

## EFFECT OF DIFFERENT RATES OF (N, P, K) FERTILIZERS ON *BEMISIA TABACI* (GENN.) INFESTATION ON TOMATO AND ITS EFFECT ON THE YIELD

K.K. EL-RAFIE

Plant Protection Research Institute, Agricultural Research Centre, Dokki, Giza.

(Manuscript received 12 January 1998)

### Abstract

The relation between the major plant nutrients, NPK and their combinations on tomato infestation with *B.tabaci* (Genn.), was studied in Imbaba district, Giza Governorate during 1995-1996. An obvious increase of this pest accompanied by decreasing in tomato yield was observed on the plants treated with high levels of N. (ammonium sulphate, 21% N).

On the other hand, the study proved that the moderate level of N (150 unit) corresponding with potassium sulfate [Potassium sulfate, 60 units/(K<sub>2</sub>O)] and superphosphate (60 unit/P<sub>2</sub>O<sub>5</sub>) - in mixtures-gave low population of *B.tabaci* and higher level in yield.

### INTRODUCTION

The relationship between mineral contents of tissues and their effect on insect infestation has been taken in consideration in the recent years. Elements such as, nitrogen, phosphorus, potassium, calcium, iron, zinc, manganese, magnesium, etc. appeared to affect plant attacked by insects (Hasseman, 1946). The author showed that the greenhouse thrips *Heliethrips haemerhoidalis* (Bouche) attacked only those plants growing on the lower levels of nitrogen, although calcium played no important role in making the plants attractive to the pest. Hunter (1958) reported that higher concentration of nitrogen in tomato roots infected by *Meloidogyne incognita acrita* than in the healthy roots. Beckham in Georgia (1970) reported that *Aphis gossypii* were more numerous on the leaves of its vegetable hosts as the nitrogen rate increased. Sharaf and Nazer (1983) found that the use of P<sub>2</sub>O<sub>5</sub> fertilizer improved the development of the tomato plants, thus encouraging whiteflies migration.

The effect of N.P.K. and their combinations on tomato infestation caused by *Myzus persicae* Sulz. and *Thrips tabaci* Lind. studied by Omar *et al.* (1993). They mentioned that an obvious increase of these pests was observed on plants treated with superphosphate (16% P<sub>2</sub>O<sub>5</sub>, 300 kg/fed.) either alone or in mixtures with potassium sulfate (48% P<sub>2</sub>O, 100 kg/fed.) and ammonium sulfate (21% N, 300 kg/fed.).

Tomato at Nili plantation suffered from the infestation of *B.tabaci* in Giza Governorate, therefore the present study was conducted to study the relation between levels of N.P.K., *Bemisia tabaci* (Genn.) infestation and its relation with tomato yield.

### MATERIALS AND METHODS

Field trials were carried out over two tomato growing seasons (Nili plantations of 1995 and 1996). The main purpose of these trials was to determine the relationship between rates of N, P<sub>2</sub>O<sub>5</sub>, P<sub>2</sub>O fertilizers, on *B.tabaci* tomato infestation, and tomato yield.

The experimental area was five feddan at Abo-Ghaleb village, Imbaba district, Giza province, cultivated by Dora tomato hybrid. The field was divided into 108 plots, i.e. 3 rates x 4 replicates in a complete randomized plot design.

Forty days after planting, weekly samples of 30 leaves each, were chosen, at random, from the plants of each replicate, examined for adults carefully, early in the morning, and picked in a paper bag for laboratory examination. Sampling was continued for 12 weeks and the weekly infestation averages were worked out for each replicate.

Three rates of previous nutrient elements were tested in these trials in alternation as following:

Rates of Nitrogen (N) were 100, 150 and 200 units added four times, the first after hoeing and before the 1st irrigation. The second at flowering stage, the third at fruiting stage and the fourth before colouring stage.

Rates of Phosphorus (P<sub>2</sub>O<sub>5</sub>) were 40, 50 and 60 units added before the second ploughing.

Rates of Potassium (K<sub>2</sub>O) were 40, 50 and 60 units added twice; the first at flowering and the second at fruiting stage.

At the end of the season, the yield was evaluated, and the average for every treatment was recorded.

## RESULTS AND DISCUSSION

### Effect of NPK against *Bemisia tabaci* (Genn.) population

The population averages of *B. tabaci* under the different fertilizer treatments in the two successive seasons of 1995 and 1996 was shown in Table 1 and 2.

