EFFECT OF RELAY INTERCROPPING COTTON WITH SUGAR BEET UNDER DIFFERENT LEVELS OF FERTILIZERS ON ITS YIELD AND YIELD COMPONENTS

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Abstract

Two field Experiments were conducted at Etai El-Baroud Experimental Research Station, Behira Governorate during the two growing seasons of 2001/2002 and 2002/2003 to study the effect of relay intercropping cotton with sugar beet using three dates for growing cotton; 1st, 15th of March and April 1st and three levels of NPK fertilizer; recommended (60-30-48), recommended - 25 %, (45-22.5-36) and recommended + 25 % (75-37.5-60), on yield and yield components of sugar beet and cotton. **The results indicated that:**

Sugar beet:

Weight of root/ plant, root diameter and sucrose percentage were not significantly affected by cotton relay intercropped in both seasons. Whereas, root length, % total soluble sugar (T.S.S), % purity and root yield/ fed were significantly affected by cotton relay intecropped with sugar beet. Total yield/ fed was significantly reduced by 15.54, 9.30 and 5.88 % in the first season and 15.27, 9.27 and 5.88 % in the second season when cotton was grown on March 1 st , 15 th and April 1 st, respectively.

Cotton:

1- Sowing cotton on March 1st sharply reduced all cotton growth characters and components and seed cotton yield/ plant and per feddan. Whereas, sowing cotton on March 15th was significantly higher in number of fruiting branches/plant, number of open bolls/plant, boll weight, seed index, seed cotton yield/plant and seed cotton yields/fed, compared with the other two dates.

2- Cotton fertilized by the recommended dose of NPK - 25 % (45, 22.5, 36) kg/ fed gave significant increments in numbers of fruiting branches/plant, number of open bolls/plant, boll weight, cotton seed and seed cotton yields/ plant and per feddan.

3- The interaction effects between sowing dates and NPK fertilizer levels led to higher fruiting branches/plant, total bolls/ plant, number of open bolls/plant, seed yield/plant as well as seed cotton yields/fed. when cotton grown on March 15 th and fertilized by recommended dose - 25 %.

4- Total income was 5344.40 L.E when cotton was grown as relay intercropping with sugar beet, compared with 3570 L.E as the total income of sugar beet and cotton when grown as solid crop.

Relay intercropping of cotton with sugar beet can be recommended as intensive cropping system for gaining two main yields from sugar beet and cotton without significant deleterious effect on sugar yield and sucrose percentage.

INTRODUCTION

Cotton is an important crop in Egypt and national economy as cash crop and as the main source of edible oil. It is recommended that cotton must be early sown and 1 st April is the latest recommended date for sowing. The problem which face farmers in cotton planting is that they may loose a large part of the previous winter crops like faba bean, wheat, sugar beet due to sowing cotton at the recommended date in March.

To overcome this problem, it is advisable to implement an intensification system which may be the relay intercropping of cotton with some winter crops it can be used to avoid the delaying of cotton sowing date and let the winter crop come to maturity. Hamouda (1984) found that boll weight and lint percentage was not affected by delaying sowing date, while Abou Zaid and Mohamed (1985) found significant effect of sowing dates on number of harvested open bolls/ plant, seed cotton yield/ plant and /unit area. Also, delaying sowing date resulted in decreasing seed cotton yield/ fed by 29.1 - 32.8 %, compared with March 3rd sowing date. Abou-Zaid (1991) reported that delaying planting date of cotton to mid May decreased cotton yield, number of flowers, open bolls/ plants, and lint percentage. Abo- El-Zahab and Mashhour (1998) reported that late planting date induced significant reduction in cotton seed yield and seed index. Also, they added that reduction may be attributed to higher day- degree units and heat units accumulation during the period from flowering to picking.

