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INTERCROPPING OF ONION AND COTTON

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Abstract

This investigation was carried out during 1988/1989 and 1989/1990 seasons to study the effect of intercropping onion plants (cultivar Giza 20) with cotton (cultivar Giza 76). The study involved 9 treatments (3 patterns x 3 plant spacings) of relay cropping of onion and cotton. The agronomic traits, yield, competition ability and land equivalent ratio were studied.

Solid onion and those transplanted at 5 cm outyielded all treatments in the second season only. Average bulb weight was increased with solid onion and when inter-cropped on ridges 60 or 90 cm width, besides, transplanting on 10cm distance in both seasons.

Combinations of P1xa, P2xa and P3 x a as well as solid one (280 000 plants/fed.) gave the highest onion yield/fed. Highest bulb weight was obtained by the combination of P1xc, P2xc and P3 x c (140 000 plants/fed.).

Germination %, plant height, No. of fruiting branches, earliness, seed cotton yield/fed average boll weight and No. of unopen bolls per plant were not significantly affected by intercropping patterns or transplanting spacings of onion, in both seasons. Solid cotton planting as well as those intercropped on ridges 60cm were surpassed significantly in number of open bolls/plant in both seasons too.

Onion was the dominating crop. Competition ability of both crops was increased as the ridge width increased from 60 up to 120 cm.

Cotton gave the positive value of agressivity which decreased as the distance between onion plants increased from 5 up to 10 cm (i.e. 280 000 and 140 000 plants/fed., respectively). Cotton was the dominant crop under all onion plant spacings. The highest Land equivalent ratio was achieved by planting 280, 000 plants of onion/fed.

INTRODUCTION

In recent years, the majority of cotton growers in North Delta region suffered from the increase in the production costs and the consequent decrease in the net in-

come per unit area. Therefore, they tended to grow onion with cotton aiming to increase the economic return of both crops than the solid production of each. It is observed during recent years that there is a lack in growers experience concerning the suitable agricultural practices for both crops together under the new intercropping conditions which may differ from solid planting.

Many investigators reported the effect of intercropping (Moursi 1965a & b, Ashoub 1978 and El-Gahel 1980) or overlapping onion and cotton plants (El-Gahel 1987) on characters of onion and cotton plants in addition to the competition and yield advantages of such practice (El-Gahel 1987 and Abou-Zeid *et al.* 1989).

The present study was conducted to determine the best intercropping pattern of onion and cotton plants through the evaluation of some agronomic characters, yield and its components of both crops in addition to competitive relationships as well as land equivalent ratio.

MATERIALS AND METHODS

This study was carried out at the farm of Sakha Agricultural Research Station, Agricultural Research Center, during the growing seasons of 1988/1989 and 1989/1990.

The onion variety Giza 20 and cotton variety Giza 76 were used in this study. The preceding crop was maize in the two seasons of experimentation.

The experiment included 9 treatments in the two seasons of the study, in addition to two control treatments for solid stand plantings of onion and of cotton. The experimental treatments of intercropping patterns where the rows of onion seedling and cotton hills were distributed as follows:

Pattern 1 (P1) :

Ridge width was 60 cm, onion seedlings were distributed on 2 rows, one on the top and the other on the northern side of the same ridge as follows: a) at 5 cm distance between seedlings, b) at 7.5 cm distance between seedlings, c) at 10 cm distance between seedlings. Cotton was planted in hills 20 cm apart on the southern side of the ridge.

Pattern 2 (P2) :

Ridge width was 90cm, onion seedlings were distributed on 3 rows 30 cm distance on the same ridge as the distances mentioned in pattern 1 (a,b and c, respectively). Cotton was planted in hills 25 cm apart on both sides of the ridge.

Pattern 3 (P3) :

Ridge width was 120cm, onion seedlings were distributed on 4 rows 30 cm distance on the same ridge as the distances mentioned in pattern 1 (a,b and c, respectively). Cotton was planted in hills 20 cm apart on both sides of the ridge.

Plant numbers and distribution patterns of onion and cotton/fed. are shown in Table (1) and Fig. (1).

Table 1. Intercropping patterns and plant population for both onion and cotton plants.