The largest increase in the whitefly population was found in (200 unit of N + 60 unit of  $P_2O_5$  + 40 unit of  $K_2O$ ), (200 unit of N + 40 unit of  $P_2O_5$  + 40 unit of  $K_2O$ ), (200 unit of N + 40 unit of  $P_2O_5$  + 50 unit of  $K_2O$ ) and (200 unit of N + 60 unit of  $P_2O_5$  + 50 unit of  $K_2O$ ) treatments. Moderate increase of infestation was noticed in (150 unit N + 50 unit  $P_2O_5$  + 40 unit  $K_2O$ ), (150 unit of N + 50 unit of  $P_2O_5$  + 40 unit of  $K_2O$ ), and (150 unit of N + 60 unit of  $P_2O_5$  + 40 unit of  $K_2O$ ). On the other hand, low population was found in moderate levels of N and high levels of  $P_2O_5$  and  $K_2O$ . Results in Tables 1 and 2 confirmed these findings which were significantly higher in the two successive season, 1995 and 1996.

Plants fertilized with high rates of nitrogenous fertilizers were longer, had more and larger leaves. This would attract further adults of *B. tabaci* as well as providing a more favourable habitat for population of the tomato whitefly. The aforementioned results were in agreement with Sharaf and Nazer (1983) who studied the effect of soil fertilizers on the population of *B. tabaci* on tomato.

### Effect of NPK on the yield

At the end of the season of the two successive seasons 1995 and 1996, yield was determined as weight in kilogram. Analytical methods by F-test and L.S.D. was calculated. As shown in Tables 1 and 2, the yield of treatments which had more population of *B. tabaci* were very low in the yield. On the other hand, treatments which had low population of *B. tabaci* gave the higher level in tomato yield.

Table 1. Effect of different fertilizers and their combinations on *Bemisia tabaci* population infesting tomato and corresponding yield during Nili plantation, 1995.

Fertilization rate (units)		No. of <i>B. tabaci</i> adults and yield in every replicate												Mean no. of <i>B. tabaci</i> adult Y	Mean yield of replicate (kg) X
N	P <sub>2</sub> O <sub>5</sub>	R1			R2			R3			R4				
		Y1	X1	Y2	X2	Y3	X3	Y4	X4	Y5	X5	Y6	X6		
100	60	58	841	57	843	59	840	58	842	58	842	232	3366	841.5	
15	60	62	886	63	884	65	887	61	883	61	883	251	3540	885	
100	60	57	722	55	725	57	721	56	719	56	719	225	2887	721.75	
150	60	50	69	703	71	701	68	705	69	700	67	702	2809	702.25	
100	50	60	92	609	91	605	93	607	91	608	367	91.75	2429	607.25	
150	50	60	66	679	60	681	67	677	65	679	262	65.5	2716	679	
150	40	60	74	673	71	671	75	674	72	672	292	73.0	2690	672.5	
150	40	50	85	661	84	662	86	665	83	660	338	84.5	2648	662	
150	50	50	86	659	87	657	85	659	87	657	345	86.25	2632	658	
150	60	40	89	653	91	651	88	655	90	652	358	89.5	2611	652.75	
150	40	40	99	641	97	639	99	642	96	640	391	97.75	2562	640.5	
100	60	40	101	603	104	601	101	604	103	602	409	102.25	2210	602.5	
200	40	60	116	591	110	589	117	590	119	691	464	116.0	2461	615.25	
150	50	40	128	589	129	590	128	592	124	587	509	127.25	2358	589.5	
200	40	50	151	547	149	544	153	549	150	546	603	150.75	2186	546.5	
100	40	60	158	512	160	515	158	508	161	511	637	159.25	2046	511.5	
200	50	60	152	576	150	572	153	575	155	572	610	152.5	2295	573.75	
100	50	50	166	561	163	560	166	566	164	558	653	163.25	2245	561.25	
200	40	40	168	550	170	546	168	549	170	552	676	169.0	2197	549.25	
200	50	50	169	536	167	540	169	534	166	531	671	167.75	2141	535.25	
200	60	60	182	521	181	556	179	518	183	520	725	181.25	2085	521.25	
100	50	40	186	502	185	500	187	504	186	449	744	186.0	2005	501.25	
200	50	40	189	489	191	486	188	491	180	487	758	189.5	1953	488.25	
200	60	50	192	476	195	481	192	479	194	473	773	193.25	1909	477.25	
100	40	50	197	468	199	462	196	465	195	469	787	196.75	1864	466	
100	40	40	196	451	194	448	192	452	194	450	776	194.0	1801	450.25	
200	60	40	204	425	201	421	207	427	203	421	815	203.75	1694	423.5	
LSD												41.50*	121.25*		

Number of *Bemisia tabaci* based on 30 leaves/sample.