Kamel *et al.* (1992) stated that growth, as well as yield and yield components of cotton were not adversely affected when cotton was relayed on wheat. El Agamy *et al.*

(1989) indicated that two rows/ planted - one row skipped which may be described as an alternative 40 and 80 cm row spacing increased yield components of cotton, compared with 60 cm row spacing. Selim *et al.* (1998) concluded that relay intercropping cotton with faba bean had no adverse effect on yield and yield compound of faba bean and cotton. Samira Hussein (1998) reported that relay intercropping cotton with sugar beet or with wheat had no adverse effect on their yield, yield components of sugar beet and cotton. Toaima et al. (2001) found that slight difference in chemical characters of sugar beet when intercropped with onion or garlic.

Increasing nitrogen levels from 50 to 100 kg/ fed did not affect significantly seed cotton yield/ fed. and its comoponents, except number of fruiting branches/ plant. The interaction between sowing dates and nitrogen levels had no significant effect on traits under study Abou- Zaid and Mohamed, (1985). El- Naggar (1997) found an increase in number of fruiting branches/ plant, boll number/ plant, open bolls/ plant, seed cotton yield/ plant and seed cotton and seed yield/ fed. due to increase of nitrogen levels up to 60 kg N/ fed.

The effect of phosphorous fertilization on yield and its attributes has been verified by Radwan and Eid (1995) who reported that applying P_{2O5} is one of the common practices used to encourage the fruiting growth and to decrease the excessive vegetative growth period. Abd El- malak *et al.*; (1997) indicated that higher phosphorus fertilizer rate of 30 kg P_{2O5} / fed increased final plant height and yield components per plant, while lint percentage and seed index were not significantly affected by phosphorus fertilizer. Seed cotton yield/ fed. as well was significantly increased in favor of higher phosphorus rate of 30 kg P_2o_5/ fed., compared with 15 and 22.5 kg/ fed.

Abou- Zaid *et al.*; (1997) showed that the positive effect of potassium sulfate when it was applied at the proper time as soil application after thinning (24 kg $K_{2\,O}$ / fed), resulted in taller plants with higher number of fruiting branches, less number of vegetative branches/ plant, but higher bolls and seed cotton yield/ plant and per fed. and lint percentage.

This research aims at studying the effect of relay intercropping cotton with sugar beet and NPK fertilizer levels under different sowing dates on its yield and yield components. Also, to try some planting patterns that may increase the planting area of sugar beet without affecting the area devoted to grow cotton or to enable sowing cotton relay with sugar beet in the area devoted to sugar beet.

MATERIALS AND METHODS

Two field experiments were conducted at Etai El- Baroud Agricultural Research Station, El Behaira Governorate during 2001/2002 and 2002/2003 seasons. The objectives of this research were: (1) investigate the possibility of growing cotton before harvesting sugar beet to overcome the adverse effect of delaying sowing date of cotton, (2) determine the recommended NPK fertilizer for cotton intercropped and their effects on cotton yield and its attributes as well as sugar beet yield and its components and (3) the effect of different sowing dates of cotton.

The experimental soil was prepared for planting sugar beet in ridges 60 cm apart, 20 cm between planting hill space and sugar beet seeds were sown on October 15 th and 18 th in 2001 and 2002 seasons, respectively. Sugar beet was fertilized by 70 kg N/fed and 24 kg K_2O/fed as recommended.

The other cultural practices of sugar beet were conducted as recommended. At May 5 th beet roots were hand uprooted.

A split plot design with four replications was used. The area of sub plots was 21 m^2 (3 X 7 m) and included 5 ridges. Sowing dates of cotton were arranged in the main plots, while the NPK levels were distributed in the sub-plots.

Cotton cv. Giza 88 was relay intercropped with sugar beet in three dates; 1 st, 15 th of March and April 1st , while pure stand of cotton was sown on March 15 th in both seasons. Cotton was seeded on the other side of sugar beet ridges spaced at 20 cm between hills and two plants/ hill.

Three levels of NPK/ fed were used of cotton yield to investigate the response to (1) recommended dose (60, 30, 48) kg/ fed, (2) 25 % - recommended dose (45, 22.5,36) kg/ fed and (3) recommended dose + 25 % (75, 37.5, 60) kg/ fed. Superphosphate (15.5 % P_{205}) was applied before the cultivation of sugar beet crop, nitrogen was applied in form of ammonium nitrate (33.5 % N) in two equal doses prior the first and second irrigation of cotton, and potassium sulfate (48 % k_{2O}) was applied with the first dose of nitrogen and after harvesting of the sugar beet. The experiment included 9 treatments, which were the combination of three sowing dates and three levels of NPK fertilization. The other cultural practices of cotton were followed as recommended.

