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INFLUENCE OF SOWING DATE, NITROGEN AND POTASSIUM FERTILIZATION ON COTTON YIELD UNDER SAITE AFFECTED SOILS IN NORTH OF DELTA

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ABSTRACT

Two field experiments were conducted at El- Serw Agricultural Research Station (ARC), Damietta Governorate, during the two successive summer seasons of 2004 and 2005 to investigate the effect of three planting dates and (N, k) fertilizers rates, and accordingly their interactions on yield, yield components and the concentration of NPK nutrients in the plant leaves of Giza 86 Egyptian cotton cultivar. A Split -Split plot design with four replicates was used .The obtained results could be summarized as follows..

Late planting induced a significant reduction in number of open bolls / plant, boll weight, lint percentage, seed cotton yield, seed yield and lint yield / fed., N, K concentrations of cotton leaves while there was no significant effect in P concentration in the two seasons.

In contrast, raising N fertilizer level up to 75 kg N/ fed. significantly increased all studied trails in the two seasons compared with control treatment.

Applying potassium fertilizer revealed the same trend of N fertilizer in the two seasons.

The interaction between sowing date and nitrogen fertilizer level had a significant effect on seed cotton yield, number of open bolls/ plant in the two seasons and 100-seed weight only in the second season.

Finally, it could be recommended to grow cotton early at the last week of March with using (75 kg N/fed. + 24 kg k2O/fed.) to maximize the yield, while in the case of late sowing at the first week of May it can be recommended by using only (45 kg N/ fed. + 24 kg K2O/fed.) for Giza 86 cotton cultivar under the soil conditions of this study.

INTRODUCTION

Cotton (Gosypium barbadene L.) is an important cash crop for the Egyptian farmers and vital source of raw material for textile industry and thus plays an important role in Egyptian economy. We should recognize all factors that affect cotton yield in order to maximize the yield per unite area. This could be achieved by applying recommended cultural practices such as sowing date, nitrogen and potassium fertilizers.

In the last years, most of farmers used to sow cotton lately perhaps to May, to gain maximum cuts of bersseem. Sowing date is considered the most important factor among the different factors which influence growth and cotton yield. In Egypt many investigations showed that early sowing had a favorable effect on yield of seed cotton compared with late sowing. Abou El-Nour et al. (2000) reported that early planting increased number of total and open bolls/plant and seed cotton yield. On the other hand, it had no effect on boll weight, seed index and lint percentage. Similar results were obtained by Ali and El-Sayed (2001).Abdel- Aal.(1997) revealed that early planting

increased number of open bolls, boll weight, seed index and seed cotton yield.

Nitrogen is considered an important limiting factor that affects plant growth, as it plays an important role in encouraging cell division and consequently increasing vegetative growth and metabolic processes which reflected on increasing final yield. Nitrogen was found to increase seed cotton yield, boll weight, lint percentage and (N, P and K) contents of cotton leaves (Metwally, 2006 and Abd El- Magid 2002).

Potassium is one of the important elements in plant nutrition, which effects on enzyme activation, water relation, energy relations, translocation of assimilation and nitrogen uptake, protein and starch synthesis. Also potassium has an important physiological and biochemical functions which helps plant grown in saline conditions to tolerate salinity. Many workers studied the effect of potassium application (Sabik et al 2002, El-Sayed and El-Menshawi 2001 and Abd El-Magid 2002).

This investigation was done to study to what extent late sowing affects yield of cotton, and also to know the optimum rate of nitrogen and potassium fertilizers which obtain maximum yield under this condition specially under salt affected soil in the north of Delta.

MATERIALS AND METHODES

Two field experiments were conducted at El-Serw Agriculture Research Station (Damietta governorate) at the two successive summer seasons 2004 and 2005.Physical and chemical analysis of the experimental soil is shown in Table (1).

Table (1): Some physical and chemical properties of the experimental soil in 2004 and 2005 seasons.

