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EFFECT OF NPK FERTILIZERS ON COTTON INFESTATION WITH WHITEFLY AND PINK BOLLWORM

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ABSTRACT

The effects of the major plant nutrients, NPK on cotton infestation by *Bemisia tabaci* (Genn); *Pectinophora gossypiella* (Saund.) and some associated predators, were conducted at Sakha Agricultural Research Station, Kafr El-Sheikh Governorate, Egypt during 1997 and 1998 seasons. The obtained results revealed that the effect of phosphorus was pronounced on the occurrence of whitefly, while the effect of nitrogen was variable. All fertilization treatments have no effect on the population size of the pink bollworm. As for associated predator, the use of normal fertilization exhibited relative increase of the population size.

INTRODUCTION

Correct nutration is a key factor in cotton production and has more direct effect on yield than unit quality (Elbelhar *et al.*, 1991). Several agricultural practices have been tried to reduce the population size of pests infesting cotton plant.

The balance between NPK elements, is critical for crop production because every elements affect the uptake of the others. Also, the balance between these nutrient elements can change the plant as food for insect (Coaker, 1987).

Several work concerning the effect of fertilizers on the population trend of the main insect pests on different crops has been undertaken (Farrag *et al.*, 1980, Hoda *et al.*, 1986, Sharaf and Nazer, 1983, Rote and Puri, 1992 and El-Hawary *et al.*, 1995).

The aim of the present work was to study the effect of the major fertilizer nutrients, NPK on cotton infestation with some pests.

MATERIALS AND METHODS

This work was carried out during 1997 and 1998 cotton growing seasons at Sakha Agriculture Research Station, Kafr El-Sheikh Governorate. The cultivated cotton variety was Giza 89. The treatments were arranged in complete randomized block design with four replicates of half feddan for each.

Normal agricultural practices were carried out without any insecticidal treatments through the whole growing seasons.

The studied insects were the cotton whitefly, *Bemisia tabaci* (Genn.), the pink bollworms, *Pectinophora gossypiella* (Saund). and some associated predators namely, *Paederus alfierii, Coccinella undecimpunctata, Scymnus* spp. and true spiders (adults). Examination of weekly samples (25-leaves each/replicate) were initiated from May 17th till 23rd September (1997) and

from the fifth of June till 20th of September (1998). The leaves were taken from lower, middle and upper portions of the plant, leaf samples were transferred to the laboratory on the same day and the total number of immature stages (larvae and pupae) of the whitefly found on both surface of each leaf was counted. Twenty five green bolls/each replicate were weekly picked up starting from July 30th till September 10th (1997) and July from 28th till September 11th (1998).

Treatments:

1. 90 (N) (N_1)
2. 90 (N) + 30 (P_2O_5) (N_1P_1)
3. 90 (N) + 30 (P_2O_5) 48 (K_2O) ($N_1P_1K_1$).
4. 60 (N) (N_2).
5. 60 (N) + 15 (P_2O_5) (N_2P_2).
6. 60 (N) + 15 (P_2O_4) + 24 (K_2O) ($N_2P_2K_2$).
7. Control without fertilization.

Treatment composition:

1. Nitrogen (ammonium sulphate 31% (N).
2. Phosphorus superphosphate 16% (P_2O_5).
3. Potassium (potassium sulphate 52% K_2O).

The data were statistically analyzed using Duncan's multiple range test (DNMRT).

RESULT AND DISCUSSION

a.Effect of fertilization treatment on *B. tabaci* population::

