Egypt. J. Agric. Res., 71 (1), 1993

EFFECT OF N P K AND THEIR COMBINATIONS AS SOIL FERTILIZERS ON TOMATO INFESTATION WITH CERTAIN INSECTS.

H.I.H. OMAR, M.F. HAYDAR AND F.M. L. AFIFI

1 Plant Protection Research Institute, Agricultural Research Centre, Dokki, Egypt.

(Manuscript received 12 September1990)

Abstract

The effect of the major plant nutrients, NPK and their combinations on tomato infestation caused by *Myzus persicae* Sulz., and *Thrips tabaci* Lind., was studied in field experiments in Etay El-Baroud Agricultural Research Station, El Beheira Governorate. An obvious increase of these pests was observed on plants treated with superphosphate (16% P_2O_5, 300 kg/f) either alone or in mixtures with potasisum sulfate (48% K_2O, 100kg/f) and ammonium sulfate (21%, N,300 kg/f). The corresponding levels of infestation with potassium sulfate and ammonium sulfate whether alone or in mixtures were less pronounced.

The use of P fertilizer had improved the development of the tomato plants , thus encouraging the aphids and thrips migration and subsequently reducing leaf deformation.

INTRODUCTION

Several agricultural practices have been tried to reduce the population density of pests infesting tomato plants. Abu- Gharbieh *et al.*, (1978) found that 6 out of 108 tomato cultivars tested showed slight tolerance to TYLCV. Doss and Atallah 1985 reported that tomato cultivated at the density of one seedling per one hill with 15 cm apart was the most suitable agricultural practice for obtaining clean plants from pest and higher tomato yield.

Little work concerning the effect of fertilizers on the population trend of

the main insect pests of different crops has been undertaken. Cannon and Connell (1965) and Le Roux (1954) on soybean., El - Behedi and Gouhar (1971) on squash and Gomba *et al.*, (1976) on wheat . Sharaf and Nazer (1983) found that the use of P fertilizer improved the development of tomato plants, thus encouraging whiteflies migration. Hoda *et al.,* (1986) showed positive correlation between nitrogen level and mite increase on soybean.

The aim of the present work was to study the effect of the major fertilizer nutrients and their combiantions on tomato infestation with *Myzus persicae* and *Thrips tabaci.*

MATERIALS AND METHODS

Two field experiments were conducted at Etay El - Baroud Research Station , El - Beheira Goernorate, to investigate the effect of major plant nutrients on tomato infestation caused by aphids and thrips.

Summer plantation of 1988 (Experiment 1)

Tomato seedings about 30 days and 15 cm in height of the variety strain - B VF - 145 raised in greenhouse at the Research Station Experimental Farm, were transplanted on April 10, 1988 into replicated plots measuring 12x10 m2 (three plots for each fertilizer) . Three hundred seedlings were planted in equal distances in 9 rows in each plot. The plant spacing was 100 cm between rows and 30 cm between plants . Three plots of similar size with the same number of plants were maintained as a control.

Summer plantation of 1989 (Experiment 2)

The same procedure mentioned in experiment 1 was followed . Tomato seedlings were raised in Etay El -Baroud Research Station and were transplanted on April 8, 1989 .

Fertilizers and other agricultural practices

The fertilizers, ammonium sulphate (31%N), superphosphate (16% P_2O_5), and potassium sulfate (52% K_2O), were applied to the soil three times after planting, at the rates of 300,300 and 100 kg/feddan, respectively. Normal racommended agri-

cultural practices were followed , and insecticidal treatments were completely avoided.

Sampling , counting and statistical analysis

In both experiments, samples of three leaves per plot were collected at random from the upper, middle and lower levels of the plants every week. The samples were examined in the laboratory for adults and immature stages of aphids using a binocular , whereas the work was carried out immediately in the field for thrips adults and immature stages.

In experiment 1, sampling started on May 1988 and ended on July 3. In experiment 2 sampling started on May 3 and was terminated on July 19. The data were analyzed statistically using the analysis of variance, and the treatment means fell into three categories according to Duncan's multiple range test.