Treatments	Intercropping patterns			Plant population (1000/fed)			
	Ridge width (cm)	No. of rows/ridge		Onion distance (cm)			Cotton
		Onion	Cotton	5 (a)	7.5 (b)	10 (c)	
Pattern 1 (p1)	60	2	1	280	186.666	140.000	70.000
Pattern 2 (p2)	90	3	2	280	186.666	140.000	74.666
Pattern 3 (p3)	120	4	2	280	186.666	140.000	70.000

The treatments were arranged in randomized complete blocks design with 4 replications. Each plot was 5 meters long and 3.6 meters wide (18m2, i.e. 1/233 fed.). The plots varied in their number of ridges owing to the used intercropping patterns in different treatments which were 6, 4 and 3 for P1 and two solid plantings, P2 and P3, respectively. Onion transplanting was practiced in Dec. 15th and 31st using onion seedlings 55 days old in the first and the second seasons, respectively. Phosphorous at the rate of 31 kg P_2O_5/fed in the form of ordinary superphosphate (15.5% P_2O_5) and potassium at the rate of 24 kg K_2O/fed in the form of potassium sulphate (48% K_2O) were applied at the first irrigation i.e. after 21 days of transplanting. Nitrogen fertilizer in the form of ammonium sulphate (20.6% N) at the rate of 90 kg/fed was added in two equal doses, the first dose after 21 days from transplanting and the second one month later.

Harvesting of onion was carried out after 153 days from transplanting when cotton plants were nearly 48 days age in the two seasons. Different cultural practices were carried out for onion plants after cotton sowing as required for cotton production.

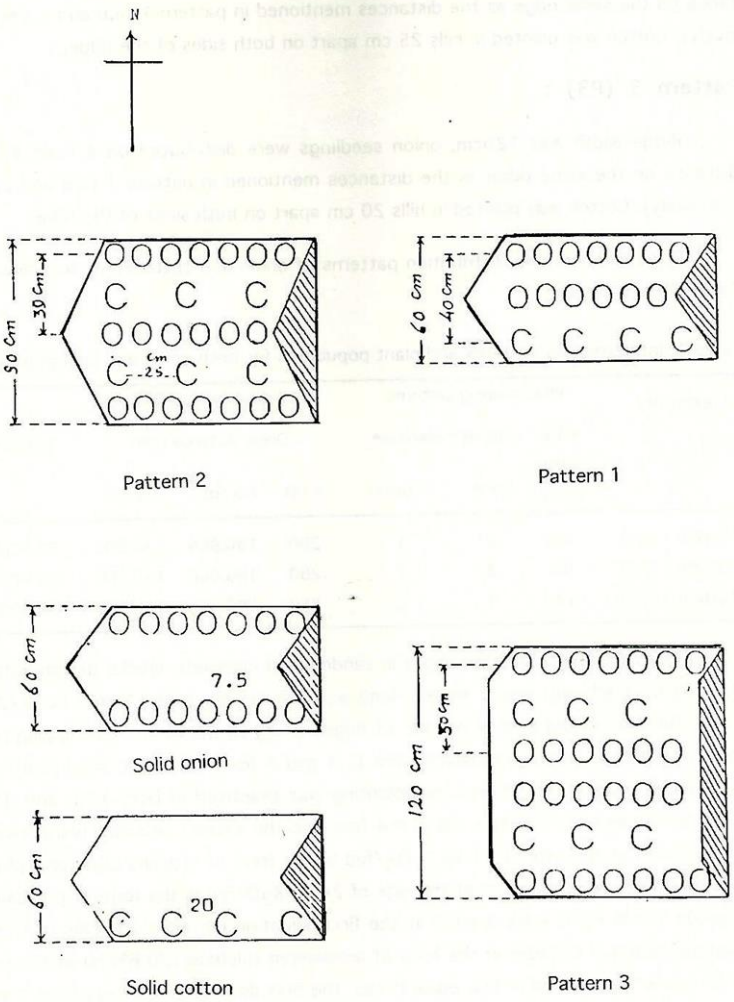

Fig. 1. Patterns of intercropping: cotton (C) and onion (O).

Cotton sowing was carried out on March 25th in hills using 50 kg seeds/fed soaked in water for about 18 hours before sowing in both seasons. Thinning was practiced twice, the first after 25 days of sowing leaving 3 plants per hill and the second one week later leaving two strong plants per hill.

Phosphorous fertilizer at the rate of 15.5 kg P_2O_5/fed as ordinary superphosphate (15.5% P_2O_5) was added in a single dose just before cotton sowing. Nitrogen fertilizer in the form of urea (46.5%N) at the rate of 60 kg/fed was added in two equal portions, the first after thinning and the second 21 days later.

All other cultural practices were followed as recommended for cotton production. In the first season, seed cotton yield was harvested twice on Sept. 18th and Oct. 6th, i.e. after 177 and 195 days from sowing. In the second season harvesting was carried out in one pick on Sept. 28th, i.e. after 187 days from sowing.