At harvest:

Sugar beet quality and yield: Ten plants were chosen randomly to determine top fresh weight (g), weight of root/ plant (g), root length (cm) and root diameter (cm), while total yield/ ton (fed) was determined on the whole sup-plot.

A fresh sample of 26 g weight was taken from fresh roots of beet plant representing each treatment to determine the % total soluble sugar (T.S.S) using refractometer and sucrose % by Saccharameter and purity % was calculated as (% sucrose by T. S.S) X 100.

Cotton: Three inner ridges were used for the determination of seed cotton yield, lint yield, seed index, while seed cotton yield/ fed was determined on the whole sub-plot. At the same time, 10 plants were chosen from each plot and were used to measure plant height (cm), number of open polls/ plant, number of fruiting branches/ plant, weight of boll/ (g), seed cotton yield/ plant, seed weight/ plant (g) and height of the first node.

Results of this experiment were evaluated in terms of the market value of the inputs and output.

Data were statistically analyzed according to the procedure out – lined by Gomez and Gomez (1984).

RESULTS AND DISCUSSIONS

Effect of sowing date:

Data presented in Tables (1 and 2) indicated the effect of sowing date on cotton growth and yield components under relay intrcropping with sugar beet. The response of plant height at harvest, number of fruiting branches/ plant, total bolls/ plant, number of open bolls/ plant, boll weight, number of seeds/ boll, height of the first fruiting node/plant, seed index, weight of seeds/ plant, lint percentage, seed cotton yield/ plant and seed cotton yield/ fed were estimated.

Results showed that plant height of cotton recorded the highest values when growing cotton on March 15 st followed by sowing date of April 1st, whereas the lowest value was recorded by the date of March 1st. Comparing with the control treatment, data revealed a significant difference with all sowing dates, except March 15 th. These results are in accordance with those obtained by Abou Zaid and Mohamed (1985).

With respect to number of fruiting branches/ plant, total bolls/ plant and number of open bolls/ plant, results showed that higher values were obtained by sowing cotton on March 15 st followed by sowing date of April 1st, while the lowest one was recorded with sowing date of March 1st. Insignificant difference was showed between values of March 15 th and control treatment, but significant effect was showed between control treatment and other sowing dates of March 1 st and April 1 st.

Height of the first node/ plant increased due to late sowing. The previous results which confirmed higher results by growing cotton on March 15 th or April 1 st may be due to higher day-degree units and heat units accumulation during the period from flowering to picking (Abou El Zahab and Mashhour 1998).

With respect to boll weight, number of seeds/ boll, seed index and weight of seeds/ plant, data indicated insignificant effect of sowing dates on these characters, (Hamouda 1984).

Lint percentage and seed cotton yield/ plant were significantly affected by sowing dates. Sowing date of March 15 th recorded the highest values, followed by April 1st, while the lowest value was recorded on March 1 st. These results are in agreement with those obtained by Abou Zaid and Mohamed (1985).

Seed cotton yield/ fed was affected by sowing date during relay intercropping with sugar beet. Relay intercropping on March 1st caused reduction in seed yield by 31.68 % and on April 1 st by 21.07 %, compared with March 15 th.

The reduction due to different growing dates, compared with the sole conventional pattern were 37.32, 8.25 and 27.59 % for 1st, 15 th of March and April 1 st, respectively. The reduction in the seed cotton and seed yields/ fed. due to early or late sowing probably due to the decreasing of the yield components. As well as, early sowing reduce the vegetative growth stage due to cold weather and short lighting, period while late sowing did not enable the bolls to entire maturity and expose it to the infection of boll warms. These results are in agreement with those collected by Abo El-zahab and Mashhour (1998). It is cleared that relay intecropping cotton with sugar beet on March 15 th surpassed the other sowing dates for all cotton characters under study.

