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EFFECT OF INTERCROPPING SYSTEM AND SOWING DATES OF WHEAT INTERCROPPED WITH SUGAR BEET

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ABSTRACT

An intercropping trail of wheat with sugar beet was carried out at Gemmeza Research Station, El Gharbiua Governorate,Egypt, in2009/10 and 2010/11 seasons to study the effect of intercropping wheat with sugar beet at different sowing dates.

1-Results showed that all the traits of sugar beet were significantly reduced by intercropping system of wheat with sugar beet as compared with pure stand in both seasons.Intercropping system of wheat with sugar beet on the top of the second bed (120cm)S4 had the highest values for all character. ,while,the lowest values were obtained from intercropping wheat with sugar beet on the other side of the second ridge (60cm S1).

2- All characters for yield and yield components of wheat were significantly affected by intercropping system and sowing date in the two seasons,except,spike length in the first season and No. of spikelets in the second season,respectivily.The highest values were obtained from intercropping wheat with sugar beet on S3 in both seasons,while,from S1 on sowing date (T1) in the both seasons .

3-Table(1) The interactions between intercropping system and sowing dates of wheat had significant effects on all the traits of sugar beet ,except,yield(t/fed.) in both seasons,while,all charactersof wheat had in insignificant in both seasons,except, plant height, no.of spikes/m2,No. of grains/spike and grain yield/fed.were had significant effects in both seasons.

4- The highest values of land equivalent ratio(LER) was1.306and1.253 in the of first and second seasons,respectively.

5-Relative crowding coefficient(R.C.C.)was12.99 and 5.36 in the two seasons,were recorded with intercropping wheat on the top of the second bed of sugar beet (S4) .

6-Aggressivity(Ag) indicated that sugar beet was the dominat crop,whereas wheat was the dominated in both seasons.

7- The highest gross return was obtained with cropping 25% of pure stand of wheat on the top of the second bed of sugar beet (S4) in the first season,while,the highest value was produced when wheat sown on all beds of sugar beet in the second season(S3).

From this study it could be concluded that, the best results for sugar beet was obtained by intercropping system of wheat with sugar beet on the top of the second bed(120cm)S4with sowing wheat after42 days(T3).While,the highest grain yield/fed for wheat was obtained with suger beet planted on both sides of the bed(120cm) and wheat planted on the top of all bedsxwheat planted in the same time of seeding sugar beet (S3/T1)in both seasons.

INTRODUCTION

Sugar beet (*Beta vulgaris* L.) is an important crop, not only in Egypt, but also allover the world as sources of sugar industry. In Egypt, it is the second sugar after sugar cane. Egyptian Government imports large amounts of sugar every year to meet the needs of the rapid increase of population. Sugar beet successfully grows in the newly reclaimed soils 78.485 fed and in old lands 307.201 fed in 2009/2010 season. It gives higher yield and growth period is about 1/2 of sugar cane in season (6-7 months) and it has a lower

water 1/4 the requirements of sugar cane(Agticulture and Land Reclamation,Economic Affaris Setor,Agriculture Statistics,volume winter crops.

Wheat (*Triticum aestivum* L.) is one of the main cereal crop in the world as well as in Egypt. Yield of wheat can be increased by increasing the wheat area, higher varieties and improving cultural practices. As an attempt to narrow the gab in sugar and wheats come the important roles of agricultural intensification by intercropping wheat with sugar beet successfully, without any change in sugar beet density.

Intercropping wheat with sugar beet on sugar beet's ridges or beds is one of the most important practices as a means of maximizing productivity and allow full utilization of the environment resources with minimum competition, especially for light. In this respect Willey (1979) found that a major cause of yield advantage intercropping is the better use of growth resources. Intercropping allows better control weeds and pests or disease. Better control of weeds where intercropping provides more competitive community of crop plants, either is space or time than sole cropping. Osman and Haggag (1981) revealed that the highest yield of sugar beet roots was obtained wheat within the crop planting in pure stand. Intercropping wheat within alternating of strips sugar beet significant reduced yield of roots/unit area, root size and root width of sugar beet. Willey *et al*.(1983) mentioned out that intercropping systems are beneficial to the small farmers in the low-input high risk environment of the developing areas of the world. Singh *et al*. (1984) reported that intercropping 3 row of wheat with sugar beet gave the highest net return compared with 1 and 2 rows. Wany *et al*.(1994) studies the effect of plant density and other cultural on yield, quality and sugar yield of sugar beet was sown in strip intercropping with wheat. They recorded that the optimum cultural techniques were 2800-500 plants/mu, 12-19 kg N/mu and 10-14 kg P_2O_5/mu which gave a sugar beet yield of 2- t/mu with sugar beet content 17%. (1 mu=0.067 ha).

Amer *et al*. (1997) showed that intercropping significantly reduced of sugar beet root and sugar yield /fed, the decrease percentage due to intercropping was 26.8 and 17.2% for root yields and 25.8 and 21.5 % for sugar yields/fed. While, sugar beet quality, as expressed in sucrose%, TSS % and purity % were not affected by intercropping with faba bean. Maria Beshoy *et al*., (2000) found that intercropping beet + wheat (3 rows) gave the highest reduction in root, sugar and top yield. The reduction in beet quality and productivity was depended not only on the intercropping crops but also upon its density where, gowns wheat in 3 rows was reduced those traits than 2 rows. They added intercropping increased markedly farmer net return and profitability.