Characters studied :

1. Onion:

a. Total onion bulb yield (weight of single bulbs + total culls) was taken from the whole plot area.

b. Bulb size (%), single bulbs of different treatments were collected separately, diameter of bulbs measured and the percentages of each grade were counted according to Moursi *et al.* (1973) as follows: 1) Large: 6 cm in diameter, 2) Medium 4.5-6cm, 3) Small 3.4-4.5 cm.

c. Average weight of bulb (g).

II. Cotton :

Germination (%). Seedlings were counted for each plot. Five guarded hills (10 plants) were taken from each plot for calculating the agronomic traits, earliness and yield components as follows: Final plant height, number of fruiting branches/plant, node number of first fruiting branch, days to first flower, average boll weight, number of open and unopen bolls/plant, lint (%) and seed index. Seed cotton yield/fed was calculated from the 4 inner rows of each experimental plot.

III. Competition and yield advantages :

A. Aggressivity (A):

It gives a simple measure of how much the relative yield increase in onion "O" is greater than that of cotton "C" Agressivity values (A) were calculated according

to the formula of McGilchrist (1965) as follows:

$$AOC = \frac{YOC}{YOO \times ZOC} - \frac{YCO}{YCC \times ZCO}$$

Where :

Yoo = Solid Stand - Yield of onion.

Ycc = Solid Stand - Yield of cotton.

Yoc = Intercropped - Yield of onion (in combination with cotton).

Yco = Intercropped - Yield of cotton (in combination with cotton).

Zoc = Sown proportion of onion (in mixture with cotton).

Zco = Sown proportion of cotton (in mixture with onion).

An aggressivity value of zero indicates that the component species are equally competitive. For another situation, both species will have the same numerical value but the sign of the dominant species will be positive and that of the dominated negative; the greater the numerical value the bigger the difference in competitive abilities.

B. Land equivalent ratio (LER):

This may defined as the relative land area under the crops that is required to produce the yields achieved in intercropping. It was computed according to the formula of Willey (1979) as follows:

$$LER = \frac{\text{pure stand yield of onion}}{\text{Intercropping yield of onion}} - \frac{\text{pure stand yield of cotton}}{\text{Intercropping yield of cotton}}$$

LER values of less than 1, equal to 1, or greater than 1 indicate a yield disadvantage, no differences, or a yield advantage for intercropping respectively, thus a LER of 1.20 would indicate a yield advantage of 20%.

Statistical analysis of the data was carried out according to Snedecor and Cochran (1967). Percentages data were transformed to Arc-Sine and the true mean values were tabulated and compared at 5% level of significance according to Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

1. Onion :

A. Effect of ridge width:

Data presented in Table (2) indicated that ridge width significantly affected

both onion bulb yield/fed and average weight of bulb in both seasons. An exception being noted on yield in the first season. Solid onion (control) outyielded all studied treatments. The differences amounted to 2.16, 1.88. and 1.15 ton/fed for ridges of 60, 90 and 120 cm width in the second season only. It is found that ridges of 60cm width yielded the least amount of onion bulbs when intercropped with cotton in both seasons. Ridges of 60cm width gave the least bulb weight among all treatments in both seasons.

As for bulb size, higher percentage of large bulbs was achieved by planting onion seedlings on ridges of 90cm width in both seasons. However, solid onion gave the least percentage of medium bulbs compared to different treatments which was insignificantly affected by ridge width in both seasons. Also, percentage of small bulbs was higher with the control compared to the remaining treatments in the first season only.

B. Effect of transplanting spacing :

Table (2) shows that onion bulb yield was significantly affected by transplanting spacing in the second season only. Solid onion outyielded those intercropped with cotton in both seasons. The difference amounted to 0.74, 2.59 and 1.86 ton/fed for the above mentioned spacings in the second season only. With regard to average bulb weight, slight differences were reflected in both seasons.

As for bulb size (%), onion transplanted at 10cm distance recorded the higher percentage of large bulbs compared to other treatments (except 5cm) in the first season. In the second season, no significant effect was reflected in this respect. The control recorded the least value of medium bulbs in the first season. However, percentage of small bulbs was higher with the control and 7.5cm while 10 and 5cm spacings gave the least percentage of those bulbs in the first season only.

