Madras Agric. J. 89 (1-3) : 36-38 January-March 2002
https://doi.org/10.29321/MAJ.10.A00177

Effect of pretreatment of seeds, preplanting application of zinc and post planting application of Penshibao on yield and its components in tomato (*Lycopersicon esculentum* Mill.)

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Abstract: The seeds treated with Penshibao at 50 and 100 ppm were raised in field applied with 5 and 10 kg Zn ha^{-1} according to treatments. Penshibao at 50 and 100 ppm were given as foliar spray three times at 20 days interval commencing from 20 DAT. Significant *per se* effect of pretreatment of seeds with penshibao, basal application of zinc and foliar application of penshibao was observed on various yield traits. Beneficial effect of penshibao has been attributed to the micronutrients present in it. Both zinc and penshibao influenced the number of fruits, fruit weight by improving the sink strength. Among the 27 treatment combinations, seed treatment with penshibao 50 ppm and soil application of zinc 5 kg ha^{-1} followed by 3 applications of 50 ppm penshibao at 20 days interval commencing from 20 DAT has been identified as the best combination based on yield and economic returns. *(Key words : Tomato, Zinc, Penshibao, Yield)*

Tomato is one of the important vegetable crops being cultivated throughout India. Application of zinc to deficient soil has produced remarkable increase of fruit yield in vegetables in Tamil Nadu. Zinc assumes greater importance in the traditionally rice based coastal Veeranum ayacut zone. A field experiment was conducted to assess the effect of zinc and penshibao on yield of tomato.

Materials and Methods

The field experiment was conducted in the Department of Horticulture, Faculty of Agriculture, Annamalai University during 2000-2001 on zinc deficient soil using tomato hybrid 'Ramya' as test crop. The treatments consisted of three levels each of penshibao seed treatment, foliar spray and soil application of zinc and their factorial combinations.

Table 1. Main effect of various treatments on yield and its components

Treatments	Plant height (90 DAT) (cm)	Number of fruits per plant	Fruit weight (g)	Yied per plant (g)	Dry matter production per plant (g)
S_0	108.0	37.7	67.3	2544.9	3748.0
S_{50}	114.2	41.3	70.0	2896.9	4266.6
S_{100}	115.1	41.5	68.8	2859.3	4211.1
S.Ed.	0.15	0.3	0.3	20.0	29.4
CD (P=0.05)	0.3	0.6	0.6	0.0	59.0
Z_0	103.3	37.4	65.7	2465.3	3630.8
Z_{50}	116.7	41.8	69.9	2925.9	4309.2
Z_{100}	117.3	41.2	70.5	2909.0	4285.7
S.Ed.	0.15	0.3	0.3	20.0	29.4
CD (P=0.05)	0.3	0.6	0.6	40.0	59.0
F_0	107.4	38.7	64.6	2509.7	3696.2
F_{50}	114.6	40.8	70.7	2889.4	4255.5
F_{100}	115.3	40.9	70.8	2902.0	4274.0
S.Ed.	0.15	0.3	0.3	20.0	29.4
CD (P=0.05)	0.3	0.6	0.6	40.0	59.0

The crop received an uniform dose of 250:250:250 kg NPK ha^{-1} through urea, single superphosphate, and muriate of potash respectively. The treatments consisted of three levels (0 (Z_0), 5(Z_5), 10(Z_{10}) kg ha^{-1}) of zinc and penshibao (0(S_0), 50(S_{50}), 100 (S_{100}) ppm) seed treatment and foliar spray 0(F_0), 50(F_{50}), 100(F_{100}) and their combinations. The experiment was laid out in Factorial Randomised Block Design with three replications. The data on plant height, number of fruits per plant, fruit weight, yield per plant and dry matter production was recorded and analysed statistically following the methods of Panse and Sukhatme (1978).

Results and Discussion

The data on *per se* effects and interaction effects are presented in Table I and 2. Significant *per se* effect of all three factors was observed on all characters studied. Zinc application showed higher *per se* effect on yield than the other factors. The analysis of variance showed significant third order interaction.

