ISSN 1110-0419

Annals Of Agric. Sc., Moshtohor,
Vol. 44(4): 1385-1404, (2006).

PERFORMANCE OF COTTON AND WHEAT UNDER INTERCROPPING, PLANTING PATTERNS AND NITROGEN FERTILIZATION

BY

Samira M.A.Hussein,
Field Crop Institute, Agric. Res. Center, Giza, Egypt

ABSTRACT

Two field trails were conducted at the Experimental Farm of the Faculty of Agriculture, Zagazig University during two successive seasons of 2003/2004 and 2004/2005 to study the response of two intercropping components cotton and wheat to planting methods and patterns as well as nitrogen fertilization. Yield and yield components of Cotton (cv. Giza 85) and wheat (cv. Sakha 93) were concerned. The obtained results reveal that:

Wheat:

Relay intercropping of cotton with wheat significantly reduced some traits of wheat and grain yield /fed, but the results from the interaction between planting methods and planting patterns of wheat showed no significant differences between sole and intercropped wheat with cotton on ridges (60 cm width) in grain yield (ardab/fed) and yield components i.e. number of grains/spike, weight of grain /spike and number of spikes/m^2.

Cotton:

Relay intercropping of cotton with wheat significantly increased plant height, the first sympodium height, number of days to the first flower appearance, No. of plants at picking /fed and seed yield/fed. But decreased yield components and lint percentage., while there was no significant difference between sole cotton and intercropped cotton in seed cotton yield/fed. Concerning planting patterns, the tallest cotton plants were found by sowing cotton on beds (120 cm width), but the height of the first sympodium and number of days to the first flower appearance were higher by planting cotton on rows (60 cm). Planting cotton on ridges (60 cm width) gave the highest values of seed cotton yield and some of yield components as well as lint percentage, while number of plants at picking was the highest by planting cotton on beds (120 cm width). Increasing nitrogen fertilization up to 75 kgN/fed increased plant height, height of the first sympodium, No. of days to the first flower appearance and No. of plants at picking /fed. While the highest values of yield and yield components as well as lint percentage were produced by adding 60 kgN/fed.

Seed cotton yield/fed. was significantly affected by various interaction effects of all experimental factors. From the effect of the 2nd order interaction on seed cotton yield /fed, it could be conclude that the highest value was produced

when cotton was intercropped with wheat on ridges (60cm width) under nitrogen level of 60 kg/fed.

Land equivalent ratio (LER) and area time equivalent ratio (ATER) recorded the highest values when cotton was intercropped with wheat on ridges (60 cm width). Aggressivety data showed very low competitive abilities for any of intercrop combination. Cotton was dominant and wheat was dominated when cotton was intercropped with wheat on rows or on beds (120 cm width), while wheat was dominant and cotton was dominated when cotton was intercropped with wheat on ridges (60 cm width). The total income was the highest when cotton was grown as relay intercropping with wheat on ridges (60cm width)

Relay intercropping of cotton with wheat as intensive cropping system to increase the productivity of the unit area for gaining two main yields to increase wheat production to overcome the gab between consumption and production of wheat can be recommended.

INTRODUCTION

In Egypt cotton (*Gossypium barbadense* L.) is an important crop for national economy as fiber crop and major source of vegatable oil It was recommended that cotton must be sown early before 31th March as the latest date for sowing. This means that nearly one million feddans of winter crops like wheat, faba bean and sugar beet need 2 months to reach maturity and growing cotton should be delayed. Delaying cotton planting date to the end of April or May reflected adverse effect on flowering and earliness parameters assembled herein as higher nodal position of first sympodium, shorter period to first flower appearance or boll opening as well as greater young boll shedding, as found by Makram *et al.* (1994), Ali and El-Sayed (2001).

Also Ali and El-Sayed (2001) found that late planting at the end of April decrease seed cotton yield and its components. Brown (1982), Abbas *et al.* (1983), Hammouda (1984) concluded that delaying planting date of cotton to mid-May decreased cotton yield, number of flowers and open boll/plant, earliness and lint percentage. On the other side the national target for increasing the cultivated area of wheat instead of the area of clover as a catch crop may be detected by planting cotton as a relay intercropping with wheat keeping the recommending sowing data of cotton and harvesting date of wheat at optimum time. From the previous studies, which pointed out that early sowing through March or relaying cotton with wheat increased cotton yield and its components.

Abo-El Zahab and Mashhor (1998) reported that late planting date caused significant reduction in cotton seed yield and seed index. Also, they added that the reduction may be attributed to higher day degree units and heat units accumulation during the period from flowering to picking. Kamel *et al.* (1992) and Selim *et al.* (1998) concluded that growth and yield and its components of cotton were not adversely affected when cotton was relayed with wheat. Hussein, Samira (1998a and b) stated that sowing cotton as relay intercropping with either

wheat, sugar beet had no deleterious effects on their yield and yield components. Hussain, Samira (1999, 2000 and 2005) stated that relay intercropping of cotton with faba bean or wheat in old or new reclaimed sandy soil produced the highest seed cotton and seed yields per plant and feddan

Nitrogen nutrient is very important for growth and development of cotton plants as well as many other plants. Many investigators studied the effect of nitrogen fertilization on cotton yield and its attributes. Abou Zaid (1991), Abd El-Aal *et al.* (1992), Ali *et al* (1992), Abou El-Nour *et al* (2000), El-Kalla *et al* (1994), El-Naggar (1997), Hussein, Samira (1998a, 2000) reported significant increments in yield and its attributes due to increasing nitrogen levels up to 60 kgN/fed Hussein, Samira (2005) stated that increasing nitrogen level up to 80 kgN/fed showed no significant differences in most studied traits of cotton comparing with 60 kgN/feddan. So the purpose of this study was to fined out suitable intercropping patterns of cotton with wheat, and to determine the optimum nitrogen fertilizer level for the intercropped components. This may extend the cultivated area of wheat by 30% of the winter crops area without affecting the area devoted for growing cotton

MATERIALS AND METHODS

Two field experiments were carried out at the Experimental Farm of the Faculty of Agriculture, Zagazig University, Zagazig, Egypt, during 2003/2004 and 2004/2005 seasons to study the effect of relay intercropping cotton (cv. Giza 85) with wheat (cv. Sakha 93) and planting systems as well as nitrogen fertilization levels on growth, yield and yield attributes of cotton. The preceeding crop was maize. The experimental soil was clay texture. The mechanical and chemical analysis of the soil are presented in Table (1). The treatments were executed as follows:

A: Planting methods: a1) Sole cotton planting, a2) Cotton planting as a relay intercropping with wheat.