C. Row width-transplanting spacing interaction :

The interaction revealed that patterns for P1x a (60 x 5cm), P2xa (90 x 5cm) and P3xa (120 x 5cm) gave the highest onion bulb yield in the second season only. The differences were in favor to the control which amounted to 1.18, 1.14 and 0.01 ton/fed for the afore mentioned treatments, respectively. In regard to the average bulb weight, in the second season, the differences were in favor to the intercropping patterns. The increases amounted to 9.66 and 0.66 g/bulb for the combination of P2xc and P3xC, respectively. As for medium bulbs size (%), P1 x a (60 x

Table 2. Onion bulb yield, average bulb weight and size (%) as affected by intercropping of onion and cotton plants in 1988/1989 and 1989/1990 seasons.

Characters	Seasons	Sig.	Control	Ridge width (cm)			Sig.	Control	Transplanting spacing (cm)		
				60	90	120			5	7.5	10
Onion bulb yield	First	N.S.	11.16	9.30	9.63	9.44	N.S.	11.16	9.26	9.98	9.13
(ton/fed)	Second	*	7.46a	5.30c	5.58bc	6.31b	*	7.46a	6.72a	4.87b	5.60b
Average bulb	First	*	64.28a	57.00b	63.27a	64.03a	*	64.28a	57.20b	61.63e	65.47a
weight (g)	Second	*	51.67a	38.33b	52.67a	49.22a	*	51.67a	43.00b	45.89ab	51.33a
Bulb size (%):	First	N.S.	8.53b	17.70ab	21.61a	14.27ab	*	8.53c	17.00ab	13.09b	23.19a
Large (6cm)	Second	*	26.67	13.78	27.50	13.78	N.S.	26.67	21.98	16.50	16.58
Medium (4.5-6cm)	First	N.S.	28.00	37.01	35.06	34.41	*	28.00b	37.00a	33.10b	36.24ab
	Second	N.S.	33.33	41.78	35.50	49.78	N.S.	33.33	42.00	42.45	41.89
Small (3.5-4.5 cm)	First	*	63.47a	45.29b	43.33b	51.32ab	*	63.47a	46.00b	53.81ab	40.57b
	Second	N.S.	40.00	44.44	37.00	36.44	N.S.	40.00	36.02	41.05	41.53

* and N.S. indicate $P<0.05$ and not significant, respectively. Means designated by the same letter are not significantly different at 5% level according to Duncan's Multiple Range Test.

5cm), P2 x C (90 x 10cm) and P3 x a (120 x 5cm) patterns gave higher percentages of those bulbs where the differences amounted to 21.2, 16.9 and 18.73 (%) for the mentioned systems compared to the control, respectively, in the first season. No significant differences were found in the second season.

Percentage of small bulbs reached its maximum value with the combinations for P1 x b and P3 x c in addition to the control. The increases amounted to 2.76 and 2.56 (%) for the two mentioned combinations in the first season, respectively. No significant effects were obtained in the second season.

The obtained results for onion bulb yield, average weight of bulbs and medium bulbs (%) revealed that solid planting and the combinations of P1 x a, P2 x a and P3 x a increased onion bulb yield. This was mainly due to the higher plant population (280 000/fed).

On the contrary, average weight of bulb was increased by intercropping patterns of P1 x c, P2xc and P3 x c (140 000 plants/fed) compared to the remaining combinations as well as solid planting (Tables 2 and 3). This may be due to plant distribution which decreased the inter and intra competition in the surrounding media for nutrients, light and water. This increased the plant efficiency in intercepting solar energy and converting it into dry matter (Brewester 1977). These observations are highly important from the production point of view. In this concern, Moustafa (1979), El-Zawily *et al.* (1984) and El-Gahel (1987) obtained similar results.

Farmers and agronomists know that individual plants will produce large bulbs and higher average weight of bulb at low plant densities. The findings of the present study showed that final output of intercropped onion field depends to a great extent on the number of plants per unit ground area. The farmer may fail to make real progress in increasing the bulbs yielding efficiency of his field unless he has sufficient information about how dense to transplant his intercropped onion and the suitable agricultural treatments without decreasing the seed cotton yield. These results are in accordance with those obtained by Moursi (1965 b), Ashoub (1978) and El-Gahel (1980 and 1987).

II. Cotton :

Agronomic and earliness traits:

A. Effect of ridge width:

Data presented in Table (4) showed that no significant effect of row width was

Table 3. Effect of intercropping-interaction on onion bulb yield, average bulb weight, medium and small bulbs (%) in 1988/1989 and 1989/1990 seasons.