Table 1. Effect of cotton sowing date on growth characters of cotton as affected by relay intercropping with sugar beet (combined over the two seasons)

Characters Sowing dates	Plant height (cm)	No. of fruiting branches/ plant	Total bolls/ plant	No. of open bolls/ plant	Boll weight (g)	No. of seeds/ boll	Height of the first node
March 1 st	118.65	10.64	16.40	12.36	1.85	14.10	8.62
March 15 th	147.38	14.73	34.69	21.24	2.23	14.12	9.14
April 1 st	139.11	13.89	27.44	14.60	2.05	14.23	10.42
Control (15 th March)	148.50	15.10	35.80	22.16	2.32	14.26	11.30
L.S.D at (0.05)	2.09	0.40	1.20	1.01	N.S	N.S	0.24

Table 2. Effect of cotton sowing date on yield and yield attributes of cotton as affected by relay intercropping with sugar beet

Characters Sowing dates	Seed index	Weight of seeds/plant (g)	Lint %	Seed cotton yield/ plant (g)	Seed cotton yield/fed (kent)
March 1 st	8.49	11.59	34.34	19.83	5.09
March 15 th	8.47	12.48	40.12	20.75	7.45
April 1 st	8.36	12.21	36.99	23.98	5.88
Control (March 15 th)	8.52	12.53	40.23	20.88	8.12
L.S.D at (0.05)	N.S	N.S	1.35	2.02	0.68

Effect of fertilizer level:

Data presented in Table (3 and 4) indicated the effect of NPK fertilization on cotton growth and yield components. The response of plant height at harvest, number of fruiting branches/ plant, total bolls/ plant, number of open bolls/ plant, boll weight, number of seeds/ boll, height of the first node, seed index, weight of seeds/ plant, lint percentage, seed cotton yield/ plant and seed cotton yield/ fed. were recorded.

Plant height significantly increased with increasing NPK level. Adding low fertilizer (30-15-24) NPK/ fed had significant effect on number of fruiting branches/ plant, total bolls/ plant, number of open bolls/ plant, seed index, seed cotton yield/ plant and seed cotton yield/ fed. On the other hand, boll weight, number of seeds/ boll, height of the first fruiting node/plant, weight of seeds/ plant and lint % were not significantly affected by increasing NPK.

The increments in seed cotton yield/plant and seed cotton yield/ fed. was due to reducing NPK from higher fertilizer level to the lower. Adding different NPK fertilizer levels and compare with sole cropping which fertilized by recommended NPK cotton seed yields/ fed were reduced by 8.51, 15.81 and 26.76 % for recommended - 25 %, recommended and recommended + 25 % fertilizer levels, respectively.

The increase in seed cotton yield/ fed. due to decreasing NPK dose to (45-22.5-36) kg/ fed was ascribed to increasing number of fruiting branches/ plant and number of open bolls/ plant. These results are compatible with those obtained by El-Shinnawy *et al.*, (1984); El- Debaby and Hamouda (1987); Abd El- Aal et al (1992); Ali *et al.* (1992); and El- Naggar (1997).

The previous results could be confirmed by Andrews and Newman (1970) who reported that nitrogen is readily dissolved in soil water and thus moves by mass flow, making it just as mobile as water in the soil column, while potassium is easily adsorbed on the surface of soil particles and phosphorus is easily fixed in top soil surface into insoluble forms, thus both the two nutrients move slowly in the soil. In addition to the opinion of Donahue *et al.* (1977), who mentioned that 99 % of nitrogen, 91 % of phosphorous and 78 % of potassium are made available through mass flow. Thus, when cotton intercropped with sugar beet, cotton plants can absorb the residual of NPK fertilizer that were given to sugar beet as recommended. From this intercropping model 25 % of fertilizer was saved and that reflect on net income.