Toaima(2006)and Attia *et al*. (2007) studied the effect of cropping 2 and 3 rows of wheat, Plus sugar beet and wheat in pure stand. They found that all studied characters had significant effect in the two seasons. On the other hand sucrose and purity percentage gave the highest values with 3 rows of wheat with sugar beet. Ibrahim *et al*. (2008) intercropping wheat with sugar beet (2 and 3 rows) of wheat of the bed of sugar beet 120 cm with and solid

culture of both crops. They showed that root length, root diameter, root fresh weight /plant, root fresh yield/fed and purity % were reduced by intercropping systems as compared with pure stand.

This review for sowing wheat in pure stand because there are not review for sowing dates of wheat with sugar beet.Mahmoud (1992)when studied three sowing dates(15th_November, 30th_ Nov.and when 15th_Decmbeer)mentioned that sowing date of 15th November was superior to three other tested sowing dates in eash of plant height,number of spike/m2 ,spike length, 1000-grain weight and grain and straw yields/fed. Similer results were obtained by El-Shami et el(1995),Salem(1999)and Hameed *et al*(2002).Inamullah *et al*(2007)investigated five sowing dates .They found that sowing in time around 25th Oct.is the best policy for getting higher values for plant height,spike length,number of spikelets/spike,number of grains/spike ,1000-grain weight and grain yield.These characters weredecreased gradually up to sowing date5th Dec.Similer resultus were obtained by Aslam *et al*.(2003),Abdullah *et al*(2007)and Malik *et al*. (2009).

The objective of this research was to study the response of wheat intrcropping with sugar beet and sowing dates of wheat for maximizing the net profit per unite area.

MATERIALS AND METHODS

Two field experiments were carried out in Gemmeiza Research Station El-Gharbiua Governorate in 2009/2010 and2010/ 2011 seasons to study the effect of intercropping wheat (*Triticum aestivum* L.) cv. Gemmeiza 10 at different sowing dates with sugar beet (*Beta vulageris* L.)cv. Kawemira on growth, yield and yield components as well as competitive relationships of both crops.

Experiment included 14 treatments which were the combination of 4 intercropping systems wheat with sugar beet 2 of pure stand of or sugar beet and wheat , as well as three different sowing dates and two pure stand of wheat and sugar beet. The experimental design was split plot design with three replication.

The treatments of this study as follows:

Intercropping systems:

The treatments of intercropping were assigned in the main plots.

1-sugar beet was planted as recommended (35000 plants/fed) on one side of the ridge (60 cm width), 20 cm apart between hills and thinned one plant/hill, wheat was sown with 25% (12.5 kg/fed) from pure stand of wheat50 kg seed/fed, on the other side of the second ridge of suger beet.(s1).

2- Sugar beet planted (35000 plants/fed) on one side of the ridge 60 cm and wheat planted on the fourth ridge in other side of the ridge 25% (12.5 seed/fed) of pure stand with 50 kg seeds /fed).(S2)

3- Sugar beet planted (35000 plants/fed) on both sides of the bed (120 cm width), 20 cm apart between hills and thinned one plant/hill and wheat planted with 25% (12.5 kg seed/fed) of pure stand 50 kg seed /fed on the top of all beds.(S3)

4- Sugar beet planted (35000 plants/fed) on both sides of the bed and wheat planted with 25% (12.5 kg seed/fed) of pure stand 50 kg seed /fed on the top of second bed (50% of beds intercropping and left the others.)S4
5-Sugar beet planted in pure stand as recommended (35000 plant/fed)
6-Wheat planted in pure stand as recommended (50 kg seed /fed)

B-Three sowing dates of wheat

The sub- plots,were devoted to the following three sowing dates of wheat.

In the same time of seeding sugar beet, 21 days after seeding sugar beet and 42 days after planting sugar beet.

The experimental field was prepared using two plowings. Calcum super phosphate 15% P_2O_5 was applied during land preparation at the rate of 150 kg/fed then divided into the sub-plots each one included ten ridge (60 cm width) and 5 beds (120 cm width) and 3.5 m long . The preceding summer crop was maize in both seasons. Potassium suphate (50 K_2O) at the rate of 100 kg/fed and nitrogen fertilizer was applied in the form of urea (46% N) at the 250 kg /fed in three equal doses 1/3 at the first irrigation , 1/3 at the second irrigation and the last one before third irrigation of sugar beet.

Sugar beet was sown on 14thNov. in the first season 2009/2010 and Nov. 16th in the second season 2010/2011 and wheat was planted in the same time of seeding sugar ,21 days after seeding sugar beet and 42 days after seeding sugar beet in both seasons. The other recommended agronomic practices of growing wheat with sugar beet were applied as recommendations.