Soil properties	First season	Second season
Soil texture	Clayey	Clayey
Soil pH (1: 2.5) soil- water susp.	8.1	8.3
Ec (soil paste at 25c°), dS/m.	4.8	5.2
O.M.%	1.2%	1.1%
$CaCo_3$ %	1.8	1.5
Available nitrogen (ppm)	42	38
Available phosphorus (ppm)	12	13
Available potassium (ppm)	480	450

The experimental plot area was 10.5m2, contained five ridges (3.5m long and 60 cm width) with a distance of 20 cm between hills. Each experiment was arranged in split split plot design with four replicates, where planting date was allocated in main plots, while nitrogen fertilizer rates (45, 60, 75 and 90 kg N/ fed.) were arranged in the sub plots and potassium levels (0 and 24 kg K2O/fed.) represented the sub- sub plots.

Table (2): The three dates of planting in the two seasons.

Planting date	First season	Second season
1- first date	26 / 3 / 2004	2 / 4 / 2005
2- second date	17 / 4 / 200	20 / 4 / 2005
3- third date	6 / 5 / 2004	10 / 5 / 2005

Data in Table (2) are presenting the three times of planting in the two seasons. All normal cultural practices were done as recommended for cotton production. Calculated nitrogen fertilizer rates in the form of ammonium nitrate (33.5% N.), and potassium fertilizer rates in the form of potassium sulphate (48% K2O.) were added in two equal doses. The first dose was added after thinning, while the second dose was applied before the second irrigation.

Samples of the youngest fourth fully matured leaves on the main steam were taken at full flowering stage to determine N,P,K nutrients content by Jackson (1973). At harvest, boll weight, seed index, lint percentage, number of open bolls / plant and seed cotton yield were determined.

All obtained data were subjected to statistical analysis according to Snedecor and Cochran (1989).

RESULTS AND DISSCUSSION

1- Some Yield Components:

Table (3) shows some of cotton yield components. Data revealed that late of planting resulted in a significant reduction in number of open bolls / plant, boll weight and lint percentage in the two seasons. These results could be ascribed on the basis that, early sowing allows longer growing season and gave available time to develop a complete boll load with mature lint. Similar results were obtained by Bi,J.L. et al (2005) and Ali and El-Sayed (2001). While seed index seemed to be increased with late sowing.

Regarding the effect of nitrogen fertilization, the results showed that, raising N level up to 75 kg N/ fed., significantly increased boll weight , open bolls/ plant, seed index and lint percentage, however increasing N application rate up to 90 kg N/fed, significantly decreased all these characters. These results could be explained on the basis that excess application of N fertilization caused excessive vegetative growth which intern increased the shedding of fruiting bodies and lower fruiting branches and consequently resulting in delaying maturity.The results are in agreement with those obtained by Metwally (2006) and Abd El-Mgid (2002).

The same data showed that potassium soil application induced significant increase in number of open bolls / plant, boll weight and lint percentage, while seed index character, was not significantly increased. These results are in accordance with those of Sabik et al (2002). And Abou-Zeid et al. (1997)

2- Seed Cotton Yield:

Data in table (4) revealed that, planting date had significant effect on seed cotton yield, where the earlier planting surpassed second and third sowing date. The percentages of the reduction in seed cotton yield owing to late planting (in the second and third date) were (28% & 45%) and (8% & 25%) for the first and second seasons, respectively compared to the first sowing date. This increase of seed cotton yield owing to early planting may be due to the increase in both numbers of total and open bolls /plant and also the boll weight. With respect to seed yield and lint yield, the data showed a trend completely similar to that obtained with seed cotton yield. Those results

are in agreement with these obtained by Abou El-Nour et al (2006). Abd El-Aal (1997) and El-Shahawy et al (1994).