Table 3. Effect of NPK fertilizer level on growth characters of cotton as affected by relay intercropping with sugar beet (combined over the two seasons)

Characters NPK fertilizer	Plant height/ cm	No. of fruiting branches/ plant	Total bolls/ plant	No. of open bolls/ plant	Boll weight (g)	No. of seeds/ plant	Height of the first node
Low fertilizer	125.24	13.44	27.95	17.31	2.12	14.12	9.18
Recommended	135.78	13.09	26.27	15.73	2.07	14.32	9.40
High fertilizer	144.11	12.73	24.31	15.15	1.94	14.01	9.60
Control (March 15 th)	146.30	14.20	29.12	18.16	2.40	14.36	10.30
L.S.D at (0.05)	1.54	0.25	1.10	0.63	N.S	N.S	N.S

Table 4. Effect of NPK fertilizer level on growth characters of cotton as affected by relay intercropping with sugar beet (combined over the two seasons)

Characters NPK fertilizer	Seed index	Weight of seeds/plant (g)	Lint %	Seed cotton yield/ plant (g)	Seed cotton yield/fed (Kent)
Low fertilizer	9.05	12.60	38.92	27.36	6.77
Recommended	8.30	11.87	37.27	22.18	6.23
High fertilizer	7.97	11.80	35.27	20.02	5.42
Control (March 15 th)	8.50	12.65	39.30	26.20	7.40
L.S.D at (0.05)	0.11	N.S	N.S	0.62	0.19

Interaction effects:

Table (5) show significant interaction effects between sowing dates and NPK fertilization levels on plant height, number of fruiting branches/ plant, total bolls/ plant, number of open bolls/ plant, seed cotton yield/ plant and per feddan.

It could be concluded that cotton sowing date of March 15 st and adding lower NPK (45-22.5-36) kg/ fed with relay intercropping sugar beet gave the highest values of the seed cotton yield/ plant and per feddean, compared with the other two sowing dates and two NPK levels. On the contrary, the lowest values were obtained by early sowing date (March 1 st) under higher NPK level of (75-37.5-60).

Table 5. Interaction effect of sowing dates X nitrogen fertilizer levels on some characters.

Sowing dates	NPK levels	Plant height (cm)	No. of fruiting branches/ plant	Total bolls/ plant (g)	No. of open polls/ plant	Seed cotton yield/ plant (g)	Seed cotton yield/fed (kentar)
March 1 st	1	110.96	10.80	17.93	13.27	20.65	5.79
	2	115.67	10.07	16.40	12.20	20.08	5.17
	3	130.67	8.80	14.87	11.60	9.87	4.32
March 15 th	1	135.17	14.80	35.60	22.47	30.65	8.58
	2	153.33	14.60	34.93	20.73	28.47	7.64
	3	153.67	14.60	33.53	20.53	23.64	6.13
April 1 st	1	131.00	13.87	30.33	16.20	22.97	5.95
	2	138.33	13.20	27.47	14.27	22.96	5.87
	3	148.00	12.33	24.53	13.33	22.81	5.81
LS.D at (0.05)		1.11	1.00	4.80	2.75	3.23	0.85

Sugar beet yield and its attributes:

Cotton as relay intercropping component participating with sugar beet in the same land for about one to two months. To reduce the competition of sugar beet plants and its effect on cotton seeding, plants of sugar beet were partially defoliated from the old leaves. So, sugar beet yield and some of its components may be affected.

Data in Table (6) show that yield, yield components and chemical characters of sugar beet were significantly decreased by intercropping with cotton, except weight of root/plant, root diameter, and sucrose percentage. Results revealed that yield components characters i.e. top fresh weight and root length/ plant recorded the highest values at the sowing date of April 1 st followed by March 15 th, whereas the lowest value recorded in March 1 st- in both seasons. Values obtained with pure stand sugar beet were the highest in both seasons. These results may be due to the prolonged competition period between cotton and sugar beet which was reflected by cotton sowing date. These results are in accordance with those obtained by Samira Hussain (1998).

Yield/ fed. of sugar beet intercropped for the dates of March 1 st, March 15 th and April 1 st were 84.46, 90.70 and 94.11 % in the first season and 84.73, 90.73, and 94.12 in the second season, compared with solid crop, respectively.