Table 2. Effect of different fertilizers and their combinations on *Bemisia tabaci* population infesting tomato and corresponding yield during Nili plantation, 1996.

Fertilization rate (units)			No. of <i>B. tabaci</i> adults and yield in every replicate												Mean no. of <i>B. tabaci</i> /adult Y	Mean yield of replicate (kg) X				
N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	R1			R2			R3			R4								
			Y1	X1	Y2	X2	Y3	X3	Y4	X4	Y1	X1	Y2	X2	Y3	X3	Y4	X4		
100	60	60	56	852	59	841	52	854	57	861	52	854	57	861	52	854	57	861	3408	852
150	60	60	61	797	52	776	63	782	55	791	63	782	55	791	63	782	55	791	3146	786.5
100	60	50	55	731	63	722	58	736	64	742	58	736	64	742	58	736	64	742	2931	732.75
150	60	50	66	715	63	723	59	723	49	64	712	59	723	49	64	712	252	63.00	2869	717.25
100	50	60	91	616	89	622	63	619	92	621	62	619	92	621	62	619	92	621	335	83.75
150	50	60	64	687	67	685	85	691	69	697	67	685	85	691	69	697	257	64.25	2760	690.0
150	40	60	73	681	76	673	75	685	77	683	76	673	75	685	77	683	294	73.5	2722	680.5
150	40	50	82	673	80	668	83	661	856	654	330	82.5	2656	664.0						
150	50	50	83	679	86	658	81	661	84	653	334	83.5	2651	662.75						
150	60	40	85	661	84	627	81	663	89	654	339	84.75	2650	662.5						
150	40	40	96	662	98	653	93	659	97	655	384	96.00	2629	657.25						
100	60	40	98	612	105	631	99	625	103	628	405	101.25	2496	624.00						
200	40	60	113	618	108	616	105	621	106	629	432	108.00	2484	621.00						
150	50	40	123	602	119	605	117	609	121	617	480	120.00	2433	608.25						
200	40	50	149	593	153	587	147	599	146	586	595	148.75	2365	591.25						
100	40	60	151	518	148	507	157	513	151	506	607	151.75	2044	11.00						
200	50	60	148	591	157	579	159	583	157	573	621	155.25	2326	581.5						
100	50	50	157	579	159	561	161	572	156	580	633	158.25	2292	573.0						
200	40	40	163	562	161	569	156	560	163	557	633	158.25	2248	562.0						
200	50	50	167	548	167	562	162	559	165	546	661	165.25	2215	553.75						
200	60	60	179	532	176	527	317	521	177	517	705	176.25	2097	524.25						
100	50	40	184	517	181	525	185	529	183	523	733	183.25	2094	523.5						
200	50	40	185	509	187	495	183	502	186	498	741	185.25	2004	501.0						
200	60	50	189	489	190	486	193	492	191	497	769	192.25	1964	491.0						
100	40	50	193	493	193	481	195	487	194	485	773	193.25	1946	486.5						
100	40	40	193	442	169	463	193	451	197	456	779	194.75	1812	453.0						
200	60	40	199	435	198	438	199	441	197	454	793	198.25	1768	442.0						
LSD																			41.50*	121.25*

Number of *Bemisia tabaci* based on 30 leaves/sample.