Characters	Seasons	Sig.	P1 (60 cm)			P2 (90 cm)			P3 (120 cm)			Control
			5	7.5	10	5	7.5	10	5	7.5	10	
Onion bulb yield	First	N.S.	8.49	9.01	10.41	9.71	7.96	8.23	9.58	9.98	8.75	11.16
(ton/fed)	Second	**	6.28ab	4.39c	5.16bc	6.32a	4.64bc	5.78bc	7.56a	5.58bc	5.79bc	7.46
Average bulb	First	N.S.	80.63	54.43	57.77	65.67	60.20	63.33	79.00	52..80	60.30	64.28
weight (g)	Second	*	39.00ab	35.67b	40.33a	43.33ab	53.33a	61.33a	52.67a	42.67ab	52.33a	51.67
Medium bulbs (%)	First	**	49.20a	25.47bc	36.37abc	36.47abc	38.80ab	44.90a	46.73a	35.03abc	21.47c	28.00
	Second	N.S.	34.67	60.00	30.67	44.00	32.00	30.67	44.00	56.00	49.33	33.33
Small bulbs (%)	First	*	22.53c	66.23a	48.57ab	27.37bc	44.53ab	43.10ab	25.13bc	57.50a	66.03a	63.47
	Second	N.S.	53.33	32.00	48.00	44.00	62.67	54.67	41.33	34.67	33.33	40.00

* and ** N.S. indicate P<0.05, P<0.01 and not significant, respectively. Means designated by the same letter are not significantly different at 5% level according to Duncan's Multiple Range Test.

P1, P2 and P3 means, 2, 3 and 4 rows of onion seedlings of 60, 90 and 120 cm width per ridge, respectively.

found on cotton agronomic and earliness characters in both seasons. The increases in germination percentage by solid cotton was expected. However, the other two treatments are considered the least dense onion populations which had the least intra competition. El-Gahel (1987) recorded similar results.

B. Effect of transplanting spacing :

No significant effects of transplanting spacing were found on the agronomic and earliness traits in both seasons (Table 4), this might be interpreted that cotton plants has higher competition ability than onion plants. El-Gahel (1980) recorded similar results.

Yield and yield components :

A. Effect of row width:

As shown in Table (5), no significant effects on seed cotton yield/fed, average boll weight and number of unopen bolls/plant were recorded with different ridging distances in both seasons. The obtained data for cotton agronomic traits and earliness reflected these results (Table 4). In this concern, Moursi and Abd El-Gawad (1967) found that cotton plant roots had several advantages which help it for rapid growth and development. First, the primary root of the seedling elongates about 20-25 cm depth in the soil after seed germination and before stem elongation and simultaneously a number of leteral roots are formed. Second, the top root reaches about 150 cm in length in the soil during the vegetative growth stage. Third, lateral roots of cotton plant reaches about two meters in length. In addition to that, onion is a shallow rooted crop with virtually all the roots within the top 60 cm of soil and the bulk within the top 23cm, (Brewster, 1977).

B. Effect of transplanting spacing :

Table (5) showed that seed cotton yield/fed., average boll weight and number of unopen bolls/plant were not significantly affected by transplanting spacing of onion seedlings in both seasons. The insignificant increases in seed cotton yield, average boll weight and number of unopen bolls/plant between different transplanting spacing and the control may be due to lesser competition between the aformentioned patterns. Also, the residual effects of N,P and K which were added to onion plants might have played an important role in providing cotton plants with additional source of nutrients. Besides, the destroyed parts of tubular leaves and fibrous roots during

Table 4. Agronomic and earliness characters of cotton crop as affected by intercropping of onion and cotton plants in 1988/1989 and 1989/1990 seasons.

Characters	Seasons	Sig.	Control	Ridge width (cm)			Sig.	Control	Transplanting spacing (cm)		
				60	90	120			5	7.5	10
Germination (%)	1st	N.S.	91.25	87.42	82.00	89.00	N.S.	91.25	89.50	85.00	83.92
	2nd	N.S.	98.33	92.99	93.36	95.45	N.S.	98.33	96.43	93.61	91.75
Plant height (cm)	1st	N.S.	79.13	94.56	91.04	82.58	N.S.	79.13	84.82	90.78	92.58
	2nd	N.S.	93.67	95.78	91.33	101.67	N.S.	93.67	98.22	98.00	92.56
No. of fruiting branches	1st	N.S.	9.20	10.73	9.51	8.51	N.S.	9.20	9.11	9.49	10.16
	2nd	N.S.	8.60	8.51	7.40	8.31	N.S.	8.60	7.47	9.07	7.69
Node No. of 1st fruiting branch	1st	N.S.	5.87	6.24	6.51	6.56	N.S.	5.87	6.56	6.22	6.53
	2nd	N.S.	7.87	7.69	8.04	7.93	N.S.	7.87	7.62	8.18	7.87
Days to the first flower	1st	N.S.	102.13	99.92	100.49	103.24	N.S.	102.13	101.22	99.68	102.76
	2nd	N.S	104.67	99.89	102.49	104.14	N.S.	104.67	102.18	97.98	106.36

N.S. : Not significant.