Regarding chemical characters of T.S.S % and purity %, the results recorded slight difference among cotton sowing dates, whereas sucrose % was not affected. Pure stand of sugar beet yield was higher than the intercropping yield. These results are in harmony with those obtained by Toaima *et al.*, (2001).

Evaluation and conclusion:

To evaluate the different intercropping systems of cotton, the two seasons of winter and summer crops for the unit area (faddan) must be evaluated, where cotton as summer crop has to be sown early with berseem as winter crop and the preceding winter crop not to reach its maturity, only we can get one or two cuttings from berseem. The evaluation depended upon the cost needs for producing the winter and summer crops (input) and the income through the year from the two crops Table (7). It can be concluded that the income from the unit area over the year was higher when cotton was planted relay intercropped with sugar beet, while lower income was by solid crop which may be due to higher cost and lower income from tahreesh berseem which sown before cotton.

Table 6. Effect of relay intercropping cotton with sugar beet on yield , yield components and Chemical analysis of sugar beet.

Characters / Growing dates	Top fresh weight (kg)	Weight of root/ plant (g)	Root length (cm)	Root diameter (cm)	Root Yield / fed (ton)	T . S . S %	Sucrose %	Purity %
2001 / 2002 season								
March 1 st	0.532	1.137	31.92	35.33	28.42	19.07	12.04	63.13
March 15 th	0.557	1.221	32.92	35.56	30.52	18.16	12.40	68.28
April 1 st	0.650	1.267	33.50	36.08	31.67	17.93	12.59	70.21
Solid crop	0.678	1.346	34.64	36.08	33.65	16.13	12.64	78.36
L . S . D (0.05)	0.022	N.S	1.05	N.S	1.55	0.22	N.S	2.13
2002 / 2003 season								
March 1 st	0.540	1.150	31.95	35.37	28.52	19.12	13.20	69.04
March 15 th	0.570	1.235	32.94	35.570	30.54	18.22	13.20	72.45
April 1 st	0.670	1.280	33.60	36.12	31.68	18.03	13.56	75.21
Solid	0.690	1.360	34.65	36.18	33.66	17.14	13.68	80.01
L . S . D (0.05)	0.031	N.S	1.08	N.S	1.45	0.25	N.S	2.32

Table 7. Evaluation of intercropping patterns of cotton with sugar beet, input, output and net income of using one feddan in Egyptian pound.

Intercropping patterns	Output (cost)				Output		Total income	Net income
	Winter crops		Summer crops	Total cost	Winter crops	Summer crops		
	Berseem	Sugar beet	Cotton		S. beet or cotton	Cotton		
Solid crop	250	-----	1200	1450	960	4060	5020	3570
Relay intercropping	-----	500	850	1350	3624.40	3070	6694.40	5344.40
Net income as a cash money between solid crops and relay intercropping								1774.40

Price of sugar beet (ton) = 110 L.E
Price of cotton (kentar) = 500 L.E
Price of berseem (fed) = 960 L.E

Finally, relay intercropping of cotton with sugar beet can be recommended as intensive cropping system for gaining two main yields from sugar beet and cotton without significant deleterious effect on sugar beet and sucrose percentage. This intercropping pattern enable us to increase the cultivation area of sugar beet to overcome the gab between consumption and production of sugar yield. Also, we can extent cotton planting area to the planting area devoted for sugar beet.

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تأثير التحميل المتداخل للقطن مع بنجر السكر تحت مستويات مختلفة من التسميد على المحصول ومكوناته

