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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 4 (7): 799-801, 2001

Influence of Additional Nutrition on the Growth and Yield of Leaf Curl Infected Tomato Plant

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Abstract: The effect of additional nutrients on the growth and yield of leaf curl infected plants of tomato cultivar 'Marglobe' under natural field conditions was studied. The recommended dose of NPK were applied in the soil. After transplanting additional dose each of urea , potassium sulphate(PS) and single super phosphate(SSP) at the rate of 2.5 gm per plant were applied in two instalments. Disease incidence and severity was low in the plots in which additional nutrients were supplied. Higher fruits yield was obtained from the infected plants which were nourished with additional doses of urea, PS and SSP as compared to infected plants which were not supplied with additional nutrition. Best results were obtained when additional dose of urea, PS and SSP were applied as combination than their individual application.

Key words: Leaf curl, additional nutrition, growth, yield.

Introduction

Tomato (*Lycopersicum esculentum* Mill.) is one of the most important and popular vegetable. It is used in the agro food industries for preparation of different types of food products. Average yield of this crop is about 7.32 ton/ ha in Bangladesh (BBS, 1994). This is very low as compared to the advanced countries (Sharfuddin and Siddique, 1985). Among the major constraints of tomato production, diseases are considered as one of them responsible for low yield in Bangladesh. Tomato leaf curl is a very destructive viral disease that can infect the plant at any growth stage. Crop growth and yield is reduced up to 93.3 % when the crop is infected at an early stage (Loannou, 1992).

The incidence and severity of this disease is related to many factors, such as environmental conditions, virus source, vector population, host reaction and time of infection etc. (Verma *et al*., 1989). The effects of nutrient elements such as nitrogen and phosphorus is closely Co-Related with plant growth. Nutrient elements such as potassium, zinc, boron, molybdenum and manganese have remarkable effect on symptom severity of some viral diseases. These elements help the infected plants to recover from the disease (Bawden and Kassanis, 1950)and to increase metabolic activity of the infected plant (Zahir, 1986).

There is no remarkable research work on the effect of additional doses of N, P, K & S on the tomato leaf curl infected plants in Bangladesh. In the light of the above background, the present study was undertaken to find the effect of additional dose of urea, potassium sulphate and single super phosphate as a source of N, P,K & S on the leaf curl infected tomato plant.

Materials and Methods

The experiments were conducted with a tomato cultivar 'Marglobe' at the Horticulture farm of Bangladesh Agricultural University, Mymensingh, Bangladesh during 1997-1998. The experimental field was well prepared into a good tilth by ploughing, followed by laddering. The recommended dose of urea, Triple Super Phosphate (TSP) and murate of Potash (MP) @ of 150, 175 &150 kg /ha were applied during the final land preparation, 4 days before the transplanting of the seedlings (BARC ,1997). The field was divided into three blocks and each block into six plots. Seedlings were produced in the seed bed. Ten gram seeds were sown in 3 sq. m seed bed. Thirty-day old seedlings were transplanted in all plots. The healthy seedlings with uniform growth and height were selected for transplanting.

Additional dose of N, P, K & S in the form of urea , potassium sulphate (PS) and single super phosphate (SSP) were applied in two instalments viz. 15 and 30 days after transplanting. The treatments of the experiments were healthy control, diseased control, urea + PS + SSP, urea alone, PS alone and SSP alone. The treatments were randomly assigned in the experimental plots. Additional dose, each of urea, PS and SSP @ 2.5 g/plant was applied near the root zone. Healthy plants were maintained by controlling insect vector through spraying insecticide at 15 days intervals. The other plots were exposed to natural infection of tomato leaf curl virus. Leaf curl infected plants were recorded on the basis of symptoms. Plants with typical symptoms of leaf curl disease were considered as infected. Number of healthy and leaf curl infected plants per plot were recorded at 15 days intervals. Percent incidence in the individual plot was calculated by the following formula :

$$\text{Incidence \%} = \frac{\text{Number of infected plants/plot}}{\text{Number of plants/plot}} \times 100$$

Disease severity was assessed by the number of deformed leaflets, shoot and fruits. Fruits were harvested at 4 days intervals. Ten infected plants were selected in each plot and data on the following parameters were recorded : number of deformed and normal leaflets, number of deformed and normal shoots, number of flower cluster, number of flower per cluster, number of flower, number of fruits, individual fruit weight and fruit yield. Similar data were also collected from 10 healthy plants grown in healthy control plots. Length of the leaves of the infected and healthy plants were recorded. Diameter of curled leaves of the infected plants and normal leaves of the healthy plants were also measured.

Data were subjected to statistical analysis (ANOVA) following RCBD design to determine the level of significance (Gomez and Gomez, 1983). Mean values were presented and interpreted for discussion. Significant mean differences were determined by F-test following Least Significance Difference (LSD) and Duncan's Multiple Range Test (DMRT).

Results and Discussion

There was a remarkable variation among the treatments in percent incidence of tomato leaf curl disease. Incidence was very high in the plots which received additional dose of urea alone (Table 1). Maximum infection was recorded in the

Table 1: Influence of additional nutrition on the incidence of tomato curl disease.

Treatment	Days after transplanting				
	15	30	45	60	75
Urea alone	5b	20a	35a	40b	60 b
PS alone	5b	20a	35a	45a	50 c
SSP alone	5b	15b	25b	35c	40 d
Urea + PS + SSP	5b	15b	20c	25d	25 e
Diseased control	10a	20a	35a	45a	75 a
Healthy control	5b	5c	5d	5e	10 f

* Means followed by the same letter in a column are not significantly different at 5% level of significance.

Table 2: Influence of additional dose of urea, PS and SSP and single super phosphate on the growth of leaf curl infected tomato plants.