B: Planting patterns: Three planting patterns for cotton were used:

b1) Planting in rows 60 cm apart.

b2) Planting on ridges (60 cm width) on one side.

b3) Planting on beds (120 cm width) on both sides

a1) Sole cotton planting: After berseem (as a catch crop) the soil was prepared for cotton planting on March 25 and 28 in both seasons, respectively, as pure stand. Cotton seeds were sown in dry soil in rows 60 cm apart and on one side of the ridges (60 cm width) as well as on two sides of the beds (120 cm width) in hills 25 cm apart with seeding rate of 30 kg/fed the plants were thinned to two plants/hill, the agricultural practices for cotton were followed as recommended.

a2) Relay intercropping of cotton with wheat in different patterns: The experimental soil was prepared for planting wheat as a sole seeding and intercropping planting with cotton. Wheat seeds were sown at seed rate of 60 kg/fed on November, 20 and 25 in both seasons, respectively in three patterns i.e. in rows 15 cm apart and on ridges (60 cm width) in 4 rows 15 cm apart as well as on the top of the beds (120 cm width) in 8 rows as sole wheat crop

Table (1): Average of mechanical analysis of the experimental site during the two seasons.

Traits	Mechanical analysis before wheat planting (%)	
Clay	56.20	
Silt	30.60	
Fine sand	11.10	
Coarse sand	2.10	
Texture	Clay	
	Chemical analysis	
	Before wheat	Before cotton (after wheat)
Organic matter	2.32%	2.45%
$CaCO_3$	3.70%	3.21%
Aval. N ppm	33.0	48.0
Aval. P ppm	7.8	12.5
Aval. K ppm	160.2	190.7
pH*	7.8	7.6
E.C. ds/m	0.63	0.71

* 1:25 Soil-water suspension

-N, P and K were determined according to Jackson (1967), Olsen *et al.* (1954) and Jackson (1967) respectively.

Calcium superphosphate (15.0% P_2O_5 at rate of 250 kg/fed.) was applied at preparing the soil before planting wheat. Nitrogen fertilizer at rate of 75 kgN/fed as ammonium nitrate (33.5% N) was applied in three doses as recommended. The other agricultural managements for wheat were followed as recommended. At the same date of sowing cotton pure stand on March 25 and 28 in the two seasons, respectively, seeds of cotton were sown in rows between the rows of wheat plants (60 cm apart) and also on the other side of wheat ridges (60 cm width) which occupied 3 rows of wheat plants as well as cotton plants was planted on both sides of beds (120 cm width) which were planted before with 6 rows of wheat (75% of the pure stand of wheat). All cotton plantings and patterns were planted before the last irrigation of wheat in hills 25 cm apart at a rate of 30 kg/fed (100% of the pure stand of cotton). After harvesting wheat on the 10^{th} and 15^{th} of May in the two seasons, respectively, cotton plants were thinned to two plants/hill and the cotton seedlings were treated as pure planting.

C: Nitrogen fertilization:

Three levels of nitrogen fertilization were used to investigate the response of cotton yield to the following level of nitrogen fertilization i.e.

c1) 45 kgN/fed. c2) 60 kgN/fed. c3) 75 kgN/fed.

Nitrogen fertilizer was applied in the form of ammonium nitrate (33.5% N) in two equal doses. The experiment included 18 treatments which resulted from the components of two planting methods, three planting patterns and three levels of nitrogen fertilization. A split-split plot design with three-replicates was used. Planting

methods were arranged in the main plots while planting patterns were allocated in the subplot as well as the three levels of nitrogen were distributed in the sub-subplots. Each sub-subplot contains 10 rows or ridges (60 cm width) or 5 beds (120 cm width) with an area of $24m^2$ (4.0 m long x 6.0 m width).

The studied traits were:

Wheat:

At wheat harvest number of spike/m^2 and grain yield (ardab/fed) and straw yield (ton/fed) in each sub-subplot were estimated and at the same time, 10 plants were chosen from each sub-subplot to estimate plant height (cm), spike length (cm), weight of spike (gm), No. of grains/spike, weight of grains/spike and 1000- grain weight.

Cotton:

During the two growing seasons the height of the first sympodium and No. of days to the first flower appearance of cotton were recorded at picking of cotton on 25^{th} and 28^{th} of September in the two seasons, respectively.

Seed cotton yield and its components were determined as follows:

1- Plant height at picking (cm).
2- Number of fruiting branches/plant.
3- Earliness percentage.
4- Number of total bolls/plant.
6- Number of open bolls/plant.
6- Boll weight (gm). Mean boll weight was estimated as follows:

$$\frac{\text{Seed cotton yield/plant in grams}}{\text{No. of harvested open bolls/plant}}$$

7- Seed index: the weight of 100 cotton seeds was determined from 400 seeds and the average weight was obtained.
8- Seed cotton yield/plant (gm).
9- Number of plants per feddan at picking (thousands/fed.): number of plants at harvest per sub-subplot was recorded and transformed to thousands per feddan.
10- Seed cotton yield per feddan (kentars); seed cotton yield per plot in kilograms was transformed to kentars per feddan (1. kentar = 157.5 kg).
11- Seed yield (kg/fed.).
12- Lint percentage: After picking, seed cotton was ginned, then lint percentage was calculated as follow: lint percentage = $\frac{\text{Weight of lint cotton}}{\text{Weight of seed cotton}} \times 100$

Statistical analysis:

The collected data were subjected to the proper statistical analysis of split-split plots design according to the procedure outlined by Gomez and Gomez (1984). The treatments means were compared using the newly least significant differences (NLSD) as outlined by Waller and Duncan (1969). Competitive relationships and yield advantages i.e. land equivalent ratio (LER), area time equivalent ratio (ATER) and aggressivity were also calculated according to Willey (1979), Hiebsch and McCollum (1987) and Me-Gilchrist (1965).

respectively. Economical evaluation of the costs and outputs were accorded to Agric. Economic Research Institute, Agricultural Research Center.

RESULTS AND DISCUSSIONS

I: Cotton:

The results concerning the effects of sowing cotton as sole and relay intercropping with wheat and patterns of cotton sowing as well as the effect of different levels of nitrogen fertilization are presented in Tables (2, 3 and 4).

A) Effect of planting methods:

Effect of relay intercropping with wheat:

Data in Tables 2, 3 and 4 showed significant effects due to relay intercropping cotton with wheat compared with sole planting on all studied traits with the exception of seed cotton yield/fed. The highest values of plant height, height of the first sympodium, No. of days to first flower appearance, No. of plants at picking /fed and seeds yield/fed were obtained when cotton was intercropped with wheat While No. of fruiting branches/plant, earliness percentage, No. of bolls/plant, No. of open bolls/plant, boll weight, seed index, seed cotton yield/plant and lint percentage were significantly reduced by the intercropping. The taller cotton plants in intercropping planting and higher first sympodium may be due to the competition between cotton plants and wheat plants for light. The increments in seed cotton yield in the first season and seeds yield/feddan may be due to the higher number of intercropped cotton plants which remained until harvest, which mean that intercropping cotton with wheat hindered missing plants compared with sole sowing of cotton inspite of decline in the yield components studied. On the other hand, the difference in seed cotton yield /fed between sole and intercropped cotton with wheat did not reach the level of significant These results are inagreements with those obtained by Kamel *et al.* (1992), Selim *et al.* (1998), and Hussein, Samira (1998a and b, 1999, 2000 and 2005).