Table 5. Seed cotton yield and its components as affected by intercropping between onion and cotton plants in 1988/1989 and 1989/1990 seasons.

Characters	Seasons	Sig.	Control	Ridge width (cm)			Sig.	Control	Transplanting spacing (cm)		
				60	90	120			5	7.5	10
Seed cotton yield	1st	N.S.	4.76	5.03	4.79	4.42	N.S.	4.76	5.11	4.29	4.85
(Cantar/fed.)	2nd	N.S.	5.60	5.34	5.43	5.81	N.S.	5.60	6.19	5.20	5.20
Average boll	1st	N.S.	1.63	1.63	1.67	1.52	N.S.	1.63	1.59	1.59	1.64
weight (g)	2nd	N.S.	1.72	1.80	1.78	1.77	N.S.	1.72	1.84	1.77	1.75
No. of opened	1st	*	6.07ab	6.82a	4.78b	5.21b	N.S.	6.07	5.97	5.48	5.37
bolls/plant	2nd	*	9.70a	6.64b	5.14b	7.32b	*	9.70a	6.03b	6.47b	6.61b
No. of unopened	1st	N.S.	0.97	1.17	1.03	0.79	N.S.	0.97	0.76	1.06	1.18
bolls/plant	2nd	N.S.	0.80	1.22	0.91	1.13	N.S.	0.80	0.98	1.00	1.29
Lint (%)	1st	N.S.	40.17	40.16	40.42	40.39	N.S.	40.17	40.41	39.48	41.07
	2nd	**	35.51b	36.80a	33.12c	35.72b	**	35.51b	35.48b	36.54b	33.61c
Seed index	1st	**	9.53a	8.89ab	9.02ab	8.64b	**	9.53a	8.97ab	8.59b	9.00ab
	2nd	N.S.	8.17	8.20	8.31	8.17	**	8.17b	8.64a	8.10b	7.94b

*,** and N.S. indicate P<0.05, P<0.01 and not significent, respectively. Means designated by the same letter are not significantly different at 5% level according to Duncan's Multiple Range Test.

onion harvesting might be converted into an organic matter leading to better status of the soil for good root ramification (El-Gahel 1987). On the other hand, Thomson and Troch (1979) found that a small amount of N included in starter fertilizer increases the rate of absorption of P, while K aids in the uptake of other nutrients and in their movement within the plant. Eid (1969) and El-Gahel (1980 and 1987) obtained similar results.

The significance in lint percentage in the second season and in seed index in both seasons might be due to maturity effects.

C. Row width-transplanting spacing interaction :

No significant interaction between row width and transplanting spacing of onion on both agronomic and earliness traits, seed cotton yield and some components were recorded. As shown in Table (6) a significant interaction was observed on lint (%) and seed index, in the second and the first seasons, respectively. Hence, P1 x b, P1xC and P3xa gave the highest lint (%), however, the lowest of this trait were achieved by the combinations of P1xa, P2xc and P3xc. Seed index recorded its higher values with solid cotton planting as well as those of P1xa, P1xc, P2xa and P2xc. Pattern 3 (P3) recorded the lowest seed index.

III. Competition and yield advantages :

A. Aggressivity (A):

Aggressivity data recorded in Table (7) showed that onion was the dominated crop, while cotton was the dominant one. As the ridge width increased from 60 up to 120cm the competition ability of both crops was increased and resulted in higher positive aggressivity values for cotton and negative ones for onion in both seasons.

On the other hand, it is obvious from Table (7) that aggressivity values were progressively decreased as transplanting spacings of onion increased from 5 up to 10 cm which might be due to lesser inter competition between onion plants. Under all mentioned spacings cotton was the dominant crop, while onion was the dominated one with the same values but it had a negative sign in both seasons.

B. Land equivalent ratio (LER):

Data presented in Table (7) showed that no constant trend was obtained for LER in both seasons. The increase in total LER was mainly due to intercropping onion

on cotton rows. The increase in total LER which was achieved by intercropped onion amounted to 84.6 and 75.7% as an average of different ridging distances in both seasons, respectively.