Data in Table (1) showed that, the total mean numbers of whitefly can be arranged in the following descending orders, 286.1, 249.3, 248.5, 236.1, 233.7, 201.9 and 168.9 for N(60)+P(15), N(90) + P(30), N (60) + P (15) + K (24), control, N (90), N (60) and N (90) + P (30) + K (48), respectively in 1997 season. During the second season 1998 *B. tabaci* population was remarkably higher than that of 1997 season. Based on the control check counts, the increased percentages reached 31.6, 25.9, 24.0, 20.2, 16.8 and 11.1. For N (60), (N (90) + P (30) + K (48), N (60) + P (15), N (60) + P (15) + K (24), N (*90) and N (90) + P (30), respectively. The effect of phosphorus was pronounced in the occurrence of whitefly in the first year, while plants fertilized with high rates of nitrogen either alone or with phosphorus resulted in progressively greater foliage weights and that increase in plant and vigour enabled plants to stand against whitefly bled up, this was in contrast with Rote and Puri (1992) they found that the highest population of *B. tabaci* was recorded on cotton plant receiving the highest dose of fertilizer (200: 100: 100 kg NPK/ha). Also, Purohit and Deshpande (1991) mentioned that, normal and double rates of NPK fertilizer increased the *B. tabaci* infestation of cotton plants compared with untreated plants. Klingaut (1998), reported that aphids are affected negatively or positively by phosphorus, while low K supply and even K deficiency of host plants usually favor aphid infestation.

Table (1): Number of immature stages of whitefly *Bemisia tabaci* per 100 leaves during 1997 and 1998 seasons.

Season	Sampling Date		Treatments						
			N_1	N_1O_1	$N_1P_1K_1$	N_2	N_2O_2	$N_2P_2K_2$	Control
1997	June	17	22	29	31	32	92	27	39
		23	32	53	43	43	39	81	45
		30	45	39	43	49	54	39	34
	July	7	83	42	58	56	32	41	82
		13	24	27	27	22	36	26	4
		20	38	27	43	58	28	57	38
		28	124	308	158	198	255	233	268
	Aug.	6	315	404	307	329	495	391	363
		13	389	436	397	425	561	356	349
		0	451	982	424	564	1032	1121	809
		24	986	489	269	358	421	311	345
	Sep.	3	356	280	230	294	355	330	398
		10	289	208	212	154	481	169	291
		17	208	218	189	201	211	310	197
		23	143	197	103	240	199	235	243
	Total		3505	3739	2534	3023	4291	3727	3541
	Mean		233.7	249.3	168.9	201.5	286.1	248.5	236.1
% of different than control			-1.017	+5.592	-28.439	-14.629	21.180	+5.253	
1998	June	12	34	42	55	49	35	84	103
		19	82	87	442	83	77	115	82
		26	43	25	205	113	157	280	71
	July	3	17	80	85	270	90	270	132
		10	23	49	23	33	33	32	220
		17	108	115	199	91	65	82	43
		24	135	53	554	92	186	135	107
		31	540	190	239	84	243	495	139
	Aug.	7	1029	430	201	139	486	1280	292
		15	820	890	1121	981	1062	1032	950
		22	201	330	1631	1213	1282	981	681
		30	430	1020	782	1613	720	321	1083
	Sep.	7	991	640	642	942	813	711	793
		14	1172	1922	293	600	739	129	194
		20	145	1392	193	250	189	81	91
	Total		5820	5535	6270	6553	6177	5978	4981
	Mean		388	369.0	418.0	436.8	411.8	398.5	332.1
% of different than control			+16.8	+11.1	+25.9	+31.6	+24.0	+20.0	

L.S.D. at 0.05 p = 53.324 (1st year), and 67.32 (2nnd year)

b.Effect on pink bollworm:

The data presented in Table (2) show that, in 1997 and 1998 seasons. All population treatments have no effect on population size of the pink bollworm. The present results are in contrast to those obtained by Wahba (1996) and Korkor *et al.* (1998), they reported that a reduction in percent infestation of cotton bollworm was observed with superphosphate spraying.

From these results it appears that pink boll worms number were higher in the first season than in the second one. this may due to the differences in environmental conditions and/or the abundance of natural enemies.

Table (2): Number of pink bollworm. *Pectinophora gosspiellal*100 green boll in 1997 and 1998 seasons.