The following data were recorded:

A. Sugar beet characters:

At harvest : ten guarded plants were taken randomly from each sub- plot to estimate :

1-Root length (cm) ,2- Root diameter (cm) ,3- Foliage fresh weight/plant (kg) and 4-Root fresh weight/plant (kg)

The top yield/fed were calculated from the whole plots as follows:

5-Top yield (ton/fed) ,6- Root yield (ton/fed) and 7- suger yield (ton/fed)

Chemical quality of sugar beet:

Samples of fresh root were taken from each plot to determine:

1-Total soluble solids % (TSS%) measured by refract meter according to A.O.A.C. (1990).
2-Sucrose percentage was determined according to method described by Le-Docte (1927).
3-Apparen purity percentage was calculated as according to the method described by Carruthers and Old Field (1961).

$$\text{Purity\%} = \frac{\text{Sucrose\%}}{\text{Tss\%}} \times 100$$

B-Wheat characters:

At harvest : ten guarded plants were chosen randomly each sub plot to estimate the following characters:

1-Plant height (cm), 2-Spike length (cm),3- No.of spikes/m^2

4-No.of spikelets / spike,5- No.of grains/spike,6- Spike grains weight g), and 7-1000-grain weight (g)

Plants of the wheat sub-plots were harvest and threshed to estimated the following data,8- Straw yield (ton/fed) and9- Grain yield (ton/fed)

Competitive relationships and yield advantage.

1- Land equivalent ratio (LER) as mentioned by Willey and Osiru (1972).
2- Relative crowding Coefficient (K) as mentioned by De Wit (1960).
3- Aggrssivity (A: determined according to Mc.Gillchrist (1965).

Economic evaluations:

Gross return from each treatments was calculated in Egyptian pounds (LE)
Ton of sugar beet roots = LE
Ton of sugar beet tops= LE
Ardab of wheat grains = LE
Ton of Wheat straw = LE

In 2009/2010 and 2010/2012, respectively, Price of the yield were cost dered to the Ministry of Agriculture and Land Reclamation, Economic Affaris Sector, Agricultural Statistics, volum winter crops, November200pp,and November20pp.151.

Statistical analysis:

All obtained data of both sugar beet and wheat were statistically analyzed according to the technique of analysis of variance (ANOVA)for the split plot design as published by Gomez and Gomez(1984),using"MSTAT-C"computer software package.Least Significant Difference(LSD)method was used to test the diffrences between treatment means at 5% level of probability as described by Waller and Duncan(1969).

RESULTS AND DISCUSSION

1. Sugar beet characters:

1-1. Effect of intercropping systems.

The results in Table 1 indicated that root length, root diameter, foliage fresh weight/plant, root fresh weight/plant , top yield /fed , root yield /fed and sugar yield /fed were significantly reduced by intercropping systems of wheat with sugar beet as compared with pure stand in both seasons. Whereas, intercropping systems of wheat with sugar beet on top the second bed (120 cm)(S4) had the highest values for those characters as compared with the other intercropping systems. On the other hand, intercropped wheat with sugar beet on the other solid of the second ridge (60 cm)(S1) produced the lowest values for these character. However, the reduction in root fresh weight reached to 15.24, 11.10, 7.93 and 3.6 % in the first season and 22.19, 16.94, 12.08 and 9.6% in the second season for intercropping systems i.e. planted wheat with the sugar beet on the other side of the second ridge(S1), on the other side of the fourth ridge(S2) on top of all beds(S3) and on top of the second bed(S4) , respectively as compared with sugar in pure stand. In general, intercropped wheat with sugar beet on the back of the second bed (120)(S4) had the largest values for characters of sugar beet recorded already followed by sown wheat on the back of all beds(S3), then planted wheat on the other side of the fourth ridge(S2) and the last one intercropping

wheat on the other side of the second ridge(S1), respectavility.These results are mainly due to the effect of intraspecific and interspecific competition among sugar beet plants as well as between sugar beet and wheat plants before all energy, water and nutrients .Similar results were reported by Osman and Haggag (1981), Wany *et al* (1994), Amer *et al*.(1997), Maria Beshoy *et al*. (2000), Attia *et al*.(2007),Ibrahim *et al* (2008) and Abd El-Zaher *et al*. (2009).

1.2.Effect of sowing dates of wheat:

Data in Table 1 showed that all sugar beet characters (root length, root diameter, foliage fresh weight/plant, root fresh weight /plant, top yield /fed, root yield/fed and sugar yield/fed) were significantly affected by sowing date of wheat at the same time of sowing sugar beet, after 21 days and after 42 days from sowing sugar beet) in both seasons. Sowing date of wheat after 42 days from sowing wheat gave the highest values of these characters. The increase in root yield ton/fed reached 7.29 and 3.41 % in the first season and 12.26 and 5.56 % in the second season by sowing wheat after 42 days as compared to sowing wheat with sugar beet in the same time and after 21 days,respectively.These results may be due to sowing wheat at 42 days reduce competition among sugar beet and wheat plants for environmental resources (light, water and nutrients) especially in the first period of sugar beet plants life.

1.3. Effect of the interaction:

The results in Table 1 showed that the interactions between intercropping systems and sowing dates of wheat had significant effects on root length, root diameter, foliage fresh weight/plant, root frish weight /plant and root yield/fed in both seasons. The highest values were mentioned when intercropping wheat on the top of the second bed(S4) and sowing dates after 42 days(T3) from sowing sugar beet. While ,the lowest values for these characters were mentioned when intercropping on the other side of the second ridge(S1) and sowing dates in the same time of sowing sugar beet(T1) in both seasons .