صلاح السيد عطية طعيمة

قسم بحوث التكثيف المحصولي- معهد بحوث المحاصيل الحقلية - مركز البحوث الزراعية

أجريــت تجربـــتان حقليـــتان موسمي ٢٠٠١/ ٢٠٠٠٢ و ٢٠٠٢/ ٢٠٠٣ بمحطة البحوث الزراعــية بإيتاى البارود محافظة البحيرة على صنف القطن جيزة ٨٨ لدراسة تأثير التحميل المتداخل للقطــن مـــع بـــنجر السكر على كلا المحصولين ومكوناتهما. تم زراعة القطن فى ثلاث مواعيد أول مـــارس و ١٥ مـــارس و أول إبـــريل وتم التسميد بثلاث معدلات من التسميد النيتروجيني والبوتاسى والفوســـفاتى وهـــى الجـــرعة الموصـــى بها - ٢٥% (٤٥ -٢٢,٥ -٣٦) كجم للفدان والجرعة الموصـــي بهـــا وهى (٦٠- ٣٠- ٤٨) كجم للفدان و الجرعة الموصى بها + ٢٥% وهي (٧٥- ٣٧,٥ - ٦٠) كجـــم للفـــدان علـــي التوالي وذلك علي النمو وانتاج المحصول وعلي بعض الصفات الكيمائـــية لبـــنجر السكر وكانت نوع التربة طينية ودرجة الحموضة ٧,٩ واستخدم تصميم القطاعات المنشقة مرة واحدة .

وكانت النتائج المتحصل عليها كالتالي:

بنجر السكر

١. لـــم يـــتأثر وزن الجذر للنبات وقطر الجذر والنسبة المئوية للسكروز بالتحميل المتداخل مع القطن بيـــنما تأثـــر طول الجذر والنسبة المئوية للسكريات الكلية الذائبة درجة النقاوة والإنتاج الكلي للجذور بالتحمـــيل المتداخل مع القطن. انخفض الناتج الكلي لجذور البنجر للفدان بما يعادل ١٥,٤ % و ٩,٣٠ % و٥,٨٨ فـــي السنة الأولى و ١٥,٢ % و ٩,٢٧% و ٥,٨٨ % فى السنة الثانية وذلك عند التحميل المتداخل للقطن في أول مارس و أول إبريل علي التوالي مقارنة بالزراعة النقية في ١٥ مارس .

القطن

- أدي زراعـــة القطـــن في أول مارس إلي نقص في صفات النمو ومكونات المحصول والمحصول مـــن القطـــن الزهـــر للنبات وللفدان بينما أدت زراعة القطن في ١٥ مارس إلي زيادة في صفات الـــنمو ومكونات المحصول ومحصول القطن الزهر للنبات وللفدان. وأدي زراعة القطن في أول إبريل إلي انخفاض تدريجي لمكونات المحصول ومحصول القطن الزهر للنبات وللفدان .

- أدي التســميد بالمعدل المنخفض من NPK (٤٥ - ٢٢,٥-٣٦) كجم فدان إلى زيادة في مكونات محصول القطن الزهر للنباتات وللفدان مقارنة بالتسميد بالجرعة الموصي بها أو بالجرعة العالية.
- أظهــر الــتفاعل بين موعد زراعة القطن المحمل تحميلا متداخلا مع بنجر السكر ومعدل التسميد إلــى الحصول على أعلا كمية إنتاج لمحصول البنجر النهائي وذلك بالزراعة فى ١٥ مارس والتسميد بالجرعة الموصى بها - ٢٥ %.
- أظهــر التقيــيم الاقتصــادي زيادة في العائد النقدي للمزارع بما يعادل ١٧٧٤,٤ جنيه وذلك عند الزراعة للقطن تحميلا متداخلا مع بنجر السكر مقارنة بزراعة القطن بعد بنجر أو بعد برسيم .

مــن هــذه الدراســة نســتنتج أنــة يمكن زراعة القطن تحميلا متداخلا مع بنجر السكر في ١٥ مــارس والتسميد بالجرعة الموصي بها من NPK - ٢٥ % للقطن وزيادة المساحة المنزرعة من بــنجر السكر وتقليل الفجوة بين الاستهلاك والإنتاج من السكر مع زيادة المساحة المنزرعة من القطن دون التأثــير علــي إنتاجيــته وجودتــه مما يعمل علي زيادة معدل التكثيف المحصولي وزيادة العائد الاقتصــادي لوحدة المساحة مقارنة بالزراعة التقليدية التي تسمح بزراعة القطن فقط بعد اخذ حشة أو حشــتين مــن البرســيم حيث يوجد تنافس بين زراعة المحاصيل الشتوية وزراعة القطن علي الرقعة الزراعية .