Season	Sampling Date		Treatments						
			N_1	N_1O_1	$N_1P_1K_1$	N_2	N_2O_2	$N_2P_2K_2$	Control
1997	July	30	10	7	8	6	9	8	7
	Aug.	8	16	14	15	16	13	17	13
		15	18	18	16	15	20	18	20
		22	22	23	17	17	23	19	25
		30	42	39	37	37	32	26	30
	Sept.	2	25	39	36	36	42	35	35
		10	62	54	47	57	60	74	60
	Total		177	193	186	184	204	197	190
	Mean		25.3	27.6	26.6	26.3	29.1	28.1	27.1
1998	July	28	4	5	6	4	10	6	3
	Aug.	5	7	6	8	7	12	7	9
		12	15	20	15	16	11	13	17
		19	17	13	10	11	19	19	20
		26	26	31	27	17	19	29	29
	Sept.	4	30	29	31	27	33	43	20
		11	36	32	43	38	39	45	41
	Total		135	136	14	120	143	162	139
	Mean		19.3	19.4	20.0	17.1	20.4	23.1	19.9

L.S.D. at 0.05 p = 10.081 (1^{st} year), and 6.943 (2^{nd} year)

Effect on associated predators:

Population size of the considered predators are presented in Tables (3-4). In 1997 season, data indicated that *P. alfierii* was the most abundant species, followed by true spiders, *Scymnus* spp. and *C. undecimpunctata*, respectively. The same trend was recorded in 1998. Statistical analysis revealed insignificant differences between different fertilizer treatments of *P. alferii* size arranged descendingly from 718 to 806 (L.S.D. at 0.05 probability = 35.487) in 1997. The same trend in 1998 whereas, the aforementioned number were from 677 to 735 (L.S.D. at 0.05 probabilty was 29.813) in 1998. There is an obvious fluctuation in the results effect, for example the highest population was noticed with ($N_1P_1K_1$) in 1997, the corresponding in 1998 was the untreted check. Another trend of results was found with the population size, but there was significancy among all treatments and the untreated check (L.S.D. was 40.576) in 1998. The same was in 1997, with obvious fluctuation among treatment in the two seasons. *Scymnus* spp. was the 3^{rd} predator (as a population size), pronounced differences were found between the 1^{st} treatment (N=90) and the highest population in control (L.S.D. at 0.05 probability = 20.129). *C. undecimpunctata* proved significantly among the third treatment, ($N_1P_1K_1$, 55, 1997 and 65 in 1998) and the other fertilizer treatments.

Table (3):Number of associated predators/100 cotton seedling or leaves during 1997 season.

Sampling date		Treatments																									
		N_1				N_1P_1				$N_1P_1K_1$				N_2				N_2P_2				$N_2P_2K_2$				Control			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
May	17	0	6	12	0	0	3	2	0	0	6	2	0	0	4	19	0	0	7	2	0	0	11	3	0	0	3	2	0
	26	0	6	2	0	0	16	1	0	0	14	0	0	0	17	1	0	0	10	3	0	0	17	3	0	0	14	2	0
June	3	0	27	4	0	0	30	3	0	0	18	2	0	0	24	4	0	0	39	3	0	0	28	4	0	0	28	3	0
	10	0	17	9	6	0	16	8	13	0	9	7	4	0	16	22	3	0	16	14	5	0	14	13	6	0	12	5	5
	17	0	17	16	1	0	16	9	1	0	10	8	1	0	16	6	1	0	16	7	3	0	14	12	0	0	13	7	2
	23	13	13	23	0	22	19	20	0	5	10	12	0	10	11	11	0	3	23	23	0	7	16	23	0	13	13	17	0
	30	22	12	2	4	31	17	0	5	43	16	2	3	20	9	0	16	33	18	0	4	22	12	0	4	12	12	2	6
July	6	29	13	1	27	43	12	1	36	52	6	1	35	27	6	1	32	41	9	5	40	31	6	2	55	23	11	1	41
	13	53	10	3	59	92	16	2	77	81	15	6	66	94	9	1	56	48	15	0	57	39	15	1	59	42	14	7	83
	20	198	10	10	53	153	17	10	63	201	14	7	61	189	8	1	67	201	18	1	52	192	10	0	69	212	15	12	66
	28	186	49	0	15	174	39	0	14	164	43	2	50	169	43	10	24	173	38	10	28	139	60	10	23	178	36	0	31
Aug.	6	84	25	1	0	71	40	1	3	89	53	0	3	107	7	0	0	131	26	0	0	140	26	0	5	93	12	4	2
	13	73	49	2	0	63	31	1	0	72	84	1	0	50	19	2	0	61	11	1	0	53	31	2	0	85	29	5	2
	20	62	103	4	0	52	16	2	0	57	153	0	0	40	64	0	0	53	7	2	0	62	53	1	0	54	38	0	0
	27	10	22	2	0	32	13	1	0	31	32	1	0	12	13	0	0	32	64	3	0	22	7	2	0	28	0	0	0
Sept.	3	0	5	0	0	8	17	0	0	11	52	0	0	0	28	1	0	8	12	1	0	20	4	0	0	2	20	9	0
	10	0	7	0	0	0	7	0	0	0	10	0	0	0	31	17	0	0	19	0	0	0	25	0	0		12	0	0
	17	0	41	11	0	0	100	9	0	0	41	4	0	0	84	3	0	0	76	7	0	0	39	7	0	0	17	11	0
Total		730	442	100	165	741	425	70	212	806	580	55	223	718	409	99	199	784	427	82	189	727	418	83	221	742	299	87	238
General mean		359.3				362.0				416.0				356.25				37.5				362.25				341.0			
% different than control +/-		+5.4				+6.2				+22.0				+4.5				+8.7				+6.2							