## REFERENCES

- 1 . Beckham, M. 1970. Effect of nitrogen fertilization on the abundance of cotton insects. J. Econ. Entomol., 63 (4) : 1219-1220.
- 2 . Hasseman, L. 1946. Influence of soil mineral on insects. J. Econ. Entomol., 39: 8-11.
- 3 . Hoda, F.M., M.M. El-Beheiri, 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 (Acari : Tetranychidae). Bull. Soc. ent. Egypte, 66 : 97.
- 4 . Hunter, A.H. 1958. Nutrient absorption and translocation of phosphorus as influenced by the root-knot nematode (*Meloidogyne incognita acrita*) in soil. Science, 43: 330-338.
- 5 . Omar, H.I.H., M.F. Haydar and F.M.L. Afifi. 1993. Effect of NPK and their combinations as soil fertilizer on tomato infestation with certain insects. Egypt. J. Agric. Res., 71 (1), 1993.
- 6 . Sharaf, N.S. and J.K. Nazer. 1983. Effect of N, P and K soil fertilizers on population trends of the tobacco whitefly *Bemisia tabaci* Genn. (Homoptera, Aleyrodidae) and the incidence of tomato yellow leaf curl virus in tomatoes in the Jordan valley. Agric. Res. J., Univ. of Jordan, 1: 13-24.
- 7 . Siddig, S.A., Sudan Gezira-Research Station. 1987. Annual report of the Gezira Research Station and substations, 1978-1979, 1987, 310-317. Gezira Research Station, Khartoum, Sudan.

تأثير النيتروجين والفوسفور والبوتاسيوم  
ومخاليطها كعناصر سمادية للتربة علي إصابة الطماطم  
بحشرة الذبابة البيضاء وعلاقة ذلك بالمحصول  
خيرات خيرى الرفاعي

معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - جيزة.

درست العلاقة بين معدلات التسميد المختلفة بالعناصر السمادية الرئيسية الثلاثة (النيتروجين والفوسفور والبوتاسيوم) علي نباتات الطماطم، وأثر ذلك علي الإصابة بحشرة الذبابة البيضاء وتأثيرها علي المحصول.

وقد دلت النتائج علي أن هناك زيادة واضحة في تعداد الآفة علي النباتات في المعاملات التي عوملت بمعدلات عالية من الأزوت (٢٠٠ وحدة أزوت)، في حين أن المعاملات التي عوملت بمعدلات متوسطة من الأزوت (١٥٠ وحدة أزوت) مع البوتاسيوم (٦٠ وحدة) والفوسفور (٦٠ وحدة) كان تعداد الذبابة البيضاء فيها أقل بكثير.

وبالإضافة إلي ذلك كانت هناك زيادة واضحة في المحصول في معاملات الأزوت المعتدلة مع البوتاسيوم والفوسفور.

لذلك كان من الأهمية بمكان ضرورة الاعتدال في التسميد الأزوتي والإهتمام بالتسميد البوتاسي والفوسفوري.

Table 2. Effect of different fertilizers and their combinations on *Bemisia tabaci* population infesting tomato and corresponding yield during Nili plantation, 1996.

Fertilization rate (units)			No. of <i>B. tabaci</i> adults and yield in every replicate												Mean no. of <i>B. tabaci</i> /adult Y	Mean yield of replicate (kg) X		
N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	R1			R2			R3			R4						
			Y1	X1	Y2	X2	Y3	X3	Y4	X4	Y5	X5	Y6	X6				
100	60	60	56	852	59	841	52	854	57	861	52	854	57	861	224	56.00	3408	852
150	60	60	61	797	52	776	63	782	55	791	63	782	55	791	231	57.75	3146	786.5
100	60	50	55	731	63	722	58	736	64	742	58	736	64	742	240	60.00	2931	732.75
150	60	50	66	715	63	723	59	723	59	712	59	712	59	712	252	63.00	2869	717.25
100	50	60	91	616	89	622	63	619	92	621	63	619	92	621	335	83.75	2778	694.5
150	50	60	64	687	67	685	85	691	69	697	85	691	69	697	257	64.25	2760	690.0
150	40	60	73	681	76	673	75	685	77	683	75	685	77	683	294	73.5	2722	680.5
150	40	50	82	673	80	668	83	661	856	654	83	661	856	654	330	82.5	2656	664.0
150	50	50	83	679	86	658	81	661	84	653	81	661	84	653	334	83.5	2651	662.75
150	60	40	85	661	84	627	81	663	89	654	81	663	89	654	339	84.75	2650	662.5
150	40	40	96	662	98	653	93	659	97	655	93	659	97	655	384	96.00	2629	657.25
100	60	40	98	612	105	631	99	625	103	628	99	625	103	628	405	101.25	2496	624.00
200	40	60	113	618	108	616	105	621	106	629	105	621	106	629	432	108.00	2484	621.00
150	50	40	123	602	119	605	117	609	121	617	117	609	121	617	480	120.00	2433	608.25
200	40	50	149	593	153	587	147	599	146	586	147	599	146	586	595	148.75	2365	591.25
100	40	60	151	518	148	507	157	513	151	506	157	513	151	506	607	151.75	2044	11.00
200	50	60	148	591	157	579	159	583	157	573	159	583	157	573	621	155.25	2326	581.5
100	50	50	157	579	159	561	161	572	156	580	161	572	156	580	633	158.25	2292	573.0
200	40	40	163	562	161	569	156	560	163	557	156	560	163	557	633	158.25	2248	562.0
200	50	50	167	548	167	562	162	559	165	546	162	559	165	546	661	165.25	2215	553.75
200	60	60	179	532	176	527	317	521	177	517	521	177	517	705	176.25	2097	524.25	
100	50	40	184	517	181	525	185	529	183	523	185	529	183	523	733	183.25	2094	523.5
200	50	40	185	509	187	495	183	502	186	498	183	502	186	498	741	185.25	2004	501.0
200	60	50	189	489	190	486	193	492	191	497	193	492	191	497	769	192.25	1964	491.0
100	40	50	193	493	193	481	195	487	194	485	195	487	194	485	773	193.25	1946	486.5
100	40	40	193	442	169	463	193	451	197	456	193	451	197	456	779	194.75	1812	453.0
200	60	40	199	435	198	438	199	441	197	454	199	441	197	454	793	198.25	1768	442.0
LSD															41.50*	121.25*		