In contrast, the highest total LER was achieved by the heaviest onion poulation (280 000 plants/fed). The increase in total LER amounted to 84.33 and 75.70% as an average of all spacings in the two seasons, respectively.

The obtained results indicated that transplanting spacings of intercropped onion crop (5cm) were more effective, with respect to total LER, than ridging distances. However, those planted at 7.5cm distance gave the least total LER in both seasons.

It may be concluded that onion can successfully be intercropped with cotton. In this concern, El-Gahel (1980 and 1987) and Abou-Zeid *et al.* (1989) reported similar conclusions.

Table 6. Effect of intercropping-interaction on lint (%) and seed index characters in 1988/1989 and 1989/1990 seasons.

Characters	Seasons	Sig.	OP1			P2			P3			Control
			5	7.5	10	5	7.5	10	5	7.5	10	
Lint (%)	1st	N.S.	39.88	40.19	40.39	40.49	39.96	40.81	40.85	38.30	42.01	40.17
	2 nd	**	32.36	39.09	38.94	33.86	35.13	30.36	40.22	35.40	31.54	35.51
			d	a	c	c	b	d	a	a	d	
Seed index	1st	**	9.23	8.33	9.10	9.07	8.76	9.23	8.60	8.07	8.07	9.53
	2 nd	N.S.	ab	c	ab	ab	bc	ab	bc	c	c	
		*	8.32	8.50	7.77	8.61	8.12	8.19	8.99	7.67	7.85	8.17

** and N.S. indicate P<0.01 and not significant, respectively. Means designated by the same letter are not significantly different at 5% level according to Duncan's Multiple Range Test.

O P1, P2 and P3 means, 2, 3 and 4 rows of onion seedlings of 60, 90 and 120 cm width per ridge, respectively.

Table 7. Effect of intercropping-interaction on aggressivity (a) and land equivalent ratio (LER) in the two seasons of study.

	Raw width (cm)						Transplanting spacing (cm)					
	First season			Second season			First season			Second season		
	60	90	120	60	90	120	5	7.5	10	5	7.5	10
	Aggressivity (A)											
Onion	-0.23	-0.94	-1.44	-0.24	-0.97	-1.52	-4.08	-1.90	-1.63	-6.31	-2.06	-1.70
Cotton	+0.23	+0.94	+1.44	+0.24	+0.97	+1.52	+4.08	+1.90	+1.63	+6.31	+2.06	+1.70
	Land Equivalent Ratio (LER)											
Onion	0.83	0.86	0.85	0.71	0.75	0.85	0.83	0.89	0.82	0.90	0.65	0.75
Cotton	1.06	1.01	0.93	0.95	0.97	1.04	1.07	0.90	1.02	1.11	0.93	0.93
Total	1.86	1.87	1.79	1.66	1.72	1.89	1.90	1.79	1.84	2.01	1.58	1.68

REFERENCES

1 . Abou-Zeid, H.M., S. Saied, S.A. Moustafa and S.F. El-Gahel. 1989. Studies on the effect of intercropping onion in cotton fields. Assiut J. Agric. Sci., 20 : 2 .

2 . Ashoub, A.H. 1978. Inter and intra specific competition among onion and cotton plants. M.Sc. Thesis, Fac. Agric., Ain Shams Univ.

3 . Brewster, J.L. 1977. The physiology of the onion. HCA., 47 (1) : 17-22.

4 . Duncan, B.D. 1955. Multiple range and multiple F-test. Biometrics, 11: 1-42.

5 . Eid, A.A. 1969. Studies of some agricultural treatments on cotton. M. Sc. Thesis, Fac. Agric., Alex. Univ.

6 . El-Gahel, S.M. 1980. Studies on vegetables intercropping. M.Sc. Thesis, Fac. Agric., Mansoura Univ.

7 . El-Gahel, S.M. 1987. Studies on overlapping between onion and cotton. Ph. D. Thesis, Fac. Agric., Tanta Univ .

8. El-Zawily, A.I., E.Z. Zayed and S.A. Ibrahim. 1984. Effect of ethrel and plant spacing on onion (*Allium cepa* L.). 2. Bulb yield and quality. J. Agric. Sci., Mansoura Univ., 9 (4): 742-748.

9. Mcgilchrist, C.A. 1965. Analysis of competition experiments. Biometrics, 21: 975-985.

10. Moursi, M.A. 1965a. The interaction between cotton and other crops growing together. I-Effect of interplanting onion plants in rows of cotton plants on the competition for nutrients. Ann. Agric. Sci., Fac. Agric., Ain-Shams Univ., 10 (1) : 245-264.