2- Wheat Characters :

2.1. Effect of intercropping systems:

Data presented in Table 2 reported that characters of yield and yield components of wheat were significantly affected by intercropping systems in the two seasons, except, spike length in the first season and number of spikelets/spike in the second season unaffected significantly by intercropping systems. Plant height, number of spikes/m2 and straw as well as grain yield/fed gave the highest values when growing wheat in pure stand. This many be due to the increase in number of wheat plants compared to intercropped. On the other hand, spike length, number of spikelets/spike, number of grains/spike , 1000-grain weight and grain yield/spike surpassed when intercropped wheat on the back of all beds of sugar beet(S3) as compared with pure stand and others intercropping systems. In general , intercropping wheat on the other side of the second ridge (60 cm)(S1) of sugar beet had values of yield and yield components larger than intercropped wheat on the other side of the fourth ridge(S2), except plant height

intercropped of the fourth ridge(S2) was larger than intercropped wheat on the second ridge(S1). Also, intercropped wheat on the back all beds (120 cm) of sugar beet(S3) gave the same trend yield and yield components were larger than intercropped wheat on the back of the second bed of sugar beet(S4), except, plant height which was the opposite, intercropped wheat on the back of the second was larger than when intercropped wheat on the back of all beds sugar beet(S3).

Intercropped wheat yields were 27.41, 25.51, 4.06 and 32.11 % in the first season and 23.0, 21.51, 1.22 and 28% in the second season of pure stand when intercropped wheat (1) on the other side of the second ridgeS1 (2) on the other side of the fourth ridgeS2. On the back of all beds (S4), on the back of the second bed of sugar beet(S4) in both seasons, respectively. Whereas, when intercropped wheat with sugar produced was 57.00, 53.33 , 73.67 and 70.73% straw yield in the first season and 46.23, 35.75, 57.91 and 53.36 % in the second seasons from pure stand for intercropped wheat on the other side of the second ridge S1 , on the other side the fourth ridge S2, on the back of all S3 and on the back of the second bed S4 of sugar beet in both seasons, respectively.

The reduction in wheat yields grain and straw in the intercrop associations may be due to the increase in number of wheat plants when intercropped as compared with pure stand 100% and the severe intra-specific and inter-specific competition between wheat plants as well as between sugar beet and plants as well as between sugar beet and wheat plants for length, water and nutrients. Similar results were obtained by El-Monufi (1984), Toaima (2006), Attia *et al*. (2007), Ibrahim *et al*. (2008) and Abd El-Zaher *et al*. (2009).

2.2 Effect of sowing dates on wheat characters:

Results in Table 2 indicated that yield and yield components of wheat were significantly affected by sowing dates of wheat intercropped with sugar beet in the two seasons. Sowing date of wheat on the same time of sowing sugar beet(T1) gave the highest values for all characters studied i.e., plant height, spike length, number of spikes/m2, number of grains/spike, number of spikelets/spike, grains weight /spike, 1000-grain weight, straw yield/fed and grain yield /fed in both seasons, followed by sowing date after 21 days from sowing sugar beet(T2), Whereas, the values were obtained at sowing date of wheat after 42- days from sowing sugar beet(T3). The increase straw yield of wheat when sown at the same time of sugar beet were 8.12 and 15.85 %, 27.71 and 39.71%, as compared to sown wheat after 21(T2) or 42 days (T3)from sowing sugar beet in the two seasons, respectively.

Also, grain yield /fed increased by 5.24 and 24.2% in the first season and by 5.7 and 20.18 % in the second season, receptively, when sown wheat on the same time of sowing sugar beet (T1)as compared to the other two sowing dates i.e., 21(T2) and 42 days(T3) from sowing sugar beet. Naeem and Saleem (2012) indicated that timely sowing wheat (in the month November) yields from results in terms of enhanced productivity of wheat. Environmental conditions at this time favour proper seed germination and thus lead to healthy crop and that reduces the chances of insect pest attach and weed problems.

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More number of tillers/unit and increase in leaf area are instrumental in increasing the yield due to efficient utilization of solar radiation in photosynthesis . Moreover, plants receive required length time for different growth stages, from germination to grain filling and consequently, the yield potential of crop plants in enhanced. On the other hand, sowing wheat after 21 or 42 days from sowing sugar beet did not differed significantly in the two season. The mean values of yield and yield components of the two sown dates of wheat i.e, after 21 and 42 days were significantly decreased to compared with sown wheat in the same time of sowing sugar beet because unfavorable climatic conditions and inter compotation between wheat and sugar beet plants for light , water and nutrients. Similar results were obtained by Mahmoud (1992), El-Shami *et al*. (1995), Salem (1999), Aslani and Mehrrar (2012) they found that sowing wheat from 15th November to 25th November gave the highest values for yield and its components. Whearease, Hameed *et al*. (2002), Abdullah *et al*. (2007), Inamullah *et al*., (2007), Baloch *et al*., (2010)and Aslani and Mehrrar (2012) indicated that timely sowing wheat around 25th October to 1st November resulted the highest productively of wheat. On the other hand , Malik *et al*. (2009) mentianed out that sown wheat from 30th November to 1st December had the highest values of yield and yield components.

These results may be due to sowing wheat at 42 days(T3) reduce competition among sugar beet and wheat plants for environmental resource(light, water and nutrients) especially, in the first period of sugar beet plants life.