B) Effect of planting patterns:

Data concerning the effect of relay intercropping cotton patterns with wheat are shown in Tables (2, 3, and 4). These data revealed that there were significant differences in some studied traits of cotton due to various intercropping patterns but the differences in height of the first sympodium and earliness percentage in the second season, No. of total bolls/plant and boll weight did not reach the level of significance between planting patterns of cotton. The planting of cotton on ridges (60 cm width) reduced plant height, height of the first sympodium in the first season, No. of days to appear their first flower, while the earliest plants, lower values of number of fruiting branches per plant, and open bolls/plant, seed cotton yield/plant, No. of plants/feddan, seed cotton yield and seeds yield/feddan as will as lint percentage were recorded by planting cotton in rows pattern. The highest values of cotton seed and seeds yield/fed and lint percentage were produced by planting cotton on ridges pattern (60 cm width) (7.186 k., 732.709 kg and 35.1%) over both seasons, respectively which is due to higher earliness index, number of open bolls/plant, seed index and seed cotton yield/plant.

C) Effect of nitrogen fertilization levels:

The results concerning the effect of nitrogen fertilization in Tables (2, 3 and 4) revealed significant increments due to increasing nitrogen levels up to 60 kgN/fed. in seed cotton and seeds yield and its components as well as lint percentage Only plant height, height of the first sympodium and number of days to appearance of the first flower and number of plants at picking were significantly increased with increasing nitrogen levels up to 75 kgN/feddan. Adding 60 kgN/feddan increased each of seed cotton yield/plant, number of plants at picking, seed cotton and seed yields/feddan as well as lint percentage by 25.3% and 23.6%, 3.4% and 3.0%, 32.9% and 30.8%, 28.15% and 28.2% and 5.1% and 4.64% in the two seasons, respectively compared with adding 45 kgN/feddan (Tables 2, 3 and 4).

Table (2): Effect of planting methods and patterns and nitrogen fertilization on growth, yield and yield components of cotton in the two seasons.

Traits / Treatments	Plant height (cm)		Height of the first sympodium (cm)		No. of days to first flower appearance		No. of fruiting branches/plant		Earliness %	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Planting methods (A)										
Sole cotton	150.9	151.6	20.9	21.5	71.6	72.4	8.7	7.9	72.0	70.4
Inter. cotton with wheat	155.3	157.0	26.6	27.0	78.9	80.6	7.9	7.2	61.0	59.2
F-test	*	*	*	*	*	*	*	*	*	*
N.L.S.D. 5%	1.9	1.8	0.4	0.5	0.96	1.2	0.20	0.18	1.4	1.6
Planting patterns (B)										
Rows (60 cm)	153.5	154.2	24.4	24.9	76.9	78.7	8.0	7.0	65.0	64.4
On ridges (60 cm width)	150.1	151.7	23.1	23.2	73.2	74.2	8.6	8.4	68.0	65.4
On beds (120 cm width)	155.7	157.0	23.7	24.6	75.7	76.7	8.3	7.3	66.5	64.6
F-test	*	*	*	N.S	*	*	*	*	*	N.S
N.L.S.D. 5%	1.6	1.7	0.3		0.9	1.0	0.19	0.16	1.1	
N. Fertilization (C)										
45 kgN/fed.	145.7	147.1	23.0	24.2	69.2	68.1	8.6	7.9	67.0	65.3
60 kgN/fed.	152.5	154.3	20.2	21.0	76.3	78.5	9.7	8.6	70.6	69.3
75 kgN/fed.	161.0	161.5	28.0	27.5	80.3	83.0	6.6	6.2	61.9	59.8
F-test	*	*	*	*	*	*	*	*	*	*
N.L.S.D. 5%	1.5	1.7	0.2	0.3	0.85	0.6	0.3	0.2	0.9	0.8
Interaction effects										
A x B	N.S	N.S	*	N.S	N.S	N.S	N.S	N.S	N.S	N.S
A x C	N.S	N.S	N.S	N.S	*	*	*	*	N.S	N.S
B x C	*	*	N.S	N.S	N.S	N.S	N.S	N.S	*	*
A x B x C	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

On the other hand, the highest value of seed cotton (8.23 K./fed) over both seasons was obtained with nitrogen level 60 kg/fed, followed by nitrogen level 45 kg/fed. (6.24 K./fed), while the lowest value of seed cotton yield was recorded under nitrogen level 75 kg/fed (5.554 K./fed) over both seasons. The reduction of seed cotton yield due to increasing nitrogen level from 60 to 75 kg/fed were 34.04% and 30.8% in the two seasons, respectively. Seed cotton yield/feddan was significantly increased with increasing nitrogen level up to 60 kgN/feddan due to increasing each

of number of fruiting branches/plant, earliness percentage, number of open bolls/plant, boll weight, seed index, seed cotton yield/plant and number of plant at picking (Tables 2, 3 and 4). These results are in agreement with those found by Abou Zaid (1991) Abd El-Aal *et al.* (1992), Ali *et al.* (1992), El-Kalla *et al.* (1994), El-Naggar (1997), Hussein, Samira (1998a, 2000 and 2005).

Table (3): Effect of planting methods and patterns and nitrogen fertilization on growth, yield and yield components of cotton in the two seasons.

Traits	No. of total bolls/plant		No. of open bolls/plant		Boll weight (gm)		Seed index 1000 seed weight (gm)		Seed cotton yield (gm/plant)	
Treatments	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Planting methods (A)										
Sole cotton	22.1	21.0	15.1	14.5	1.89	1.81	8.71	8.68	25.9	23.9
Inter. cotton with wheat	18.9	18.2	11.5	11.1	1.77	1.67	8.64	8.60	22.9	20.7
F-test	*	*	*	*	*	*	*	*	*	*
N.L.S.D. 5%	0.5	0.4	0.6	0.5	0.04	0.06	0.05	0.04	1.88	0.82
Planting patterns (B)										
Rows (60 cm)	20.3	19.4	12.9	12.5	1.79	1.68	8.68	8.65	23.0	21.0
On ridges (60cm width)	20.5	19.6	13.8	13.2	1.86	1.79	8.71	8.68	25.8	23.5
On beds (120 cm width)	20.8	19.8	13.2	12.8	1.84	1.75	8.64	8.60	24.4	22.4
F-test	N.S	N.S	*	*	N.S	N.S	*	*	*	*
N.L.S.D. 5%	-	-	0.4	0.3			0.03	0.002	1.99	0.76
N. fertilization (C)										
45 kgN/fed.	20.9	20.2	12.7	12.2	1.67	1.65	8.65	8.63	23.3	21.2
60 kgN/fed.	21.5	20.6	14.8	14.4	1.97	1.83	8.75	8.71	29.2	26.2
75 kgN/fed.	19.2	18.0	12.4	11.9	1.85	1.74	8.63	8.59	20.7	19.5
F-test	*	*	*	*	*	*	*	*	*	*
N.L.S.D. 5%	0.20	0.23	0.21	0.26	0.03	0.04	0.02	0.07	1.61	0.41
Interaction effects										
A x B	N.S	N.S	*	*	N.S	N.S	N.S	N.S	*	*
A x C	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
B x C	N.S	N.S	*	*	*	*	N.S	N.S	N.S	N.S
A x B x C	N.S	N.S	N.S	N.S	N.S	*	N.S	N.S	N.S	*

Interaction effects of cotton:

The results concerning interaction effects between planting method x planting patterns in each of height of the first sympodium in the first season, No. of open bolls/plant, seed cotton yield/plant and /feddan in the two season are presented in Table 5. It could be concluded that the highest value of the first height sympodium was obtained when cotton was intercropped with wheat on the two sides of the beds (120 cm width) (2.71), while the lowest value was when cotton was planted sole on one side of the ridges (60 cm width) (19.6). The highest values of No. of open bolls/plant and seed cotton yield per plant were obtained when cotton was planted sole on one side of the ridges (60 cm width) (15.7 and 25.9, respectively) over both seasons while the lowest values were obtained when cotton was intercropped with wheat in rows between the plants of wheat (10.8 and 20.7, respectively) over both season. The highest value of seed

cotton yield was obtained when cotton was planted on one side of the ridges (60 cm width) but the differences between values when cotton was planted sole or intercropped with wheat did not reach the 5% level of significance (7.241 and 7.131) respectively over both seasons.