Table (3): Number of open bolls / plant , boll weight (g), 100 seed weight (g) and lint percentage as affected by sowing dates, nitrogen and potassium fertilizer in the two seasons

Treatments		No of open bolls /plant		Boll weight (g)		100 seed weight (g)		Lint %	
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Time of planting	First	24.4	19.80	2.84	2.94	8.52	8.93	39.64	38.70
	Second	20.30	15.50	2.71	2.94	8.49	8.80	39.04	38.54
	Third	13.20	9.60	2.67	2.82	9.70	10.15	37.54	36.56
	F. test	x	xx	xx	N.S	xx	xx	xx	xx
	L.S.D	0.530	3.294	0.076	-	0.041	0.188	0.666	0.285
N fertilization rates	45kg N/fed	16.6	14.40	2.71	2.91	8.74	8.98	38.98	37.93
	60kg N/fed	20.10	16.60	2.71	2.91	8.89	9.40	38.70	37.97
	75kg N/fed	19.90	15.80	2.77	2.92	9.00	9.52	38.69	38.00
	90kg N/fed	18.70	13.20	2.75	2.88	8.99	9.27	38.58	37.87
	F. test	x	xx	N.S	N.S	xx	xx	N.S	N.S
	L.S.D	1.113	1.225	-	-	0.075	0.150	-	-
K fertilization rates	O	18.50	14.60	2.69	2.80	8.86	9.28	38.52	37.80
	24kg K_2o/fed	20.10	15.40	2.77	3.00	8.94	9.31	38.96	38.07
	F. test	xx	x	xx	xx	N.S	N.S	xx	xx
	L.S.D	0.845	0.513	0.047	0.034	0.049	-	2.81	0.117
Interactions	T X N	x	xx	N.S	N.S	N.S	x	N.S	N.S
	T X K	N.S	xx	N.S	N.S	N.S	N.S	N.S	N.S
	N X K	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
	T X N X K	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Table (4): Seed cotton yield (ka. / fed.), seed yield (kg / fed) and lint yield (kg / fed) as affected by sowing dates, nitrogen and potassium fertilizer in the two seasons.

Treatments		Seed cotton yield (kg N / fed)		Seed yield (kg / fed)		Lint yield (kg / fed)	
		1st season	2nd season	1st season	2nd season	1st season	2nd season
Time of planting	First	11.72	7.94	1092.65	751.82	719.91	478.69
	Second	8.38	7.36	795.38	701.35	503.47	440.15
	Third	6.34	5.99	609.54	589.56	363.88	339.81
	F. test	xx	xx	xx	xx	xx	xx
	L.S.D	0.542	0.309	55.244	36.21	31.860	13.102
N fertilization rates	45 kg N/fed	8.64	6.85	817.07	659.48	521.86	403.32
	60 kg N/fed	8.94	7.46	845.97	716.49	536.32	440.64
	75 kg N/fed	9.00	7.36	848.77	707.16	540.14	434.07
	90 kg N/fed	8.68	6.71	818.30	640.51	518.03	400.17
	F. test	x	xx	x	xx	x	xx
	L.S.D	0.321	0.427	20.312	42.80	17.35	24.887
K fertilization rates	O	8.55	6.94	808.60	667.20	509.82	408.68
	24 kg K_2o/fed	9.07	7.25	856.45	694.56	548.22	430.43
	F. test	xx	xx	xx	x	xx	xx
	L.S.D	0.228	0.217	22.656	20.651	12.250	13.245
Interactions	T X N	xx	xx	N.S	N.S	N.S	N.S
	T X K	N.S	N.S	N.S	N.S	N.S	N.S
	N X K	N.S	N.S	N.S	N.S	N.S	N.S
	T X N X K	N.S	N.S	N.S	N.S	N.S	N.S

Concerning the effect of nitrogen fertilizer rates, data in Table (4) showed that increasing N rate, significantly increased seed cotton yield (kentar /fed.) seed yield (kg /fed.) and lint yield (kg /fed.) compared to control treatment. The highest value of seed cotton yield was recorded when plants received 75 kg N /fed. These increases in seed cotton yield and its attributes might be due to nitrogen nutrient as a one of the most important components of cytoplasm, nucleic acids and chlorophylls, therefore increasing nitrogen level increased multiplication of cells, which enhance the amount of metabolites necessary for building plant organs and causes more seed cotton yield. These results are in accordance with those obtained by Metwally (2006). and Assy and abd El-Malak (1997).