Table 2. Interaction effects of various treatments on yield and its components

Treatments	Plant height (90 DAT) (cm)	Number of fruits per plant	Fruit weight (g)	Yied per plant (g)	Dry matter production per plant (g)
$S_0 Z_0 F_0$	91.8	31.0	60.1	1862.0	2742.0
$S_0 Z_0 F_{50}$	98.8	37.0	67.0	2477.0	3648.0
$S_0 Z_0 F_{100}$	98.9	37.6	67.0	2518.0	3708.0
$S_0 Z_5 F_0$	105.5	40.3	65.8	2655.0	3910.0
$S_0 Z_4 F_{50}$	116.9	38.8	70.0	2716.0	4000.0
$S_0 Z_5 F_{100}$	117.8	38.9	70.0	2721.0	4008.0
$S_0 Z_{10} F_0$	106.3	39.1	65.7	2571.0	3786.0
$S_0 Z_{10} F_{50}$	117.6	38.5	69.3	2673.0	3937.0
$S_0 Z_{10} F_{100}$	118.4	38.2	71.0	2711.0	3992.0
$S_{50} Z_0 F_0$	99.8	36.4	63.1	2295.0	3380.0
$S_{50} Z_0 F_{50}$	108.6	39.3	68.0	2675.0	3940.0
$S_{50} Z_0 F_{100}$	109.1	39.5	68.0	2685.0	3954.0
$S_{50} Z_5$ Fo	114.3	40.8	66.7	2717.0	4001.0
$S_{50} Z_5 F_{50}$	119.7	43.2	74.7	3225.0	4750.0
$S_{50} Z_5 F_{100}$	120.4	44.2	73.0	3225.0	4750.0
$S_{50} Z_{10} F_0$	114.9	41.5	66.3	2755.0	4057.0
$S_{50} Z_{10} F_{50}$	120.1	43.6	74.3	3243.0	4776.0
$S_{50} Z_{10} F_{100}$	120.9	42.8	76.0	3253.0	4791.0
$S_{100} Z_0 F_0$	103.5	36.3	63.5	2304.0	3393.0
$S_{100} Z_0 F_{50}$	109.1	39.8	67.3	2676.0	3941.0
$S_{100} Z_0 F_{100}$	110.0	40.0	67.3	2695.0	3970.0
$S_{100} Z_5$ Fo	114.8	42.3	65.3	2763.0	4069.0
$S_{100} Z_5 F_{50}$	120.1	43.6	72.7	3167.0	4665.0
$S_{100} Z_5 F_{100}$	120.9	44.3	71.0	3144.0	4630.0
$S_{100} Z_{10}$ Fo	115.4	41.0	65.0	2667.0	3927.0
$S_{100} Z_{10} F_{50}$	120.6	43.2	73.0	3152.0	4642.0
$S_{100} Z_{10} F_{100}$	121.3	42.8	74.0	3165.0	4662.0
S.Ed.	0.5	0.8	0.9	59.9	88.2
CD (P=0.05)	0.9	1.7	1.8	120.1	176.9

The higher yield in zinc applied treatments might be attributed to the favourable effect of zinc on retention of flowers which might have increased number of fruits (Suryanarayana Reddy *et al.* 1986).

The beneficial effect of seed treatment and foliar spray of penshibao has been attributed to the micro nutrients especially zinc and boron and other amino acids. It was observed that foliar spray had more effect as compared to seed treatment. Since foliar spray was given at flowering and half-fruiting stages, it showed higher influence. The influence of penshibao on fruit characters has been reported bv Naresh Babu and Singh (1995).

Among the various factorial treatments, seed treatment with penshibao 100 ppm plus zinc 10kg ha^{-1} and penshibao 100 ppm foliar spray (S_{100} Z_{10} F_{100}) registered the maximum plant height (121.3 cm). It was followed by S_{50} Z_{10} F_{100}, S_{100} Z_5 F_{100}, S_{100} Z_{10} F_{50} and S_{50} Z_5 F_{50}, which were found to be on par with each other. The increased plant height observed under zinc treatment might have resulted due to the increased synthesis of tryptophan, a precursor of auxin (Kanwar, 1976). Similar results were observed in tomato by Mahopatra and Kibe (1971).

The maximum number of fruits (44.3) was observed at S_{100} Z_5 F_{100} and it was found to be par with S_{50} Z_5 F_{50}. Regarding fruit weight, seed treatment with penshibao 50 ppm plus zinc 10 kg ha^{-1} and penshibao 100 ppm foliar spray (S_{50}-Z_{10} F_{100}) registered the maximum fruit weight (76.0 g) which was found to be on par with S_{50} Z_5 F_{50} (74.7 g).

Among the treatments, the maximum yield (3253. g was observed at S_{50} Z_{100} F_{100}. It was followed by S_{50} Z_{10} F_{50}, S_{50} Z_5 F_{50}, S_{50} Z_5 F_{100}, S_{10} Z_5 F_{50}, S_{50} Z_{10} F_{100}, S_{100} Z_{100} F_{50}, S_{100} Z_{50} F_{100}, which were found to be on par with each other.

. The results go in support of the findings of Singh and Verma (1991) who also reported that soil application of zinc @ 10 kg ha^{-1} increased the yield in tomato. It is interesting to note that in addition to number of fruits, zinc had significant influence on fruit weight. The higher dry matter production observed under the zinc treatment also support the view that zinc might have altered the source-sink relationship by increasing the sink strength. Improvement of grades due to application of zinc was also reported by Mallick and Muthukrishnan (1980) in tomato. Considering the yield and economic returns, S_{50} Z_5 F_{50} i.e., seed treatment with penshibao 50 ppm, soil application of zinc 5 kg ha^{-1} and penshibao foliar spray of 50 ppm has been recommended for yield maximization in tomato.

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(Received: July 2001; Revised: December 2001)