Table (4): Effect of planting methods and patterns and nitrogen fertilization on growth, yield and yield components of cotton in the two seasons.

Traits	No. of plants at picking (thousand/fed.)		Seed cotton yield (K./fed)		Seeds yield (kg/fed)		Lint percentage (%)	
Treatments	2004	2005	2004	2005	2004	2005	2004	2005
Planting methods (A)								
Sole cotton	44.692	43.533	7.040	6.322	697 172	661.580	37.1	33.5
Inter. cotton with wheat	46.478	45.556	7.067	6.270	732.329	681.896	34.2	30.9
F-test	*	*	N.S	N.S	*	*	*	*
N.L.S.D. 5%	0.741	0.681			31.1	29.5	0.7	0.8
Planting patterns (B)								
Rows (60 cm)	43.840	43.049	6.379	5.764	663.997	622.989	33.8	31.4
On ridges (60 cm width)	45.466	44.317	7.603	6.768	753.320	712.498	37.6	33.1
On beds (120 cm width)	47.449	46.267	7.179	6.356	726.934	679.727	35.7	32.1
F-test	*	*	*	*	*	*	*	*
N.L.S.D. 5%	0.750	0.511	0.28	0.20	28.8	26.9	0.6	0.7
N. fertilization (C)								
45 kgN/fed.	43.868	42.973	6.598	5.884	660.597	627.867	36.9	32.3
60 kgN/fed.	45.343	44.245	8.775	7.685	850.692	804.647	38.8	33.8
75 kgN/fed.	47.544	46.413	5.788	5.319	632.962	582.700	31.1	30.5
F-test	*	*	*	*	*	*	*	*
N.L.S.D. 5%	0.680	0.411	0.210	0.320	24.4	21.8	0.8	0.9
Interaction effects								
A x B	N.S	N.S	*	*	N.S	N.S	N.S	N.S
A x C	N.S	N.S	*	*	N.S	N.S	N.S	N.S
B x C	*	*	*	*	N.S	N.S	N.S	N.S
A x B x C	*	*	*	*	N.S	N.S	N.S	N.S

The interaction effects between planting method x nitrogen fertilization on No. of days to first flower appearance, No. of fruiting branches/plant and seed cotton yield/fed are presented in Table (6). The results showed that the number of days to first flower appearance was increased with increasing nitrogen fertilization from 45 to 75 kgN/fed. under both planting methods sole or intercropped with wheat. On the other hand, the highest number of days to first flower appearance was obtained when cotton was intercropped with wheat and fertilized with 75 kg nitrogen (85.35) over both seasons, while the lowest value was obtained when cotton planted sole under 45 kgN/fed nitrogen (64.45) over both seasons. The number of fruiting branches decreased with increasing the level of nitrogen from 60 kg to 75 in both planting methods sole or intercropped with wheat but the 60 kgN/fed level. produced the

highest value of number of fruiting branches/plant (10.08), when cotton was grown sole. Also the seed cotton yield/fed. decreased with increasing the level of nitrogen fertilization from 60 kg to 75 kg by 37.7 and 27.2% when cotton was planted sole or intercropped with wheat over both season, respectively. There were no significant differences between cotton sole and intercropped cotton with wheat under level 60 kgN/fed. The seed cotton yield/fed. was higher when intercropped with wheat than sole growing under level of N 75 by 12.1 and 13.7% in the two seasons, respectively

The results in Table 7 revealed significant interaction effect between planting patterns and nitrogen fertilization on plant height, earliness index, number of plants at picking and seed cotton yield/fed. The data showed that the tallest plants were obtained when cotton was planted on two sides of beds (120 cm width) under (75 kgN/fed.) level (163.8 and 165.9) in the two seasons, respectively, while the shortest plants were obtained when cotton was planted on ridges (60 cm width) under 45 kgN/fed level. (134.5 and 143.7) in the two seasons, respectively.

The highest values of earliness index, and seed cotton yield/fed. were obtained when cotton was planted on one side of ridges (60 cm width) under (60 kgN/fed) level, while the lowest values of seed cotton yield/fed were obtained when cotton was planted in rows with 75 kg N/fed level. Also data in Table 7 showed that the highest number of cotton plants at picking were obtained when cotton was planted on two sides of beds (120 cm width) under nitrogen level (75 kg/fed), while the lowest value was obtained when cotton was planted in rows under nitrogen level 45 kg/fed. It can be concluded that the seed cotton yield increased with increasing the nitrogen level from 45 to 60 kg/fed by (32.1%, 35.3% and 28.3%) when cotton was grown in rows, on ridges (60 cm width) and on beds (120 cm width) respectively over both seasons. In Table 8 the results showed that the effect of the 2nd order interaction between planting method x planting patterns x nitrogen fertilization was significant only on boll weight in the second season, seed cotton yield per plant, No. of plants at picking and seed cotton yield per fed in the two seasons Also the highest yield of seed cotton/fed was obtained when cotton was intercropped with wheat on one side of ridges (60 cm width) under nitrogen level (60 kg/fed)(11.065 and 9.935k.) in the two seasons respectively

II: Wheat:

A) Effect of planting methods:

Wheat crop as a component of relay intercropping system accompanied the cotton plants in the same area for about 45 days. This period was the first growth stage of cotton (seedlings). It could be expected that wheat grain yield and its components may have been affected by relay intercropped cotton. The results in Table 9 revealed that yield attributing characters i.e. plant height, spike length, weight of spike, number of grains/spike, weight of grains/spike, weight of 1000 grains, number of spike/m^2, grain and straw yield/fed were significantly reduced with intercropping, compared to wheat sole crop. These results may be due to competition between cotton and wheat plants for nutrients, water and solar radiation leading to reduction of yield components i.e. weight of spike weight of grains/spike, weight of 1000 grains and number of spike/m^2, the reductions of grain and straw yield/fed were (24.2 and 27.4%)over both seasons, respectively. These results are in agreement with those found by Abd El-Gawad *et al.* (1988).

Table (5): Interaction effects of planting methods x planting patterns on some traits of cotton in the two seasons.