The effect of fertilizers on plant development im experiment2 was measured in the last sampling date by several criteria namely the lengh of the plants, the number of leaves per plant in 1 m^2 and the size of 9 cmpound leaves per treatment . Data on plant development were analyzed statistically using the standard deviation from the mean. The incidence of leaf deformation was recorded visually after 45 days from transplanting (the time on which clear symptoms of the disease appear) in both experiments and the percentage of incidence was calculated.

RESULTS AND DISCUSSION

Effect against aphids population

The population trend of *Myzus persicae* Sulzer under the different fertilizer treatments in the two successive seasons of 1988 and 1989 is shown in Tables 1 and 2 . The fertilizer treatments tended to increase the degree of infestation . The largest increase in aphid population was found in both ammonium/ superphospate/ potassium sulfate and ammonium/ superphosphate treatments . Moderate increase in ifestation has resulted with ammonium sulfate , superphosphate and superphosphate/ potassium sulfate treatments. On the other hand, postassium sulfate and chek treatments gave the least number of aphid population.

The results demonstrated in Table 2 confirmed further these findings except

Table 1. Effect of different fertilizers and their combinations on *Myzus persicae* population infesting tomato during summer (1988).

Treatment	Application rate Kg/f	Number of aphids at different sampling dates / 100 leaves										Seasonal mean no. of aphid per leaf (1)	Population increase over the control %	Leaf deformation %
		1/5	8/5	15/5	22/5	29/5	5/6	12/6	19/6	26/6	3/7			
Ammonium sulfate	300	29	120	197	230	88	155	280	71	59	21	12.5 b	231.56	100
Superphospate	300	4	200	199	317	156	98	174	212	296	0	15.0 b	297.88	100
Potassium sulfate	100	19	18	210	127	98	35	148	52	22	21	7.0 c	85.68	100
Amm./Super.	300/300	81	260	493	388	587	655	297	187	113	19	30.0 a	695.76	100
Amm./potas	300/100	30	89	188	123	952	133	155	55	20	5	17.5 b	364.19	100
Super./ potas.	300/100	50	140	98	411	381	861	107	202	0	0	22.5 a	796.82	100
Amm./ Super./ Potas.	300/300/ 100	50	411	39	598	939	751	41	0	10	11	28.5 a	655.97	100
No fertilizaation	---	100	498	1060	401	693	211	433	0	174	0	3.77 c	—	100

(1) Mean based on 100 leaves / sample
Means followed by the same letter are not significantly different.

Table 2. Effect of different fertilizers and their combinations on *Myzus persicae* population infesting tomato during summer (1989).

Treatment	Number of aphids at different sampling dates / 100 leaves												Seasonal mean no. of aphid per leaf (1)	Popula-tion increase over the control %	Leaf deformation %
	3/5	10/5	12/5	24/5	31/5	7/6	14/6	21/6	28/6	5/7	12/7	19/7			
Ammonuium sulfate 300 kg / fed	20	132	402	510	350	390	500	481	911	1001	403	0	43.70 b	91.67	100
Superphosphate 300 kg / fed	50	120	146	881	630	827	350	533	715	862	90	40	42.50 b	86.40	100
Postassium sulfate 100 kg/ fed	114	400	306	111	200	151	400	401	801	381	258	50	30.00 c	31.58	100
Amm. / Super 300/300 kg / fed	451	1281	911	631	1000	981	400	640	691	891	207	100	68.27 a	199.86	100
Amm. Postas. 300/100 kg / fed	90	1000	47	501	300	271	330	200	201	73	103	110	28.33 c	24.25	100
Super./Postas. 300/100 kg / fed	0	832	611	481	300	291	400	266	315	211	207	52	33.30 b	46.05	100
Amm. / Super ./ Potas. 300/300/100 kg/fed.	80	600	607	109	450	1061	830	710	2811	1361	731	80	73.75 a	223.46	100
No fertilization	207	200	711	201	275	307	110	377	207	207	144	40	22.80 c	—	100

(1) Mean based on 100 leaves / sample
Means followed by the same letter are not significantly different.

Table 3. Effect of different fertilizers and their combinations on *Thrips tabaci* population infesting tomato during summer (1988).