2.3.Effect of the interactions between cropping systems and sowing dates on wheat characters:

Data in Table 2 revealed that plant height, number of spikes/m2, number of grains/spike, weight of grains /spike and grain yield/fed were significantly affected by cropping systems and sowing dates of wheat with sugar beet.The highest values of plant height was 98.57 cm, obtained from growing wheat on the top of the second bed(S4) with sugar beet and sowing dates on the same time(S4/T1) of sowing sugar beet in the first season, whereas in the second season, the highest values of plant height (94.13 cm) produced from wheat in pure stand and sowing dates on the same time(T1) of sowing sugar beet. The interaction effect between cropping systems and sowing dates of wheat had significant effect on number of spikes/m2, number of grains/spike , weight of grains/spike and grain yield/fed in both seasons. The highest values were obtained from growing wheat on the top of all beds of sugar beet(S3) and sowing dates on the same time of sowing sugar beet(T1). Whereas, the lowest values were obtained from growing wheat on the other side of the second ridge(S1) and sowing dates of wheat after 42 days of sowing sugar beet(S1/T3). However, the highest mean of grain yield(solid) (22.11 and 23.8 ardab/fed) produced from grown wheat in pure stand and dates on the same time(T1) and sowing dates sugar beet in both seasons, respectively. The lowest means of grain yield (5.1 and 4.66 ardab/fed) were obtained from growing wheat on the other side of fourth

ridge(S2) and sowing dates of wheat after 42 days(S2/T3) from sowing sugar beet in the two seasons, respectively.

3.Chemical analysis of suger beet.

3.1.Effect of intercropping systems.

Results in Table 3 indicated that chemical charactistics of sugar beet roots were significantly influenced by the cropping system of wheat with sugar beet in both seasons, except purity% was insignificant .The presents of TSS% and sucrose in sugar beet had the highest values when cropping wheat on the second bed of sugar beet on the second seasons, while purity% was produced when cropping wheat on the top of all beds of sugar beet in the second season. On the other hand, the lowest values were obtiand when cropping wheat on the other side of second ridge of sugar beet for TSS% and sucrose% in both seasons and purity% in the second season.

Table 3: Effect of intercropping system of wheat with sugar beet under different sowing dates on some chemical characters of sugar beet in 2002/2010 and 2010/2011 SEASONS.

Characters	TSS%		Sucrose %		Purity %	
Treatments	2009 /2010	2010 /2011	2009 /2010	2010 /2011	2009 /2010	2010 /2011
A. Intercropping system						
- wheat on the other side of 2nd ridge	20.12	19.29	17.74	15.79	87.71	81.86
- wheat of the other side of 4th ridge	20.76	19.73	18.32	16.32	88.27	82.72
- wheat on the top of all peds	21.57	20.11	18.76	16.74	86.93	83.25
- wheat on the top of second bed.	22.12	20.50	19.24	17.3	87.02	83.06
- LSD at 5%	0.26	0.01	0.06	0.03	-	0.77
B- Sowing dates						
- At the same time	20.43	19.41	18.01	16.08	87.82	82.85
-After 21 days	21.23	19.93	18.54	16.55	87.34	83.06
- After 42 days	21.77	20.40	19.00	16.98	87.29	83.26
LSD at 5%	0.01	0.02	0.06	0.02	NS	NS
Interaction	*	NS	NS	*	NS	*

3.2Effect of sowing dates:

The presents of TSS% and sucrose in sugar beet had the highest values when cropping wheat after42 days from sowing sugar beet(T3) in both seasons,while purity%was insignificant in both seasons.On the other hand,the lowest values were obtained when sowing wheat in the same time with sugar beet(T1) for TSS% and sucrose% in both seasons.

3.3 Effect of the interaction between cropping system and sowing dates:

Results in Table4 showed that TSSand sucrose in sugar beet had the highest values when cropping wheat on the second bed of sugar beet and cropping wheat after 42 days from sowing sugar beet in both seasons(S2/T3).The interactions between intercropping system and sowing datesof wheat with sugar beet significantly affected on TSSandpurity in the first seasons and purity and sucrose% in the second seasons.The lowest values produced by cropping wheat on the other side of second ridge and sowing wheat on the same time with sugar beet(S1/T1).

Table 4: Effect of the interaction between intercropping system of wheat with sugar beet under different sowing dates of wheat on TSS% in 2009/2010 , sucrose% and purity% in 2010/2011 of sugar beet.

Characters		TSS % 2009/2010	Sucrose 2010/2011	Purity 2010/2011
Intercropping systems	Sowing dates			
A_1	B_1	19.37	15.37	81.60
	B_2	20.33	15.87	82.35
	B_3	20.67	16.13	81.62
A_2	B_1	20.17	15.93	83.13
	B_2	20.83	16.37	82.13
	B_3	21.27	16.67	82.80
A_3	B_1	2.82	16.2	82.24
	B_2	21.30	16.8	82.37
	B_3	22.23	17.23	84.00
A_4	B_1	21.30	16.83	83.38
	B_2	22.17	17.17	84.31
	B_3	22.90	17.90	83.07
LSD at 5%		0.03	0.07	85.80
Pure stant of sugar beet		21.10	18.21	83.14

Competitive relationships and yield advantage

Land equivalent ration(LER):

Results in Table 5 indicated that interaction wheat with sugar beet increased land equivalent ratio (LER) in all intercropping treatments in the two sowing seasons. Intercropping 25% from pure stand of wheat (50 kg seed/fed) on the top of the second bed of sugar beet(S4) gave the highest values for (LER) were 1.306 and 1.253 in the first and second seasons , respectively. While, intercropping 25% from pure stand of wheat (50 kg seed/fed) on the other side of the second ridge of sugar beet(S1) produced the lowest values of (LER) were 1.123 and 1.052 in both seasons, respectively. In all intercropping treatments sugar beet was more contributing than wheat in the two seasons.

Relative crowding coefficient(RCC).