Planting patterns / Planting methods	Height of the first sympodium (cm)			No. of open bolls/plant						Seed cotton yield (gm /plant)						Seed cotton yield (K./fed)					
	2004			2004			2005			2004			2005			2004			2005		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Sole cotton	21.7	19.6	21.4	14.8	16.1	14.3	14.3	15.3	13.9	24.2	27.0	26.5	22.3	24.9	24.5	6.428	7.638	7.053	5.853	6.842	6.271
Inter. cotton with wheat	27.1	26.6	26.0	11.0	11.5	12.1	10.7	11.1	11.7	21.8	24.7	22.3	19.7	22.1	20.3	6.330	7.568	7.305	5.675	6.694	6.441
N. L.S.D. 5%	0.40			0.30			0.20			0.40			0.30			0.20			0.18		

1 = cotton planting in rows (60 cm)2- cotton planting on ridges (60 cm width) 2- cotton planting on beds (120 cm width)

Table (6): Interaction effects of planting methods x nitrogen fertilization on some traits of cotton in the two seasons.

N levels kg/fed / Planting methods	No. of days to first flower appearance						No. of fruiting branches /plant						Seed cotton yield (K./fed)					
	2004			2005			2004			2005			2004			2005		
	45	60	75	45	60	75	45	60	75	45	60	75	45	60	75	45	60	75
Sole cotton	65.2	72.9	76.8	63.7	74.6	79.1	8.9	10.7	6.5	8.1	9.6	6.1	6.820	8.844	5.457	6.097	7.890	4.979
Inter. cotton with wheat	73.2	79.7	83.8	72.5	82.4	86.9	8.3	8.7	6.7	7.6	7.7	6.4	6.376	8.706	6.120	5.671	7.480	5.659
N. L.S.D. 5%	1.5			1.3			0.6			0.7			0.51			0.65		

45, 60 and 75 kgN/fed

Table (7): Interaction effects of planting patterns x nitrogen fertilization on some traits of cotton in the two seasons.

N.fertilization / Planting patterns	Plant height (cm)						Earliness index (%)						No. of plants at picking (thousands/fed)						Seed cotton yield (k/fed)					
	2004			2005			2004			2005			2004			2005			2004			2005		
	45	60	75	45	60	75	45	60	75	45	60	75	45	60	75	45	60	75	45	60	75	45	60	75
Rows(60 cm)	152.3	149.1	158.7	146.5	154.7	161.3	65.1	68.5	61.5	66.1	67.4	59.8	42.533	43.627	45.363	42.318	42.533	44.270	5.952	8.000	5.184	5.460	7.075	4.758
On ridges 60 cm width	134.5	155.9	160.6	143.7	154.3	157.2	68.4	72.5	63.2	65.9	69.1	67.2	44.952	44.785	46.660	42.648	42.696	44.613	6.872	9.327	6.609	6.084	8.200	6.020
On beds 120 cm width	150.3	152.6	163.8	151.3	153.8	165.9	67.6	70.9	60.9	64.0	71.4	58.4	44.120	47.618	50.608	43.952	47.493	50.355	6.972	8.998	5.567	6.105	7.780	5.180
F-test	*			*			*			*			*			*			*			*		
N.L.S.D. 5%	1.8			1.9			0.58			0.61			0.420			0.316			0.28			0.26		

Table (8): Interaction effects of planting methods x planting patterns x nitrogen fertilization on seed cotton yield in the two seasons.

Planting methods	N. fertilization / Planting patterns	Seed cotton yield (k./fed)					
		2004			2005		
		45	60	75	45	60	75
Sole cotton	Rows (60 cm)	6.293	8.032	4.982	5.618	6.981	4.553
	On ridges (60 cm width)	8.345	10.911	6.027	7.670	9.860	5.598
	On beds (120 cm width)	6.447	7.198	5.126	5.772	6.147	4.697
Inter. cotton with wheat	Rows (60 cm)	5.599	8.292	5.069	4.845	7.162	4.561
	On ridges (60 cm width)	4.189	11.065	5.086	3.435	9.935	4.578
	On beds (120 cm width)	8.717	7.152	8.438	7.963	6.022	7.930
F-test			*			*	
N.L.S.D. 5%			0.61			0.56	

B) Effect of planting patterns:

The results in Table 9 indicated that the tallest plants (96.2 cm) were obtained when wheat was drilled, while the shortest plants (93.8 cm) over both seasons were obtained when wheat was sown on beds (120 cm width). Yield components of wheat i.e. spike length, weight of spike number of grains/spike, weight of grains/spike, weight of 1000 grains, number of spiks/m^2, and yields of grain and straw/fed took the same trend of plant height. On the other hand, the highest values of the above mentioned components were obtained when wheat planted drilling of 15 cm apart, followed by sowing in rows, on ridges (60 cm width), while the lowest values, were obtained when wheat was sown on beds (120 cm width). The results in Table (9) revealed a reduction in the yields of grain and straw per feddan when wheat was sown on beds (120 cm width) by (30.48% and 40.2%) in the first season and by (31.2 and 42.3%) in the second season respectively, compared with drilling in rows.

Interaction effects of wheat:

The results concerning the significant interactions between planting methods and planting patterns on number of grains/spike, weight of grains/spike in the two seasons, number of spikes/m^2 in the first season as well as grain yield (ardab/feddan) in the two seasons are presented in Table 10. It could be concluded that the highest values of number of grains/spike (48.7 and 47.7), weight of grains gm/spike (2.03 and 2.05), number of spikes/m^2 (581.4) in the first season, and grain yield ardab /feddan (24.70 and 22.53) in the two seasons, respectively were obtained when sole wheat was drilled in rows, while the lowest values of number of grains/spike (44.3 and 43.8), weight of grains gm/spike (1.74 and 1.75), number of spikes/m^2 in the first season (313.0) and grain yield ardab/feddan (11.8 and 10.52) were obtained when wheat was intercropped with cotton on beds (120 cm width). On the other hand, the results in Table 10 showed no significant differences between sole and intercropped wheat on ridges (60 cm width) concerning grain yield (ardab/feddan) and yield components i.e. number of grains/spike, weight of grains/spike in second season and number of grains/m^2. These results are in agreement with those found by Kamel *et al.* (1992), Hussein, Samira (1998a,b, 2000 and 2005). It could be concluded that grain yield of wheat did not significantly differ by sowing wheat sole or intercropping with cotton on ridges (60 cm width).

Competitive relationship and yield advantage of intercropping:

1- Land Equivalent Ratio (LER):

Intercropping gave advantages in land use as shown in Table 11. Estimation of LER revealed increasing the efficiency of land use by 59, 96 and 79% in the first season and by 61, 95 and 74% in the second season when cotton was sown relay intercropped with wheat on rows 60 cm apart, on ridges (60 cm width) as well as on beds (120 cm width) respectively. This LER indicate that the relay intercropping of cotton with wheat was better on land use than sole growing of crops. The results of LER also showed that all intercrop combinations led to yield advantage and land equivalent ratios exceeded the unit. It could be concluded that the increase in production was due to the substantial leaf canopy, increased land use efficiency and the rate of land utilization was proportional to wheat density within the intercrop combination. Yield advantage due to intercropping could be abundant much to good compatibility and less below and above ground competition between both wheat with

cotton. The pertinence of orientation of both components in the unit area of land yield advantage of intercropping cotton with wheat has been emphasized by several investigators (Kamel *et al.*, 1992, Aly *et al.*, 1993, Badr *et al.*, 1996, Hussein, Samira, 1999 and 2005).