11. Moursi, M.A. 1965b. The interaction between cotton and other crops growing together.2. Effect of interplanting onion plants in cotton rows and nitrogenous fertilizers on the yield of cotton and onion plants. Ann. Agric. Sci., Agric., Ain Shams Univ., 10 (1) : 267-277.

12. Moursi, M.A. and A.A. Abd El-Gawad. 1967. Field Crops Agronomy. Part II, Anglo-Egyptian Bookshop. (In Arabic).

13. Moursi, M.A., K.M. El-Habbasha and N.A. Nour El-Din. 1973. Onions. Anglo Egyptian Bookshop. (In Arabic).

14. Moustafa, A.K. 1979. Studies on the inter-relationships between some cultural practices and the yield of Behairy onion. M.Sc. Thesis, Fac. Agric., Mansoura Univ.

15. Snedecor, G.W. and W.G. Cochran. 1967. Statistical Methods. 6th Ed. Iowa State Univ. Press.

16. Thompson, L.M. and F.R. Troch. 1979. Soils and soil Fertility. 4th Ed., Tata McGraw-Hill Publishing company LTD, New Delhi.

تحميل البصل على القطن

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معهد بحوث القطن مركز البحوث الزراعية – الجيزة – مصر

أجرى هذا البحث خلال موسمى ١٩٨٨/١٩٨٩ ، ١٩٨٩/١٩٩٠ لدراسة تأثير التحميل بين نباتات البصل (جيزة ٢٠) والقطن (جيزه ٧٦). اشتملت الدراسة ٩ معاملات (٣ معدات تخطيط x ٣ مسافات زراعه) للتحميل بالاضافة الى معاملتين منفردتين للبصل والقطن. استخدم تصميم القطاعات الكاملة العشوائية فى ٤ مكررات. اشتملت المعاملات ٣ معدلات للتخطيط ٦٠ ، ٩٠ ، ١٢٠ سم و ٣ مسافات لزراعة البصل ٥ ، ٧,٥ ، ١٠ سم لتحقيق كثافة نباتيه ٢٨٠ ، ٦٦٦ و ١٨٦ ، ١٤٠ ألف نبات بصل /فدان على الترتيب. ودرس التأثير على النمو، المحصول، القدرة التنافسية ومكافئ استخدام الارض، وكانت أهم النتائج المتحصل عليها مايلى :

١ – تفوق محصول البصل المنزرع منفردا وبزراعته على مسافة ٥سم معنويا على باقى المعاملات فى الموسم الثانى فقط. بينما زاد متوسط وزن البصل بالزراعة المنفردة وبالزراعة على مصاطب ٩٠ ، ١٢٠سم وبالشتل على مسافات ١٠ سم بين الشتلات فى كلا الموسمين.

٢ – أدى التفاعل بين مختلف معدلات التخطيط والزراعة على مسافة ٥سم الى الحصول على أعلى محصول من الابصال، بينما زاد متوسط وزن البصلة بالزراعة مع معدل التخطيط ٦٠ أو ٩٠سم وبالزراعه على مسافة ١٠سم بين الشتلات فى الموسم الثانى.

٣ – لم تتأثر معنويا نسبة الانبات وطول النبات وعدد الافرع الثمرية وصفات التبكير ومحصول القطن الزهر للفدان ومتوسط وزن اللوز غير المتفتح بنظم التحميل ومسافات زراعة البصل فى كلا الموسمين. تفرقت معنويا زراعة القطن منفردا وبزراعته محملا على خطوط ٦٠ سم فى عدد اللوز المتفتح للنبات فى كلا الموسمين ايضا.

٤ – كان نبات البصل اقل فى قدرته التنافسية عن نبات القطن الذى زادت قدرته التنافسيه بزيادة عرض الخط من ٦٠ الى ١٢٠ سم وتحت مختلف الكثافات المدروسة بعكس نبات البصل الذى انخفضت قدرته التنافسية بزيادة عرض الخط.

٥ – سجل القطن قيما موجبة للتنافس والتى تناقصت بزيادة المسافة بين الشتلات من ٥ – ١٠ سم (بانخفاض عدد الشتلات من ٢٨٠ – ١٤٠ الف نبات بصل / فدان)

٦ – زاد مكافئ استخدام الارض مع مختلف نظم التحميل واعداد نباتات البصل بحقل القطن.