The best results were achieved by intercropping wheat on the top of the second bed of sugar beet(S4) in both seasons(Table 5).The highest values of (RCC) were (12.99 and 5.36) in the two seasons, respectively. On the other hand, the lowest values of (RCC)were2.476 and1.389 in the two seasons, respectively, obtained from intercropping wheat on the other side of the second ridge of sugar beet(S1).

Aggressivety (A).

Data presented in Table 5 revealed that aggressivety was affected by intercropping wheat with sugar beet in both seasons. Aggressivety values of sugar beet were positive (dominant crop ,whereas, aggressivety values for wheat was negative(dominated crop in both seasons, respectively.

Economic evaluation

Results in Table 6 showed that the advantage of intercropping treatments of sugar beet and wheat in both seasons .

5-6

The highest gross returen /fed. was(9843.43LE)obtained when intercropping 25%. Of pure stand of wheat(50kg/fed). On the top of the second bed of sugar beet(S4) in the first seasons, whereas in the second seasone the highest values was (12516.14L.E). ,produced when intercropping 25/. Of pure stand of wheat(50kg/fed. On the all beds of sugar beet(S3). Also, results clear that intercropping systems of wheat with sugar beet surpoused the gross return results pure stand of sugar beet in the two seasons.The lowest values were (8562.14 and10781.22L.E) in the two seasons, obtained when intercropping 25% of wheat from pure stand (50kg/fed) on the other side of the second ridge of sugar beet(S1).

CONCLUSIONS

From this study it could be concluded that, the best results for sugar beet was obtained by intercropping system of wheat with sugar beet on the top of the second bed(120cm)S4with sowing wheat after42 days(T3).While,the highest grain yield/fed for wheat was obtained with (S3/T1)in both seasons.

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تاثير نظم التحميل و مواعيد الزراعة للقمح المحمل مع بنجر السكر

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اقيمت تجارب حقلية بمحطة البحوث الزراعية بالجميزة محافظة الغربية خلال موسمى الزراعة2009/2010و2010/2011لدراسة تاثير بعض نظم التحميل للقمح مع بنجر السكرعلى الريشة البطالة للخط الثانى لبنجر السكروعلى الريشة البطالة للخط الرابع لبنجر السكرو على ظهر المصطبة الثانية لبنجر السكروعلى ظهر كل المصاطب)وكذلك دراسة تاثير مواعيد زراعة القمح مع بنجر السكر فى نفس موعد زراعة بنجر السكر-بعد زراعة بنجر السكر ب21يومو بعد زراعة بنجر السكر ب42يوم) وقد استخدم تصميم القطع المنشقة فى ثلاث مكررات جيث تم وضع نظم التحميل فى القطع الرئيسية اما القطع الشقية فقد احتوت على مواعيد زراعة القمح

وقد اظهرت النتائج:

1- تاثرت صفات البنجر معنويا بنظم التحميل ومواعيد الزراعةوكانت اعلى القيم لطول الجذروسمك الجذروزن الجذر الطازج للنبات ووزن العرش الطازج للنبات و محصول الجذور للفدان مع نظام التحميل بزراعة القمح على ظهر المصطبة الثانية بينما اقل القيم مع نظام التحميل بزراعة القمح على الريشة البطالة للخط الثانى لبنجر السكر .
2- تفوقت صفات الجودة للبنجر تفوقا معنويا عند زراعة القمح بعد 42يوم من زراعة بنجر السكر عن الموعدين الاخيران وكانت اقل القيم لجميع الصفات عند زراعة القمح فى نفس موعد زراعة بنجر السكر.
3-اما بالنسبة لمحصول القمح فقد اظهرت النتائج تفوق القمح المنزرع منفردا معنويا فى صفات محصول الحبوب للفدان –محصول القش للفدان-وفى طول النبات كما كانت اعلى القيم مع القمح المنزرع منفردا ثم مع نظام زراعة القمح على الريشة البطالة للخط الثانى لبنجر السكر مع موعد زراعة القمح فى نفس موعد زراعة بنجر السكر
4- اظهر التفاعل بين مواعيد زراعة القمح ونظم التحميل تاثيرا معنويا على صفات بنجر السكر بينما كان التاثير للتفاعل معنويا على صفات القمح (عدد السنابل للمتر المربع وعددحبوب السنبلة ووزن حبوب السنبلة ومحصول الحبوب للفدان) وكانت اعلى القيم مع نظام زراعة القمح على ظهر كل المصاطب مع زراعة القمح فى نفس موعد زراعة بنجر السكر.
5- اشارت النتائج الى ان اعلى القيم لكل من معدل استغلال الارض (1.123و1.032)ومعامل الحشد النسبى(12.99و5.39) والعائد الكلى بالجنية المصرى 9843.43و 12516.14) تحققت بزراعة القمح على ظهر المصطبة الثانية لبنجر السكر فى الموسم الاول وعلى ظهر كل المصاطب فى الموسم الثانى.

التوصية: وضحت الدراسة طبقا لظروف التجربة ان افضل نتيجة كانت عند زراعة القمح بعد 42يوم من زراعة بنجر السكر مع زراعتة على ظهر المصطبة الثانية لبنجر السكر .

قام بتحكيم البحث

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Table1:Yield and yield components as affected by intercropping system and sowing dates and interaction on sugar beet during 2009/2010and2010/2011seasons.