N_1 = 90 P_1 = 30 K_1 = 48
N_2 = 60 P_2 = 15 K_1 = 24
1 = *Paederus alferii*
2 = True spider
3 = Coccinella undecimpunctata
4 = *Scymnus* spp.

Table (4):Number of associated predators/100 cotton seedling or leaves during 1998 season.

Sampling date		Treatments																									
		N_1				N_1P_1				$N_1P_1K_1$				N_2				N_2P_2				$N_2P_2K_2$				Control			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
June	5	5	18	5	2	6	14	3	2	3	18	1	-	5	15	7	1	3	14	4	3	4	10	1	2	8	14	7	3
	12	36	48	10	1	38	39	13	12	35	29	17	7	45	28	8	6	29	22	7	3	26	15	3	2	28	25	1	4
	19	31	46	12	0	35	22	19	4	40	38	3	20	42	21	22	9	35	18	9	3	29	12	8	4	29	21	19	7
	26	27	27	9	0	40	40	1	13	41	39	1	19	45	16	18	13	40	19	21	14	25	17	20	9	37	16	2	0
July	3	116	29	3	13	116	17	1	11	134	32	0	25	84	22	13	24	90	33	12	18	111	21	16	15	122	8	1	0
	10	147	22	2	21	160	18	3	22	182	23	0	37	161	27	8	22	143	19	16	24	155	18	7	30	146	4	2	29
	12	217	18	1	27	178	29	4	23	211	19	4	32	181	33	3	29	204	29	9	23	188	21	11	43	234	11	8	31
	24	73	22	1	32	72	28	1	28	68	4	9	33	98	27	0	31	104	31	3	30	90	27	8	62	90	18	11	30
	31	13	39	7	21	28	31	2	30	14	38	3	21	7	29	7	34	26	34	2	28	33	19	0	50	20	18	8	48
Aug.	7	9	17	11	19	14	41	3	17	10	34	2	17	6	41	5	39	19	39	0	15	12	22	8	28	15	12	9	32
	15	3	29	8	9	5	38	17	16	0	31	7	8	8	42	4	45	15	45	5	18	6	31	9	9	6	9	7	23
	22	0	36	13	8	0	27	2	8	0	29	9	7	0	32	1	32	0	32	1	10	0	22	3	0	0	12	5	9
	30	0	26	14	4	0	19	3	7	0	21	4	0	0	21	7	20	0	20	3	0	0	17	2	0	0	13	3	8
Sept.	7	0	21	3	3	0	14	8	4	0	20	3	2	0	19	0	10	0	10	3	1	0	11	1	0	0	16	3	3
	14	0	36	1	1	0	10	9	3	0	18	2	0	0	14	4	10	0	11	1	1	0	5	1	0	0	11	1	4
	20	0	14	1	0	0	0	0	0	0	0	0	0	0	1	1	11	0	10	0	0	0	0	0	0	0	6	0	0
Total		677	400	101	161	692	392	75	198	728	437	65	228	682	388	108	219	708	376	96	191	679	268	93	255	735	214	96	232
General mean		334.8				339.3				364.5				349.3				342.8				323.8				319.3			
% different than control +/-		+4.9				+6.3				+14.2				+9.4				+7.4				+1.4							

$N_1 = 90$ $P_1 = 30$ $K_1 = 48$

$N_2 = 60$ $P_2 = 15$ $K_1 = 24$

1 = *Paederus alferii* 2 = True spider

3 = *Coccinella undecimpunctata* 4 = *Scymnus* spp.