Number of *Bemisia tabaci* based on 30 leaves/sample.



## REFERENCES

- 1 . Beckham, M. 1970. Effect of nitrogen fertilization on the abundance of cotton insects. J. Econ. Entomol., 63 (4) : 1219-1220.
- 2 . Hasseman, L. 1946. Influence of soil mineral on insects. J. Econ. Entomol., 39: 8-11.
- 3 . Hoda, F.M., M.M. El-Beheiri, 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 (Acari : Tetranychidae). Bull. Soc. ent. Egypte, 66 : 97.
- 4 . Hunter, A.H. 1958. Nutrient absorption and translocation of phosphorus as influenced by the root-knot nematode (*Meloidogyne incognita acrita*) in soil. Science, 43: 330-338.
- 5 . Omar, H.I.H., M.F. Haydar and F.M.L. Afifi. 1993. Effect of NPK and their combinations as soil fertilizer on tomato infestation with certain insects. Egypt. J. Agric. Res., 71 (1), 1993.
- 6 . Sharaf, N.S. and J.K. Nazer. 1983. Effect of N, P and K soil fertilizers on population trends of the tobacco whitefly *Bemisia tabaci* Genn. (Homoptera, Aleyrodidae) and the incidence of tomato yellow leaf curl virus in tomatoes in the Jordan valley. Agric. Res. J., Univ. of Jordan, 1: 13-24.
- 7 . Siddig, S.A., Sudan Gezira-Research Station. 1987. Annual report of the Gezira Research Station and substations, 1978-1979, 1987, 310-317. Gezira Research Station, Khartoum, Sudan.

تأثير النيتروجين والفوسفور والبوتاسيوم  
ومخاليطها كعناصر سمادية للتربة علي إصابة الطماطم  
بحشرة الذبابة البيضاء وعلاقة ذلك بالمحصول  
خيرات خيرى الرفاعي

معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - جيزة.

درست العلاقة بين معدلات التسميد المختلفة بالعناصر السمادية الرئيسية الثلاثة (النيتروجين والفوسفور والبوتاسيوم) علي نباتات الطماطم، وأثر ذلك علي الاصابة بحشرة الذبابة البيضاء وتأثيرها علي المحصول.

وقد دلت النتائج علي أن هناك زيادة واضحة في تعداد الآفة علي النباتات في المعاملات التي عوملت بمعدلات عالية من الأزوت (٢٠٠ وحدة أزوت)، في حين أن المعاملات التي عوملت بمعدلات متوسطة من الأزوت (١٥٠ وحدة أزوت) مع البوتاسيوم (٦٠ وحدة) والفوسفور (٦٠ وحدة) كان تعداد الذبابة البيضاء فيها أقل بكثير.

وبالاضافة إلي ذلك كانت هناك زيادة واضحة في المحصول في معاملات الأزوت المعتدلة مع البوتاسيوم والفوسفور.

لذلك كان من الأهمية بمكان ضرورة الاعتدال في التسميد الأزوتي والإهتمام بالتسميد البوتاسي والفوسفوري.