Treatment	Rate kg / fed.	Number of thrips at different sampling dates / 100 leaves										Seasonal mean no. of aphid per leaf (1)	Population increase over the control %	Leaf deformation %
		1/5	8/5	15/5	22/5	29/5	5/6	12/6	19/6	26/6	3/7			
Ammonuium sulfate	300	20	180	860	640	160	201	89	74	0	26	22.50 c	50.0	100
Superphosphate	300	10	360	480	710	290	520	99	441	80	10	30.00 c	100.0	100
Postassium sulfate	100	20	80	160	210	70	180	110	70	100	0	10.00 d	—	100
Amm. / Super	300/100	80	430	860	730	210	990	1120	1510	320	0	62.50 a	31.66	100
Amm. / Postas.	300/100	50	79	830	610	391	694	75	281	41	9	30.00 c	100.0	100
Super./Postas.	300/100	180	189	799	717	839	961	211	381	203	20	45.00 b	200.0	100
Amm. / Super ./ Potas.	300/300/100	160	411	913	1116	690	831	1495	705	389	40	67.50 a	350.0	100
No fertilization	—	60	211	320	109	460	109	89	111	130	10	15.00 d	—	100

(1) Mean based on 100 leaves / sample
Means followed by the same letters are not significantly different.

Table 4. Effect of different fertilizers and their combinations on *Thrips tabaci* population infesting tomato during summer (1989).

Treatment	Number of thrips at different sampling dates / 100 leaves												Seasonal mean no. of aphid per leaf (1)	Population increase over the control %	Leaf deformation %
	3/5	10/5	12/5	24/5	31/5	7/6	14/6	21/6	28/6	5/7	12/7	19/7			
Ammonuium sulfate 300 kg / fed	62	106	600	600	300	740	100	1071	71	53	44	38	3.33	226.47	100
Superphosphate 300 kg / fed	73	96	542	542	250	631	550	911	81	87	27	27	3.48	241.17	100
Postassium sulfate 100 kg/ fed	83	130	230	230	100	419	101	320	179	64	17	17	1.65	61.76	100
Amm. / Super 300/300 kg / fed	111	196	273	273	200	519	100	180	200	104	10	10	4.25	120.59	100
Amm. Postas. 300/100 kg / fed	90	311	227	227	350	627	100	161	211	201	31	31	1.91	185.25	100
Super./Postas. 300/100 kg / fed	50	140	234	234	166	730	100	67	99	94	23	23	1.66	62.74	100
Amm. / Super ./ Potas. 300/300/100 kg/fed.	58	144	334	334	100	1008	816	899	235	887	66	66	4.78	368.62	100
No fertilization	11	44	208	208	227	411	71	15	72	15	2	2	1.02	—	100

(1) Mean based on 100 leaves / sample

Table 5. Effect of different fertilizers and their conbiantions on plant develompent.

Fertilizer treatment	Mean plant height cm	Mean no. of leaves / plant	Mean area of 9 tomato leaves in cm^2
Ammonuium sulfate	85.7 a	208.0 b	585.0 a
Superphosphate	90.4 a	228.4 b	602.0 a
Postassium sulfate	80.8 b	199.0 c	497.2 b
Amm. / Super.	92.7 a	242.7 a	601.8 a
Amm. Postas.	91.9 a	240.1 a	398.2 a
Super./Postas.	89.4 a	233.6 a	588.7 a
Amm. / Super ./ Potas.	94.1 a	260.4 a	612.7 a
No fertilization	80.1 b	107.6 b	527.0 b

Mean based on 7 plants measured in 1 m^2 in the different fertilizer treatments and the control.
Mean followed by the same letter is not significantly different.

for the seasonal average number of aphids in ammonium / potassium and superphospate/ postassium treatments which were significantly higher in 1988.

Effect against *Thrips tabaci* Lind.

The population trend of *Thrips tabaci* under the different fertilizer treatments are shown in Tables 3 and 4. The fertilizers treatments tended to increase the degree of infestation to a significant level only in 1988 season. the largest increase was found with ammonium /super-phosphate/potassium , ammonium / superphosphate treatments followed by superphospate/ pctassium treatment. Slight increase in infestation was obtained with ammonium sulfate, superphosphate and ammonium /potassium treatments. Potassium sulfate treatment was in the same order of the untreated check .