		Root length(cm)		Root diameter(cm)		Root fresh weight /plant(g)		Foliage fresh weight/p(g)		Top yield(t/fed)		Root yield(t/fed)	
		2009/2010	2010/2011	2009/2010	2010/2011	2009	2010	2009	2010	2009/2010	2010/2011	2009/2010	2010/2011
S1		26.36	25.67	9.38	8.82	0.650	0.821	0.543	0.651	9.619	11.292	21.98	20.96
S2		27.76	28.72	10.28	9.07	0.688	0.868	0.559	0.726	10.006	12.736	22.80	21.90
S3		29.56	30.60	10.88	9.99	0.756	1.010	0.608	0.830	10.636	14.546	23.47	22.85
S4		30.56	31.26	11.23	10.89	0.970	1.137	0.786	0.928	13.849	14.984	24.44	23.36
LSDat.05		1.05	0.88	1.00	0.66	0.036	0.063	0.036	0.063	0.4894	1.408	1.26	0.65
	T1	26.00	27.56	9.44	8.88	0.682	0.895	0.539	0.707	9.602	11.762	22.35	20.97
	T2	29.15	28.81	10.65	9.68	0.775	0.964	0.611	0.789	10.852	13.475	23.19	22.30
	T3	30.52	30.83	11.23	10.52	0.841	1.017	0.723	0.855	12.629	14.931	23.98	23.54
LSD at0.05		0.61	0.66	0.71	0.28	0.027	0.047	0.027	0.027	0.4142	0.7344	1.02	0.49
Solid		31.6	32.1	11.5	11	1	1.2	0.965	1.1	14.1	15	25.33	25.61
S1	T1	23.67	24.00	8.23	7.93	0.578	0.743	0.473	0.553	8.617	8.997	21.30	19.94
S1	T2	28.10	25.89	9.43	8.73	0.662	0.810	0.530	0.647	9.275	11.475	21.90	20.94
S1	T3	27.30	27.11	10.47	9.79	0.740	0.909	0.627	0.753	10.967	13.403	22.73	22.01
S2	T1	24.67	28.01	9.17	8.34	0.595	0.805	0.463	0.630	8.442	11.101	22.13	20.37
S2	T2	28.73	28.45	10.63	8.97	0.700	0.889	0.543	0.743	9.851	12.457	22.90	21.99
S2	T3	29.87	29.71	11.03	9.90	0.769	0.910	0.672	0.803	11.725	14.651	23.37	23.33
S3	T1	28.00	28.99	9.90	9.10	0.695	0.962	0.526	0.760	9.217	13.039	22.50	21.87
S3	T2	29.70	30.17	11.13	10.00	0.760	1.016	0.597	0.830	10.442	14.866	23.40	23.05
S3	T3	30.97	32.65	11.60	10.87	0.812	1.053	0.702	0.900	12.25	15.733	24.50	23.63
S4	T1	27.67	29.22	10.47	10.12	0.888	1.072	0.694	0.883	12.133	13.912	23.47	21.70
S4	T2	30.07	30.71	11.40	11.01	0.977	1.142	0.773	0.937	13.842	15.102	24.57	23.20
S4	T3	33.93	33.85	11.83	11.54	1.044	1.196	0.891	0.963	15.573	15.939	25.30	25.19
LSD at.05		1.23	1.69	1.43	0.55	0.054	0.095	2009	2010	NS	NS	2.04	0.91

Table 2: Yield and yield components of wheat as affected by intercropping system and sowing dates and interaction on wheat during 2009/2010and2010/2011seasons.