REFERENCES

Coaker, T.M. (1987). Cultural methods, in: Burn, A.J., Coaker, T. and P.C. Jepson. Integrated Pest Management, Academic Press, London, pp. 69-88.

Elbelhar, W.M.; Gardon, R.T. and Pringle, H.C. (1991). Potassium and nitrogen interactions. Beltwide Cotton Conference USA.

El-Hawary, I.S.; Shenishen; M.s. Tadros and M.M. Ibrahim (1995). Effect of the foliar fertilizers and plant growth regulator on *Aphis gossypii* (glover), *Bemesia tabaci* (Genn.) and consequence on *Pectinophora gossypiella* infestation in cotton fields. Menofia J. Agric., 20(4): 1545-1603.

Farrag, A.M.I.; A..S. Abdel Salam; H.L. Wahba and M.S. Abu-Lela (1980). Effect of soil fertilization on the population density of the spider mite, *Tetranychus arabicus* on soybean plants. First conference plant protection. Research Institute Cairo Egypt, 1980, 3: 31-39.

Hoda, F.M.; M.H. El;-Beheir; G.A. Ibrahim and H.A. Taha (1986). Effect of soil fertilization and density of plant on the population of the spider mite *Tetranychus cucurbitacearum* (Sayed) on soybean plants. Bull. Soc. Ent. Egypt, 66-97.

Klingaut, F.A. (1987). Feeding adaptation and excretion. Pages 225-253, In A.K. Minks and P. Harrewin. Eds., Aehids, Their biology natural enemies on and control volume. A. Amsterdam.

Korkor, A.A.; A.M Hamid and A.M. El-Beltagy (1998). Effect of different local inorganic production on the population density of some cotton pests. Alex. Sci. Xch: 19(4): 559-570.

Sharaf, NB.S. and J.K. Nazer (1983). Effect of N, P and K soil fertilizers on population tread of the tobacco whitefly *Bemsiia tabaci* Genn (Homoptera, Aleyrodedae) and the incidence of tomato yellow leaf curl virus in tomato in the Jordan Valley. Agric. Res. J., Univ. of Jordan, J.: 13-24.

Purohit, M.S. and A.D. Deshpande (1991a). Effect of inorganic fertilizers and insecticides on population density of cotton whitefly *B. tabaci*. Indian J. of Agric. Sci., 61(9): 696-698.

Rote, N.B. and S.N. Puri (1992). Effect of fertilizer application on incidence of whitefly on different cotton cultivars. J. of Maharashtra Agric. Univ., 19(1): 45-18.

Wahaba, E.A. (1996). Studies on strategic control some cotton pest s. M.Sc. Thesis, Fac. of Agric. Al-Azhar Univ.

تاثير النيتروجين والفسفور والبوتاسيوم كعناصر سمادية علـــى إصابـــة القطـــن بالذبابة البيضاء ودودة اللوز القرنفلية

فايزة حسن شرف

معهد بحوث وقاية النباتات ــ مركز البحوث الزراعية بالدقى

الهدف من إجراء البحث هو تأثير إضافة العناصر السمادية الرئيسية الثلاثية النيتروجين والفسفور والبوتاسيوم على إصابة القطن بالذبابة البيضاء ودودة اللوز القرنفلية وبعض الأعداء الحيوية. وقد أجريت التجربة فى محطة البحـــوث الزراعيـــة بســـخا ــ محافظة كفرالشيخ فى موسم ١٩٩٧ ، ١٩٩٨م وأوضحت النتائج المتحصل عليها أن تأثير الفسفور واضح على معدل الإصابة بالذبابة البيضاء بينما تأثير النيتروجين متغير . وأن العناصر السمادية الثلاثة لا تؤثر على نسبة الاصابة بدودة اللوزة القرنفلية. بالنسبة للأعداء الحيوية وجد أن المعدل الطبيعى للثلاثة عناصر تؤدى الى زيادة التعداد.