2-Area Time Equivalent Ratio (ATER):

The ATER is a concept that considers the time factor along with land area which was proposed by Hiebsch (1978) and Hiebsch and Mc Collum (1987a). The ATER accurately estimates the biological efficiency which is defined as the rate at which radiant energy is converted to harvestable biological energy the myriad processes that take place in green plants (Hiebsch and Mc Collum 1987b). It is clear that the values of ATER were less than that of LER values but still exceeding one with intercropping cotton with wheat on ridges (60 cm width) or on beds (120 width), while intercropping in rows was less than one. This means that yield advantage was produced and land usage efficiency increased by intercropping cotton with wheat. The highest ATER values were recorded with intercropping on ridges (60 cm width) (1.13 and 1.12) and on beds (120 cm width) (1.04 and 1.00) on the two seasons, respectively indicating that the productivity of unit area increased by (13.0 and 12.0%) by intercropping in ridges (60 cm width) in the two seasons, respectively.

3- Aggressivity:

The data showed very low competitive abilities for any of the intercrop combinations wheat and cotton indicating that the intra specific competition is stronger than the inter specific one. On the other hand, the data on the aggressivity showed lower values when cotton was intercropped with wheat in rows, or on beds (120 cm width) values of cotton were positive (dominant), whereas the values of wheat were negative (dominated), while on ridges (60 cm width) the cotton was dominated and wheat dominant in the two seasons. Although both intercrop combinations were far enough to give any detrimental effect on cotton or wheat.

Evaluation and Conclusion:

It could be concluded that the net income from the unit over the year was the highest when cotton was planted in relay intercropping with wheat because the system may increase land equivalent ratio and decrease the relatively production costs and gaining two main yields from wheat (long duration) and from cotton to asses the different sowing dates and patterns of cotton hey must be evaluated around the two seasons of winter and summer crops from the unit area (feddan). The evaluation depended upon the cost needs for production of winter and summer crops (input) and the income around the year from the unit area in Egyptian pounds from Table (12). It can be concluded that net income from unit area over the year was the highest when cotton was intercropping with wheat on ridges (60 cm width). In spite of the low costs of the two crops (berssem and cotton) during the year by conventional sowing method comparing with relay intercropping of cotton with wheat during the same period the total income of wheat was higher, so, the net income of relay intercropping crops was the highest.

Table (9): Effect of planting methods and planting patterns on yield and its components of wheat in two seasons.

Traits	Plant height (cm)		Spike length (cm)		Weight of spike (gm)		No. of grains/spike		Weight of grains/spike (gm)		Weight of 1000 grains (gm)		No. of spikes/m²		Grain yield ardab/fed.		Straw yield/fed (ton)	
Treatments	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Planting method (A)																		
Sole wheat	96.4	95.0	11.3	10.9	3.4	3.1	46.9	46.3	1.96	1.92	41.8	41.5	472.57	443.20	19.32	17.89	4.536	3.717
Inter. wheat	95.3	93.6	10.2	9.7	2.9	2.7	45.8	45.1	1.84	1.82	40.8	40.4	369.56	354.40	14.65	13.57	3.245	2.772
F-test	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
N.L.S.D. 5%	1.0	1.2	0.4	0.5	0.3	0.2	0.7	0.6	0.04	0.05	0.6	0.5	11.1	10.8	0.46	0.40	0.28	0.24
Planting patterns (B)																		
Drilling	97.1	95.3	11.8	11.3	3.6	3.3	47.7	46.7	1.99	1.96	41.9	41.4	475.60	454.20	19.88	18.43	5.015	4.245
On ridges (60 cm width)	95 9	94.9	10.7	10.2	3.1	2.9	46.3	45 9	1.89	1.85	41.3	41.0	428.04	406.60	17.26	16.06	3.660	3.042
On beds (120 cm width)	94.8	92.8	9.9	9.5	2.8	2.6	45.0	44.5	1.82	1.80	40.8	40.5	359.55	335.60	13.82	12.7	2.999	2.449
F-test	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
N.L.S.D.5%	0.9	0.8	0.3	0.4	0.2	0.16	0.5	0.4	0.03	0.04	0.4	0.3	8.5	7.8	0.31	0.30	0.24	0.20
Interaction effect																		
A x B	N.S	N.S	N.S	N.S	N.S	N.S	*	*	*	*	N.S	N.S	*	N.S	*	*	N.S	N.S

Table (10): Interaction effects of planting methods x planting patterns on some traits of wheat in two seasons.

Planting patterns / Planting methods	No. of grains/spike						Weight of grains/spike (gm)						No. of spikes/m²			Grain yield (ard./fed)					
	2004			2005			2004			2005			2004			2004			2005		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Sole what	48.7	46.2	45.7	47.7	46.1	45.2	2.03	1.96	1.90	2.05	1.87	1.85	581.4	431.0	405.3	24.70	17.51	15.75	22.53	16.27	14.88
Inter. wheat	46.7	46.4	44.3	45.7	45.7	43.8	1.95	1.82	1.74	1.87	1.83	1.75	369.8	425.1	313.0	15.06	17.01	11.89	14.33	15.85	10.52
F.test		*			*			*			*			*			*			*	
N.L.S.D. 5%		0.9			0.8			0.06			0.05			11.2			0.56			0.61	

1- Drilling 15 cm apart 2- On ridges (60 cm width) 3- On beds (120 cm width)

Table (11): Input and output of intercropping of cotton with wheat as evaluation of different planting sowing and patterns of cotton with wheat over the two seasons.

Planting sowing and patterns	Input (cost)				Output (income)			
	Winter crop	Cost	Summer crop cotton	Total cost	Winter crop	Summer crop cotton	Total income	Net (L.E/fed.)
Sole cotton in rows	Berseem	758.0	2050.0	2808.0	1646.60	3378.10	5024.70	2216.70
Intercropping with wheat in rows	Wheat	1961.0	1160.0	3121.0	2424.68	3301.38	5702.96	2605.96
Sole cotton on ridges (60 cm width	Berseem	758.0	2050.0	2808.0	1646.60	3982.28	5628.88	2820.88
Intercropping with wheat on ridges (60 cm width)	Wheat	1961.0	1160.0	3121.0	2710.80	3922.05	6632.85	3511.85
Sole cotton on beds (120 cm width)	Berseem	758.0	2050.0	2808.0	1646.60	3664.10	5310.70	2502.70
Intercropping with wheat on beds (120 cm width)	Wheat	1961.0	1160.0	3121.0	1848.85	3779.88	5628.73	2507.73

*The cost and output were according to Agric. Economics Research Institute. Agricultural Research Center

Price of wheat (ardab) = 165 L.E.

Price of cotton (kentar) = 550 L.E.

Price of berssem (fed) = 162'/ L.E.