The effect on plant

Fertilized plants were longer, had more and larger leaves than those which were not fertilized (Table 5). This would attract further adult aphids and thrips as well as providing a more favourable habitat for the development of immature stages. Consequently, larger numbers of thrips eggs were deposited and more immature stages of aphids were produced on fertilized plants than on non-fertilized ones . Results obtained were in agreement with Sharaf and Nazer (1983) who studied the effect of soil fertilizers on the population of whitefly on tomato.

REFERENCES

1 . Abu - Gharbieh, W.L., K.M. Makkouk and A. R. Saghir 1978. Response of different tomato cultivars to the root - knot nematode, tomato yellow leaf curl virus, and Orobanche in Jordon. Pt. Dis. Reptr., 62 : 263 - 266.

2 . Cannon , W.N. and W. A. C. Connell , 1965. Populations of *Tetranychus atlanticus* on soybean supplied with various levels of nitrogen, phosphorus and potassium. Ent. Exp. Appl., 8 : 151 - 161.

3 . Doss, S. A and E. A. Atallah 1985. Effect of plant density of tomato infestation by different insect pests. Agric. Res. Rev., Cairo, 63 (1) : 69 - 75.

4 . El - Beheidi , M. and K. A. Gouhar 1971. The effect of nitrogen, phosphorus, potassium, and some selective insecticides on whitefly *Bemisia tabaci* infestation

and squash yield. Beitrag Zur Tropischen Und Subtropischen, 9: 159 - 166.

5 . Gomba, A., El-Kalla and A. A. Gomha 1976. Effect of some phosphoric and nitrogen fertilizers on wheat yield and aphids infestation . Agric. Res. Rev., 12: 11 - 19.

6 . 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. Egypt, 66: 97

7 . Le Roux, E. Y. 1954. Effect of various levels of N, P and K on nutrient solution on the fecundity of two spotted spider mite. Can. J. Agr. Serv., 34 : 145 - 151.

8 . Sharaf, N. S. and J. K. Nazer 1983. Effect of N, P and K soil fertilizers on population trends of the tobacco withefly *Bemisia tabaci* Genn. (Homoptera, Aleyrodidae) and the incidence of tomato yellow leaf curl virus in tomatoe in the Jordan Valley. Agric. Res. J., Univ. of Jordan, 1 : 13- 24.

تأثير النيتروجين والفوسفور والبوتاسيوم ومخاليطها كعناصر سمادية للتربة علي اصابة الطماطم بأهم الآفات الحشرية

د . حافظ اسماعيل حافظ عمر د. محمد فوزي حيدر
د. فريال محمد لطفي عفيفي

معهد بحوث وقاية النبات – مركز البحوث الزراعية – الدقي

الهدف من البحث هو دراسه تأثير اضافة العناصر السمادية الرئيسيه الثلاثه النيتروجين والفوسفور والبوتاسيوم ومخاليطها علي محصول الطماطم وتأثير ذلك علي إصابته بحشرتي من الخوخ الأخضر وتربس القطن والبصل. وقد أقيمت التجارب الحقليه ف محطة البحوث الزراعية بايتاي البارود – محافظة البحيرة

ودلت النتائج علي أن هناك زيادة واضحة في تعداد الافتين علي النباتات في المعاملات التي عوملت بسماد السوبر فوسفات (١٦٪ فو ٢ أ ٥) بمعدل ٣٠٠ كجم / فدان علي حده أو مخلوطة بكل من سلفات البواسيوم (٤٨ ٪ بو ٢ أ) بمعدل ١٠٠ كجم / فدان وسلفات الأمونيوم (٢١ ٪ نيتروجين) بمعدل ٣٠٠ كجم / فدان . في حين أن الاصابة في حالة المعاملات التي أستخدم فيها كل من سلفات البوتاسيوم أو سلفات الامونيوم منفردة أو مخاليطهما كانت أقل بكثير عنها في حالة اضافة السوبر فوسفات.

ونخلص من ذلك بأن استخدام التسميد الفوسفاتي قد حسن من نمو نباتات الطماطم الأمر الذي شجع حشرتي المن والتربس علي الهجرة إليها وزيادة الاصابة بها مما يؤدي إلي زيادة نسبه تشوه الأوراق.