Treatment	Leaves/plant	Deformed leaflets (%)	Deformed shoots (%)	Shoots with yellowing symptom	Plant height (cm)
Urea alone	62 b	60 b	50 c	5 c	75 c
PS alone	50 c	65 b	60 b	10 b	58 d
SSP alone	45 c	65 b	55 c	10 b	55 d
Urea + PS + SSP	80 a	20 c	25 d	5 c	98 b
Diseased control	42 cd	85 a	75 a	15 a	61 e
Healthy control	64 b	5 d	5 e	5 c	129 a
LSD (P=0.05)	6.00	5.00	2.00	200	5.00

* Means followed by the same letter in a column are not significantly different at 5% level of significance.

Table 3: Leaf morphology of the infected plants as influenced by additional dose of urea, SSP and PS.

Treatments	Middle		Apical	
	Diameter (cm)	Length (cm)	Diameter (cm)	Length (cm)
Urea alone	1.70 c	7.12	2.15 d	4.00 b
PS alone	1.50 c	5.86 d	1.75 e	3.81 b
SSP alone	1.66 c	6.50 c	1.90 e	3.95 b
Urea + PS + SSP	3.25 b	8.47 b	2.75 c	5.03 a
Diseased control	1.56 c	5.86 d	3.25 b	3.12 b
Healthy control	5.64 a	11.61 a	4.26 a	6.81 a
LSD (P=0.05)	1.11	1.41	1.31	1.38

Means followed by the same letter in a column are not significantly different at the 5% level of significance.

Table 4: Influence of additional dose of urea, SSP and PS on the yield and yield components of leaf curl infected plants.

Treatments	Number of fruits/cluster	Number of fruits/plant	Number of fruits/plot	Weight of individual fruit (g)	Weight of fruits/ plant (Kg)	Weight of fruits/plot	Fruit yield (tons/ha)
Urea alone	3.03 c	7.83 c	94.00 c	152.00 b	1.18 c	14.16 c	32.78 c
PS alone	2.47 d	6.22 d	74.68 d	97.90 d	0.60 d	7.24 d	16.76 d
SSP alone	2.36 d	5.82 d	69.75 d	84.29 d	0.50 d	5.88 d	13.89 d
Urea + PS + SSP	3.64 b	8.92 b	107.00 b	180.50 a	1.61 a	16.32 a	44.72 a
Diseased control	1.92 e	5.13 e	61.60 e	74.32 e	0.38 e	4.56 e	10.56 e
Healthy control	4.53 a	12.79 a	153.48 a	110.59 c	1.42 b	17.00 b	39.35 b
LSD (P=0.05)	0.40	0.89	10.66	18.56	0.18	1.92	4.33

Means followed by the same letter in a column are not significantly different at 5% level of significance.

control plots. Plant infection was 40-50% in the PS alone or SSP alone treated plots. Infection was minimum in the plots where additional dose of urea, PS and SSP were applied (Table 1). Chant and Gbaja (1985) reported that tomato mosaic virus infection was suppressed by the NPK nutrition of the plants. Sastry (1989) also mentioned that tomato leaf curl infection can be minimized by root dipping of seedling in carbafuran solution. Number of leaves was high in the infected plants which received additional dose of urea, PS and SSP .It was low in the plots which did not get additional nutrition. Shukla and Joshi (1982) observed that high amount of N supply increase the leaf area of the sugarcane plants infected with mosaic virus. Number of deformed leaflets was high in the infected plants grown in the control plots. Minimum number of deformed leaflets was recorded in the plots where additional dose of urea , PS and SSP were applied (Table 2). Similarly, number of shoots with visible symptoms was high in the plants grown without additional nutrition. Number of shoots with visible symptom was minimum in the plots where additional dose of urea , SSP and PS were applied (Table 2) Daivedi and Shukla (1981) noticed that potassium increase the resistance of the infected plant because of which it may recover from the visible symptoms. The infected plants which were supplied with additional dose of urea , PS and SSP were taller than those which were not supplied with additional nutrition (Table 2). Healthy plants grown in the insecticide sprayed plots attained maximum height. The height of the infected plants supplied with additional dose of urea alone was high as compared to the plants supplied with SSP or PS alone (Table 2). Shukla and Joshi (1982) proved that higher dose of nitrogenous fertilizer increase the height of viral infected plants.

Remarkable variation was observed in the length and diameters of the leaves of infected plants as influenced by the additional dose of urea, SSP and PS (Table 3). Leaf curling was minimum in the plants which were nourished with additional dose of urea, SSP and PS (Table 3). Severe curling of the infected leaves was recorded in the diseased plants not supplied with additional nutrition. Walker and Fosler (1946) noted that balanced nutrition brought about a decrease in disease severity.

The number of fruits /cluster, number of fruits/plant, number

of fruits/plot, weight of individual fruit, wt. of fruits/plant, wt. of fruits/plot and fruit yield were high when the infected plants were supplied with additional dose of urea, PS and SSP (Table 4). Variation in number of flower clusters per plant was significant. Maximum number of flower clusters were produced by the plants supplied with additional dose of urea, SSP and PS (Table 4). Maximum number of flowers and fruits were produced by the infected plants which were fed with additional nutrition. Application of additional dose of urea, SSP and PS resulted large sized fruits. As a result the fruits yield was high in the plots where urea, SSP and PS were applied as additional dose (Table 4). Sharma and Sohi (1983) mentioned that higher dose of P and k increase the size and quality of the fruits produced by the infected plants. The fruit yield harvested from the healthy plant was comparable to that produced by the infected plants supplied with additional nutrients. It can be concluded that yield loss of tomato can be minimized by the application of additional dose of nutrients to the infected plants.

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