Regarding the effect of potassium fertilizer application, the same data indicated that there were significant responses of seed cotton yield towards potassium application. These results might by attributed to the role of potassium in encouraging root hairs to grow early and increasing its elongation as well as early appearance of bolls of cotton plants. In addition, potassium affects promotion of photosynthesis and carbohydrate metabolism, and association with protein synthesis and water relation in plant, and its positive effect on increasing the fruiting capacity of cotton plants. These results are in agreement with those obtained by El-Sayed and El-Menshawi (2001).

3- N, P and K concentration of cotton Leaves:-

A- Nitrogen concentration of cotton leaf:

Data in Table (5) indicated that there was a significant decrease in N concentration of cotton leaf due to late planting, while there was a high significant increase in N concentration of cotton leaf owing to applying N fertilization up to 90 kg N /fed. which recorded the highest value of N concentration. Those results are in accordance with those of Abd El-Magid (2002) and Metwally (2006).

On the other hand the same data indicated that there was insignificant increase in nitrogen concentration of cotton leaf with applying 24 kg K2O / fed in the two seasons.

B- Phosphorous concentration of cotton leaf:

Data in Table (5) clearly indicated that both timing of planting and potassium fertilization caused insignificant increase in P% of cotton leaf in the two seasons, while applying N fertilization (up to 90 kg N /fed) induced positive significant increase in P concentration in the two seasons compared to the control treatment. These results had been supported by Metwally (2006).

C- Potassium concentration of cotton leaf:

The results illustrated in Table (5) showed that late planting induced gradually decrease in K% of cotton leaf in the two seasons, while N and K fertilization treatments resulted in a high significant increase in potassium concentration of cotton leaf in the two seasons.All these results may be attributed to role of N and K in helping the plant to grow healthy and subsequently allow more nutrients uptake by the root system. - Interaction effect:

Concerning the interaction effect between nitrogen fertilizer and sowing date, the obtained date in Table (6) revealed insignificant effect on all trails studied in this investigation except seed cotton yield, number of open bolls per plant in the two seasons, and 100- seed weight only in the second season .

Table (5): N, P and K concentrations of cotton leaves at peak of flowering stage as affected by sowing dates, nitrogen and potassium fertilizers in the two seasons.

Treatments		N%		P%		K%	
		1st season	2nd season	1st season	2nd season	1st season	2nd season
Time of planting	First	3.04	2.99	0.337	0.333	3.34	3.40
	Second	3.00	2.92	0.339	0.331	3.19	3.22
	Third	2.92	2.90	0.333	0.335	3.08	3.13
	F. test	x	x	N.S	N.S	xx	xx
	L.S.D	0.074	0.061	-	-	0.073	0.066
N fertilization rates	45 kg N/fed	2.66	2.70	0.313	0.321	3.01	3.08
	60 kg N/fed	2.91	2.90	0.334	0.335	3.13	3.16
	75 kg N/fed	3.17	3.10	0.345	0.344	3.33	3.38
	90 kg N/fed	3.20	3.18	0.354	0.355	3.34	3.41
	F. test	xx	xx	xx	xx	xx	xx
	L.S.D	0.077	0.063	0.006	0.005	0.065	0.062
K fertilization rates	O	2.96	2.91	0.335	0.329	3.11	3.06
	24 kg K_2o/fed	3.01	3.00	0.338	0.331	3.29	3.25
	F. test	N.S	N.S	N.S	N.S	xx	xx
	L.S.D	-	-	-	-	0.059	0.060
Interactions	T X N	N.S	N.S	N.S	N.S	N.S	N.S
	T X K	N.S	N.S	N.S	N.S	N.S	N.S
	N X K	N.S	N.S	N.S	N.S	N.S	N.S
	T X N X K	N.S	N.S	N.S	N.S	N.S	N.S

Table (6): Seed cotton yield, number of open bolls / plant and 100 seed weight as affected by the interaction between nitrogen fertilizer and sowing date in the two seasons.

