as compare those grown with low onion density (33.3%).The highest values LER was observed by intercropping beet with high onion population density (66.6%) on wide ridges (1.46), while the lowest value was observed by intercropping beet with low onion density on narrow ridges(1.25) This results was conceived by Farghely *et al* (2003) and Ismail (2005).

3-2- Relative Crowding Coefficient (k) :

If a species has Relative crowding coefficient (K) less than equal to greater the one this means that it produced less yield, the same yield or more yield than expected, respectively ....

Rsults in Table 6 show that Relative crowding coefficient for both crops i.e. sugar beet and onion were larges than one. The values of K were greater when intercropped on wied ridges (8.3) than on narrow ridges (5.26), also, it is greater with high onion density (7.54) than with low onion density (6.01). The highest values were when grown on wide ridges and using high onion density and the lowest values were when grown narrow ridges and using high onion density. Similar results were observed by Farghely *et al* (2003).

3-3- Aggressivety (Ag):

An aggressivety values of zero indicated that the component species are equally compostive for any other situation both species will have the some numerical values but the sign of dominant crops will be positive and that of dominated will be negatives the greater the numerical value the bigger the difference in competitive abilities and the bigger the difference between actual and expected yields.

Data in table (6) showed that Aggressively values were larger than Zero when inter cropping sugar beet with onion under difference onion density .The highest value was when grown on narrow ridges with high onion density while the lowest value was when grown on wide ridges with low onion density .Sugar beet was the dominated crop (negative values) where as, the onion was the dominant crop (positive values). The results is in agreement with that found by Tosima *et al* (2001) and,Farghely *et al* (2003).

3-4- Economical evaluation:-

The result in Table 7 showed that the advantage of intercropping sugar beet with onion under different onion density and ridges width as economical evaluation the results clear that the intercropping on narrow ridges had the higher the total income (LE) than on wide ridges; Also the intercropping with low density had the higher total income than with high onion density.

Table 7: **Effect of ridges width and onion population density on Land Equivalent Ratio (LER),Relative Crowding Coefficient(k), Aggressively (Ag) and economical evaluation total income as Egyptian pound (LE).**(Average of the two season).

		LER			K			A_{gs}		gross
Ridges width	Crop systems	L_{beet}	L_{on}	LER	K_{beet}	K_{on}	K	A_{beet}	Ag_{on}	profit
Narrow ridges	Beet/ onion33.3%	0.94	0.39	1.33	12.04	0.63	7.58	- 1.11	- 1.11	416.5
	Beet/onion 66.6%	0.71	0.54	1.25	5.16	0.57	2.94	+ 1.37	- 1.37	3625.7
	M	0.63	0.66	1.29			5.26	1.24		3970.1
Wide ridges	Beet/ onion33.3%	0.81	0.49	1.30	4.45	1.00	4.45	- 0.69	- 0.69	3959.6
	Beet/ onion66.6%	0.64	0.82	1.46	3.74	3.25	12.15	- 0.67	- 0.67	3756.1
	M	0.72	0.69	1.39			8.3	0.63		3856.2
With 33.3 % onion		0.67	0.45	1.31			6.01	+ 0.65	- 65	4502.0
With 66.6 % onion		0.67	0.68	1.35			7.54	+ 1.02	- 102	3690.95
Solid sugar beet										3957.6
Solid Onion										1445.0

The highest values of total income could be achieved by treatment of grown on narrow ridges with low onion population density, whereas, the lowest value was observed when using high onion density on narrow ridges. Similar results were obtained by Toaimae *et al* (2001), Farghley *et al* (2003) and Saleh (2003).

Finally it can be concluded that intercropping sugar beet (100% density) with low onion population density (33% of pure stand) on narrow ridges (60 cm) has improved to be a highly beneficial practice for sugar beet farmers without, in general any effect on the quality and productivity of beet.

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تأثير عرض الخط والكثافة النباتية للبصل علي محصولي بنجر السكر والبصل المحملين معاً

فتحي رجب نوار
قسم بحوث التكثيف المحصولي – معهد بحوث المحاصيل الحقلية – الجيزة – مصر

اجريت تجربتان حقليتان في محطة بحوث ملوي خلال الموسمين ٢٠٠٢/٢٠٠٣ و ٢٠٠٣/٢٠٠٤ لدراسة تاثير عرض الخط (٦٠،١٢٠ سم) ونظم التحميل تحت معدلات من الكثافة النباتية للبصل (٣٣,٣%،٦٦,٦%) علي محصول بنجر السكر والبصل .
التصميم المستخدم كان قطع منشقة مرة واحدة في أربعة مكررات
ويمكن تلخيص النتائج فيما يلي : –
١- لقد سجل محصول بنجر السكر ومكوناته زيادة معنوية عند الزراعة علي خطوط ضيقة (٦٠سم)مقارنة بالزراعة علي الخطوط العريضة (١٢٠سم) وكان محصول البصل عاليا عند الزراعة علي الخطوط العريضة مقارنة بتلك التي زرعت علي الخطوط الضيقة .
٢- لقد نقص في محصول بنجر السكر المحمل بكثافة نباتية عالية من البصل (٦٦,٦%) معنويا مقارنة بالذي حمل بكثافة نباتية منخفضة من البصل (٣٣,٣%) –قطر ووزن البصلة كانت كبيرة عند التحميل بكثافة منخفضة إذا ما قورن بالذي حمل في الكثافة العالية.بينما محصول البصل كان مرتفعا في حالة التحميل بكثافة عالية عن التحميل بكثافة أقل .
٣- سجل معدل استغلال الارض أعلي انتاجية (١,٤٦) عندما حمل بنجر السكر علي خطوط (٦٠سم) مع كثافة نباتية عالية من البصل(٦٦,٦%) . بينما كان أكبر عائد نقدي (٤٣١٦,٥ جليه مصري) عند تحميل بنجر السكر علي خطوط ضيقة (٦٠سم) مع كثافة نباتية منخفضة من البصل (٣٣,٣%).
يمكن التوصية بتحميل بنجر السكر(١٠٠%) مع كثافة نباتية من البصل (٣٣,٣%) علي خطوط ضيقة (٦٠سم) والتي سجلت أعلي عائد اقتصادي لوحدة المساحة بدون أي تاثير علي محصول بنجر السكر وجودته.