Finally, relay intercropping of cotton with wheat can be recommended as intensive cropping system for gaining two main yields from wheat and cotton. This pattern enables us to increase wheat cultivated area to overcome the gab between consumption and production of wheat.

The different of the cost of cotton between intercropped cotton and solid after berseem for two irrigation which was done within wheat irrigation + beds preparation for sowing of cotton which was planted after berseem + pesticides.

Table (12): Effect of intercropping patterns on competitive relationships in two seasons.

Competitive relationships / Treatments	LER			ATER	Aggressivety	
	Wheat	Cotton	Total		Wheat	Cotton
Planting methods and patterns	**2003/2004**					
Rows (60 cm)	0.61	0.98	1.59	0.92	- 0.002	+ 0.002
On ridges (60 cm width)	0.97	0.99	1.96	1.13	+ 0.003	- 0.003
On beds (120 cm width)	0.75	1.04	1.79	1.04	- 0.0001	+ 0.0001
Planting methods and patterns	**2004/2005**					
Rows (60 cm)	0.64	0.97	1.61	0.93	- 0.001	+0.001
On ridges (60 cm width)	0.97	0.98	1.95	1.12	+ 0.010	- 0.010
On beds (120 cm width)	0.71	1.03	1.74	1.00	- 0.001	+ 0.001

LER = Land Equivalent Ratio **ATER** = Area Time Equivalent Ratio

REFERENCES

Abbas, A.M.; N.F. Dawla and M.A. Rizk (1983). Effect of transplanting on Egyptian cotton under different seedling ages and sowing dates. Annals of Agric., Sci. Moshtohor, 20:3-14.

Abd El-Aal, S.A.; S.A. All and K.S. El-Bayoumy (1992). Effect of hill spacing and nitrogen levels on Egyptian cotton variety Giza 81 at early sowing date. J. Agric. Sci. *Mansoura* Univ., 17 (11): 3421-3429.

Abd El-Gawad, A.A.; A.S. Edris and A.M Shetaia (1988). Effect of intercropping feba bean with wheat on growth, yield components of wheat Ann. Agric., Ain Shams Univ.,33 (2): 983-998.

Abou El-Nour, M.S.; M.A. Saeed and M.A. Morsy (2000). Effect of fertilization under two planting dates on yield, yield components and some technological and chemical properties of Giza 80 cotton cultivar. Egypt. J. Agric. Res., 78 (3): 1219-1231.

Abou El-Zahab, A.A. and E.A. Mashhour (1998). Planting seed quality in Egyptian cotton 1 Stress of late planting and its interaction with genotypes. Proc. 8th Conf. Agron., Suez Canal Univ., Ismailia, Egypt, 28-29.

Abou-Zaid, M.K.M. (1991). Effect of planting date, plant density and nitrogen fertilization on growth and production of cotton. Ph.D. Thesis, Fac. of Agric., Alex. Univ.

Ali, S.A. Abd El-Aal and S.S. Hillow (1992). Effect of hill spacing and nitrogen levels on Egyptian cotton variety Giza 81 at late sowing date. J. Agric. Sci., Mansoura Univ 17 (11): 3430-3436.

Ali, S.A. and E.A. El-Sayed (2001). Response of cotton cultivar Giza 70 to meepiquate chloride (pix) at early and late sowing dates. J Agric Sci Mansoura Univ., 226 (4): 1841-1851.

Aly, A.M.; S.K. Badr and M.N. Sherif (1993). Studies on onion densities associated with cotton, Monofiya J. Agric. Res., 18.(1): 2191-2205

Brown, C.M. (1982). Relay intercropping planting soybeans in growing wheat Crops and soil magazine. Amer Soc. Of Agron.. PP 7-8

El-Kalla, S.E.; A.T. El-Kassaby; A.A. Leilah; M.H Ghonema anc M.M Ismail (1994). Effect of sowing dates, population and distribution of plants and nitrogen fertilizer levels on growth and yield of Egyptian cotton, Giza 75. Variety. Proc. 6th Agron. Al-Azhar Univ . Cairo, Egypt. Sept., Vol. (1): 95-108.

El-Naggar, V.M.M. (1997). Effect of nitrogen fertilizer and hand hoeing on yield. yield components and associated weeds of cotton. Zagazig J Agric Res. 24. (2): 247-259.

Gomez, K.A. and A.A. Gomez. (1984). Statistical procedures for agricultural research. Jogn Wiley and Sons., Inc., New York.

Hammouda, M.M. (1984). Effect of planting date, nitrogen rate and its time of application on yield and earliness of Egyptian cotton. Ph.D Thesis. Fac. of Agric., Al-Azhar Univ.

Hiebsch, C.K. (1978): Comparing intercrops with monocultures. P 187-200 In agronomic Economic research on soil of the tropics 1976-1977. Annual Report, North Carolaina State Univ., Raleigh, N C

Hiebsch, C.K. and R.E. McCollum. (1987a). Area x Time Equiva ent Ratio. A method for evaluating the productivity of intercrops. Agron. J. 79:15-22.

Hiebsch, C.K. and R.E. McCollum. (1987b). Area x Time Equivalent Ratio: A method for evaluating the productivity of intercrops. Agron. J. 79:945-946.

Hussein, Samira, M.A. (1998a). Possibility of relay intercropping of cotton with sugar beet. J. of Agric. Sci. Mansoura Univ., 23 (10): 4223-4233.

Hussein, Samira, M.A. (1998b). Response of cotton yield and its attributes to different planting methods and patterns under two levels of nitrogen fertilization. Bull. Fac. Agric. Univ. Cairo; 49: 331-344.

Hussein, Samira M.A. (1999). Relay intercropping of cotton with some winter crops under different cultural treatments in sandy soil under drip irrigation systems. Proceedings of the 1st Congress. Recent Technologies in Agriculture, Cairo Unit., Nov. 27-29. Vol. II: 302-314.

Hussein, Samira M.A. and M.A. Haikel. (2000). Possibility of cotton cultivation under the desert conditions in north Sinai. Egypt. J. Appl. Sci; 15 (7): 139-150.

Hussein. Samira M.A. (2005). Planting date, pattern and N. fertilizer level for cotton grown in relay intercropping with wheat. Zagazig J. Agric. Res., 32, (5):1403-1425.

Jackson. M.L. (1967). Soil chemical analysis Printice-Hall of India, New Delhi.

Kamel, A.S., I.O. El-Said, M.S. Selim, N.A. El-Hawary and M.A. El-Masry (1992). Relay intercropping of cotton with some long duration winter crops Proc. 5th Conf. Agron. Zagazig, 13-15 Sep. (2): 588-596.

Makram, E.A., M.I. El-Shahawy, S.F. El-Gahel and R.R. Abd El-Malik (1994) Effect of hill spacing, soil fertilization and its interaction on growth. yield and earliness in Egyptian cotton cultivars I- Giza 70. J. Agric Sci. Mansoura Univ. 19 (1): 1-13

McGilchrist, C. A. (1965). Analysis of competition experiments. Biometrics; 21. 975-985.

Olsen, S.R., C. V. Cole; F.S. Wotonable and L.A. Dean. (1954). Estimation of available phosphorus in soil by interaction with sodium bicarbonate U.S. Dept. Agric. Cr. 939.