Treatments				Seed cotton yield (ka. N/ fed.)		No. of open bolls / plant		100 seed weight (g)
				2004	2005	2004	2005	2005
Nitrogen fertilization rates	45kg N / fed	Sowing date	First date	11.10	7.31	22.20	18.20	8.59
			Second date	8.35	6.91	19:80	14.80	8.52
			Third date	6.55	6.34	13.70	10.30	9.84
	60 kg N / fed	Sowing date	First date	11.95	8.35	26.00	22.30	9.08
			Second date	8.75	7.80	21.80	16.80	9.01
			Third date	6.10	6.21	12.80	10.50	10.10
	75 kg N / fed	Sowing date	First date	12.25	8.50	25.50	19.80	9.32
			Second date	8.35	7.70	20.00	15.80	8.92
			Third date	6.35	5.90	13.70	11.70	10.33
	90 kg N / fed	Sowing date	First date	11.45	7.60	24.00	19.00	8.72
			Second date	8.10	7.02	19.50	14.70	8.76
			Third date	6.10	5.50	12.50	5.80	10.31
	F. Test			x	x	x	xx	x
	L.S.D at 5%			0.453	0.388	2.069	1.991	0.238

Generally it is recommended to grow cotton early at the last week of March, using (75 kg N /fed+ 24 kg K2o /fed) to gain the maximum yield of cotton, while in the case of late sowing at the first week of May it can be recommended to use (45 kg N /fed+ 24 kg K2o /fed) for Giza 86 cotton cultivar under the conditions of this study.

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تأثير ميعاد الزراعة والتسميد النتروجيني والبوتاسي على محصول القطن تحت ظروف الأراضي المتأثرة بالأملاح في شمال الدلتا

محمد محسن الذكي ، سمير غريب متولي ، شاكر زيد صالح و إبراهيم محمد البنا
معهد بحوث الأراضي والمياه والبيئة – مركز البحوث الزراعية – الجيزة – مصر .

أقيمت تجربتان حقليتان في محطة البحوث الزراعية بالسرو – محافظة دمياط خلال الموسمين الصيفيين ٢٠٠٤/٢٠٠٥ لدراسة تأثير ثلاث مواعيد لزراعة القطن وثلاث معدلات من التسميد النتروجيني ومستويين من التسميد البوتاسي وكذلك التفاعل بينهما على محصول القطن ومكوناته وتركيز عناصر النتروجين والفوسفور والبوتاسيوم في الأوراق وذلك لصنف القطن جيزة ٨٦ استخدم التصميم الإحصائي القطع المنشقة مرتين في أربع مكررات وكانت النتائج المتحصل عليها كالأتي :

١- أدي التأخير في ميعاد زراعة القطن إلى حدوث نقص معنوي في عدد اللوز المتفتح / نبات ، وزن اللوزة ، نسبة الحليج ، محصول القطن / محصول البذرة ، محصول الشعر للفدان وكذلك تركيز عنصري النتروجين والبوتاسيوم في الأوراق . في حين لم يتأثر تركيز عنصر الفوسفور وذلك خلال موسمي الزراعة .

٢- أدى زيادة التسميد النتروجيني إلى ٧٥ وحدة نتروجين للفدان إلى حدوث زيادة معنوية في جميع الصفات المدروسة مقارنة بمعاملة الكنترول وذلك خلال موسمي الزراعة .

٣- أظهرت النتائج أيضا أن التسميد البوتاسي سلك نفس سلوك التسميد النتروجيني على جميع الصفات تحت الدراسة .

٤- أظهر التفاعل بين مواعيد الزراعة والتسميد النتروجيني تأثير معنوي على كل من عدد اللوز المتفتح / للنبات ، محصول القطن خلال موسمي الزراعة وكذلك وزن المائة بذرة خلال الموسم الثاني فقط .

- يمكن التوصية بزراعة القطن مبكرا في الأسبوع الأخير من شهر مارس مع استخدام ٧٥ كجم نتروجين / فدان + ٢٤ كجم لو٢ أ / فدان لتعظيم إنتاجية محصول القطن ، وفي حالة تأخير ميعاد الزراعة إلى الأسبوع الأول من شهر مايو ينصح بعدم الإفراط في التسميد النتروجيني ويوصي باستخدام معدل ٤٥ كجم نتروجين للفدان + ٢٤ كجم لو٢ أ / فدان وذلك للصنف جيزة ٨٦ تحت ظروف الأراضي المتأثرة بالأملاح في منطقة شمال الدلتا .