		plant height(cm)		spike length(cm)		N. of spikes/m^2		N. of spikelets/ spike		N. of grains/spike		Grain weight /spike(g)		1000- grain Weight(g)		straw yield (ton/fed)		Grain yield/ fed(ardab)	
		2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
S1		86.09	79.09	11.84	11.22	335.56	338.56	20.67	20.56	61.67	62.89	1.93	2.11	45.43	49.26	1.60	1.47	6.06	5.48
S2		84.30	83.74	11.68	11.37	394.11	385	20.33	20.78	62.67	64.78	1.96	2.33	46.56	48.87	1.71	1.48	5.64	5.12
S3		89.59	92.18	12.33	12.72	334.44	334.44	21.78	21.67	68.33	70.56	2.49	2.70	49.07	52.12	2.21	1.86	7.64	7.43
S4		92.34	89.59	11.89	11.99	377	353.89	21.56	21.11	66.22	68.56	2.18	2.17	45.42	50.33	2.12	1.71	7.21	6.69
LSD at.05		1.97	3.21	NS	0.61	27.53	24.68	1.24	NS	6.41	1.26	0.26	0.30	1.25	2.38	0.27	0.23	0.58	0.12
	T1	92.96	88.95	12.94	13.11	393.83	373	22.33	22.33	69.75	71.83	2.32	2.72	50.84	56.76	2.12	1.90	7.23	6.67
	T2	90.60	87.22	12.42	11.98	365.67	373	21.42	22.00	67.08	67.83	2.21	2.38	48.14	52.32	1.95	1.64	6.87	6.33
	T3	80.68	82.28	10.45	10.39	321.33	312.92	19.50	18.75	57.33	60.42	1.89	1.88	40.88	41.35	1.66	1.36	5.82	5.55
LSD at.05		1.66	3.87	0.30	0.53	20.73	14.22	0.69	0.59	2.24	0.96	0.17	0.17	1.06	1.78	0.12	0.12	0.16	0.18
S1	T1	90.57	81.30	12.80	12.07	363.33	365	21.67	21.33	66.33	65.67	2.03	2.33	50.34	55.18	1.83	1.82	6.60	5.9
S1	T2	89.20	78.73	12.17	11.60	438	408	21.00	21.67	62.33	63.33	1.94	2.16	47.58	51.38	1.67	1.39	6.21	5.72
S1	T3	78.50	77.23	10.57	10.00	369.67	331.33	19.33	18.67	56.33	59.67	1.81	1.83	38.37	41.23	1.30	1.20	5.50	4.81
S2	T1	87.60	88.40	12.70	12.10	404.33	387.67	21.33	21.67	66.67	68.67	2.03	2.82	50.37	54.72	1.87	1.64	6.02	5.60
S2	T2	84.97	86.33	12.10	11.53	330.33	345.67	20.67	21.67	64.67	66.00	1.98	2.28	48.98	51.65	1.77	1.46	5.77	5.11
S2	T3	80.33	76.50	10.23	10.47	396.33	397.67	19.00	19.00	56.67	59.67	1.86	1.88	40.34	40.24	1.48	1.35	5.13	4.66
S3	T1	95.10	93.37	13.43	14.63	345.67	362.67	23.33	23.33	75.00	77.33	2.75	3.19	53.23	58.86	2.42	2.13	8.45	7.84
S3	T2	93.70	93.00	13.13	13.03	390.33	386	22.33	22.33	72.00	72.67	2.73	2.93	49.49	56.83	2.26	1.94	8.04	7.63
S3	T3	79.97	90.17	10.43	10.49	313	305	19.67	19.33	58.00	61.67	1.98	1.97	44.48	40.66	1.95	1.51	6.42	6.82
S4	T1	98.57	92.73	12.83	13.63	348	349.33	23.00	23.00	71.00	75.67	2.46	2.53	49.42	58.28	2.36	2.00	7.86	7.32
S4	T2	94.53	90.80	12.27	11.73	288	309.33	21.67	22.33	69.33	69.33	2.18	2.14	46.52	49.43	2.09	1.76	7.43	6.85
S4	T3	83.93	85.23	10.57	10.60	336.33	288	20.00	18.00	58.33	60.67	1.92	1.86	40.33	43.27	1.92	1.38	6.33	5.92
LSD at 0.05		3.32	7.74	NS	NS	47.69	42.76	NS	NS	4.48	4.34	0.32	0.34	NS	NS	NS	NS	0.31	0.35

Table 5: Competitive relationships calculated from yields as affected by intercropping wheat with sugar beet

	LER (Wheat)		LER(BEET)		LER		Ka(sugar beet		Kb(wheat		RCC(k		Aab(sugar beet		Aba(wheat	
	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
s1	0.255	0.234	0.868	0.818	1.123	1.052	1.64	1.13	1.51	1.23	2.476	1.389	0.593	0.583	-0.593	-0.583
s2	0.274	0.251	0.900	0.855	1.174	1.106	9.01	1.48	1037	1.34	12.34	1.983	0.645	0.599	-0.645	-0.599
s3	0.321	0.307	0.927	0.892	1.248	1.199	3.15	2.07	2.07	1.77	6.51	3.66	0.586	0.585	-0.586	-0.585
s4	0.341	0.341	0.965	0.912	1.306	1.253	6.87	2.59	1.89	2.07	12.99	5.36	0.644	0.571	-0.644	-0.571

Table 6 : Total income of sugar beet and wheat advantages of intercropping treatment in 2009/2010 and 2010/2011 seasons.

Treatments	Solid				S_1				S_2				S_3				S_4			
	Sugar beet		Wheat		Sugar beet Ton / Red		Wheat		Sugar beet Ton /fed		Wheat		Sugar beet Ton /fed		Wheat		Sugar beet Ton /fed		Wheat	
	Suger beet Ton/Red	Top Rresh weight	Grain and red	Selow Ton/fed	Sugar beet	Top Rresha weight	Sugar beet	Sugar beet	Sugar beet	Top Reesh weight	Grain and red	Straw Ton/fed	Sugar beet	Top Reesh weight	Grain and red	Straw Ton/fed	Sugar beet	Top Reesh weight	Grain and red	Straw Ton/fed
2009/2010																				
yield	25.33	14.1	22.11	3.210	21.98	9.619	6.06	1.71	22.80	10.006	5.64	1.60	23.47	10.636	7.63	2.210	24.44	13.849	7.1	2.122
Actual yield L.E.	6661.79	578.1	6013.92	1386.72	5780.74	394.38	1648.30	738.72	5996.4	410.75	1534.08	691.2	6172.61	436.08	2075.6	454.72	6427.22	567.81	1931.2	416.7
Total income L.E.	7239.89		.....		8562.14				8631.93				9638.77				9843.43			
2010/2011																				
yield	25.61	15.0	21.8	3.00	20.96	11.292	5.48	1.484	21.90	12.736	5.12	1.147	22.85	14.546	4.43	1.859	23.36	4.954	6.69	1.413
yield	9091.55	825	7630	1620	7440.8	621.06	1918	801.36	7774.5	704.15	1792	619.38	8111.75	800.03	2600.5	1003.86	8292.8	824.17	2341.5	925.0
Actual yield L.E.	9916.55		.....		10781.22				10958.03				12516.14				12383.44			
Total income L.E.																				