Selim, M.S.M., M.I. Abd El-Mohsen and E.M.A. Gabr. (1998). Effect of relay intercropping cotton with some faba bean varieties under different plant densities of faba bean on yield of each component crop Egypt.J.Appl.Sci;13(11):126-141.

Waller, R.A. and D.B. Duncan (1969). A bays rule for the symmetric multiple comparison problem. J Am. Stat. assoc., 1485-1503.

Willey, R.W. (1979). Intercropping,, its importance and research needs. Part I-competition a ~/n yield advantages. Field Crop Abst. 32: 1-10.

أداء محصولي القطن والقمح تحت نظم التحميل والزراعة والتسميد النتروجيني

سميرة محمد على حسين

قسم بحوث التكثيف المحصولى- معهد بحوث المحاصيل الحقلية

مركز البحوث الزراعية

أقيمت تجربتان حقليتان بالمزرعة التجريبية بكلية الزراعة جامعة الزقازيق خلال موسمي الزراعة ٢٠٠٣/ ٢٠٠٤، ٢٠٠٤/ ٢٠٠٥ لدراسة استجابة المحصول ومكوناته للقطن (صنف جيزة ٨٥) والقمح (سخا ٩٣) للتحميل (غير محمل، تحميل مناوب للقطن مع القمح) ونظم الزراعة (فى سطور ٦٠ سم، على خطوط بعرض ٦٠ سم وعلى مصاطب بعرض ١٢٠ سم) وكذلك التسميد النتروجيني (٦٠،٤٥، ٧٥ كجم/ للفدان)، **وقد أوضحت النتائج ما يلي:-**

القمح:

تشير النتائج إلي نقص في طول النبات ومحصول القمح ومكوناته، طول السنبلة، وزن السنبلة، عدد حبوب السنبلة، وزن حبوب السنبلة، وزن الألف حبة، عدد لسنابل فى المتر مربع، ومحصول القش نتيجة تحمل القطن مع القمح ووجد أن أعلى القيم من هذه المكونات تم الحصول عليها عند زراعة القمح منفردا فى سطور بينها ١٥ سم يليها زراعة القمح على خطوط بينما زراعة القمح على ظهر المصطبة ١٢٠ سم أعطت أقل القيم من المحصول ومكوناته ولكن من التفاعل بين طريقة الزراعة فى القمح ونظم الزراعة أظهرت النتائج أنه لا يوجد فرق معنوي بين محصول الحبوب عند زراعة القمح منفردا أو محملا مع القطن على خطوط ٦٠ سم.

القطن:

لوحظ عند تحميل القطن مناوبا مع القمح ارتفاع النبات وارتفاع أول برعم زهري وعدد الأيام لظهور أول زهره وأيضا عدد النباتات للفدان زادت معنويا فى النباتات المحملة بينما نقصت قيم مكونات الحاصل الأخرى تحت الدراسة ولا يوجد فرق معنوى فى حاصل القطن سواء تم زراعته محملا مع القمح أو مفردا.

وبالنسبه لنظم الزراعه فقد لوحظ أن أطول النباتات كانت عند زراعتها على مصاطب (١٢٠سم) وان أعلي ارتفاع لأول برعم زهري وأطول فترة لظهور أول زهرة كانت عند زراعة القطن فى سطور ٦٠ سم. فى حين أن زراعة القطن على

خطوط ٦٠ سم أعطي أعلي عدد من اللوز المتفتح، ونسبة التبكير ووزن اللوزة، ودليل البذور، محصول القطن الزهر للنبات والفدان وكذلك نسبة القطن الشعر- بينما وجد أن عدد النباتات عند الجني كان الأعلى عند زراعة القطن محملا على مصاطب ١٢٠سم.

وبالنسبة لتأثير التسميد النتروجيني فقد لوحظ أن أعلى ارتفاع للنبات كان عند مستوي تسميد ٧٥كجم نتروجين/ للفدان وكذلك ارتفاع أول برعم وأيضا عدد الأيام لظهور أول زهرة- بينما عند مستوي التسميد النتروجيني ٦٠ كجم نتروجين/ للفدان أنتج القطن أكبر عدد من اللوز المتفتح وأعلي نسبة من التبكير ومن محصول القطن الزهر والشعر

أظهر لتفاعل بين طريقة الزراعة ونظم الزراعة المختلفة أنه لا يوجد فرق معنوي فى محصول القطن الزهر للفدان عند زراعته مفردا أو محملا تحميلا مناوبا على خطوط ٦٠ سم بينما أطول فرع ثمري كان عند تحميل القطن علي مصاطب ١٢٠ سم، ووجد أيضا تفاعل بين طرق الزراعة ومعدل التسميد الأزوتي وأيضا بين نظم الزراعة ومعدل التسميد الأزوتي وتم الحصول على أعلي محصول من القطن للفدان عند زراعته محملاً مع القمح على خطوط ٦٠ سم، ومعدل تسميد من النتروجين ٦٠ كجم للفدان ومن التفاعل الثلاثى بين طريقة ونظم الزراعه ومعدل التسميد الازوتى اظهرت النتائج ان اعلى حاصل من القطن تم الحصول عليه من زراعته محملا مع القمح على خطوط ٦٠ سم تحت معدل التسميد الازوتى ٦٠ كجم ن /الفدان.

أظهر تحميل القطن مع القمح تأثير ايجابي على معدل استغلال الأرض وقدرت الزيادة بـ ٥٩% ، ٩٦% ، ٧٩% فى الموسم الأول ٦١% ، ٩٥% ، ٧٤% ، فى الموسم الثاني عند زراعة القطن محملا فى سطور ٦٠ سم وعلى خطوط ٦٠ سم، على مصاطب ١٢٠ سم على التوالي

ومن بيانات العدوانية والتنافس وجد تنافس قليل جدا بين نباتات القمح والقطن وكان القطن سائدا عند زراعته فى سطور ٦٠سم بين نباتات القمح أو على مصاطب بعرض ١٢٠ سم وكان القمح المسود بينما عند زراعة القطن على خطوط ٦٠ سم كان القمح هو السائد والقطن هو المسود.

أظهر التقيم الاقتصادي زيادة العائد النقدي للمزارع وكان أعلي قيمة. عند زراعة القطن محملا على خطوط ٦٠ سم.

من هذه الدراسة نوصي أنه يمكن زراعة القطن تحميلا مناوبا مع القمح والحصول على أعلي القيم من مكوني التحميل عند تحميل القطن على القمح على خطوط ١٠سم تحت معدل من التسميد النتروجيني ٦٠كجم وهذا يؤدي إلي زيادة المساحة من القمح وتقليل الفجوة بين الاستهلاك والإنتاج مع زيادة المساحة المنزرعة من القطن دون التأثير على إنتاجيته مما يعمل على زيادة معدل التكثيف المحصولي والعائد الاقتصادي لوحدة المساحة مقارنة للزراعة التقليدية التى تسمح بزراعة القطن فقط بعد أزد حشه أو حشتين من البرسيم حيث يوجد تنافس بين زراعة المحاصيل الشتوية كالقمح وزراعة القطن على الرقعة الزراعية.