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Short Communication

Effect of Nitrogen, Zinc and Manganese Fertilization on the Growth and Yield of Guava (*Psidium guajava* L.) Cv. Allahabad Safeda

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Guava is one of the most important sub-tropical and tropical fruit crops in India, but its production has not been satisfactory due to various factors. One of the important factors that limit the production is non-availability of 'nutrients', of which N, Zn and Mn play dominant roles. Among micro-nutrients, inadequacy of zinc and manganese is widespread (Roychoudhury *et al.*, 1961). Although many workers have reported the effect of these nutrients on plant growth and yield, there is lack of information about the effects of combined application of urea, zinc sulphate and manganese sulphate on growth and yield of guava. Therefore, the study was undertaken to standardize the proper management practices and fertilizer application in guava orchard.

The experiment was conducted at Horticulture Farm, Rajasthan College of Agriculture, Udaipur, during 1993-94 and 1994-95. Fifteen-year-old grafted and uniform plants of guava, cv. Allahabad Safeda, were selected for investigation. The plants were maintained under uniform conditions of orchard management. The treatments composed of three levels of nitrogen, viz., 0, 300 and 600 g plant^{-1}, three levels of zinc, viz., 0, 2 and 4 g plant^{-1} and three levels of manganese, viz., 0, 2 and 4 g plant^{-1}. In all, there were 27 treatment combinations. The experiment was laid out in complete randomized design using factorial approach with three replications.

The experimental soil was silty loam with available nitrogen 0.78%, phosphorus 45.28 kg ha^{-1}, potassium 305.15 kg ha^{-1}, zinc 0.46 ppm, manganese 5.81 ppm and pH 8.10. The deficiency symptoms of N, Zn and Mn were identified by a panel of four scientists in the experimental orchard. The leaf analysis of orchard before fertilization was done (Bhargava and Raghupathi, 1993), and N (0.74%), P (0.16%), K (1.47%), Zn (35.12 ppm) and Mn (38.43 ppm) contents were recorded.

The nitrogen, zinc and manganese were applied through urea (46%), $ZnSO_4$ (35%) and $MnSO_4$ (26%), respectively. For recording shoot growth, six newly emerged terminal and lateral shoots on each tree were tagged and observations were recorded. Fruit weight and yield were recorded at the time of harvesting. The data were statistically analyzed with the methods suggested by Panse and Sukhatme (1985).

Data presented in Table 1 revealed that growth parameters were influenced

*Table 1. Effect of N, Zn and Mn on growth and yield of guava**

Treatments	Shoot length (%)	Shoot diameter (%)	Leaf area (%)	No. of leaves $shoot^{-1}$	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	No. of fruits $tree^{-1}$	Yield kg $tree^{-1}$
N_0	16.14	16.73	16.75	5.37	5.61	6.03	181.00	259.30	46.99
N_1	22.37	22.82	22.17	8.41	6.35	6.82	203.04	285.85	58.11
N_2	33.57	27.94	27.34	9.92	7.12	7.53	224.00	297.85	66.81
SEm±	0.32	0.34	0.39	0.16	0.11	0.12	0.95	0.68	0.22
CD (p=0.05)	0.77	0.80	0.92	0.38	0.27	0.28	2.24	1.60	0.53
Zn_0	20.27	18.08	17.85	6.18	5.99	6.48	195.85	268.89	52.90
Zn_1	24.49	23.37	22.92	8.22	6.40	6.76	203.11	284.59	58.14
Zn_2	25.59	25.77	25.20	9.30	6.69	7.13	209.08	289.52	60.87
SEm±	0.32	0.34	0.39	0.16	0.11	0.12	0.95	0.68	0.22
CD (p=0.05)	0.77	0.80	0.92	0.38	0.27	0.28	2.24	1.60	0.53
Mn_0	21.37	18.83	18.65	6.47	6.01	6.46	197.64	271.26	53.88
Mn_1	24.15	23.37	22.99	8.14	6.34	6.77	202.54	281.44	57.31
Mn_2	25.59	24.93	24.33	8.81	6.73	7.14	207.86	290.30	60.72
SEm±	0.32	0.34	0.39	0.16	0.11	0.12	0.95	0.68	0.22
CD (p=0.05)	0.77	0.80	0.92	0.38	0.27	0.28	2.24	1.60	0.53
Cv. %	5.80	6.25	7.24	10.61	9.25	9.06	2.43	1.25	2.03

* Pooled means of two years

Here: N_0 = 0 g N $plant^{-1}$; N_1 = 300 g N $plant^{-1}$; N_2 = 600 g N $plant^{-1}$; Zn_0 = 0 g P_2O_5 $plant^{-1}$; Zn_1 = 2 g P_2O_5 $plant^{-1}$; Zn_2 = 4 g P_2O_5 $plant^{-1}$; Mn_0 = 0 g K_2O $plant^{-1}$; Mn_1 = 2 g K_2O $plant^{-1}$; Mn_2 = 4 g K_2O $plant^{-1}$

significantly with increasing level of N, Zn and Mn. The highest values of shoot length, shoot diameter, leaf area and leaves per shoot were recorded at the highest dose of N, Zn and Mn treatments, respectively. Similar results have also been reported by Singh (1983) and Ghosh (1986).

Increased levels of N, Zn and Mn also increased significantly the yield and its attributes (Table 1). The maximum fruit diameter, fruit weight, number of fruits per tree and yield per tree were recorded at the highest dose of N, Zn and Mn treatments. The results are in close agreement with the work of Arora and Singh (1970).

Under interaction effects the highest yield (76.97 kg $plant^{-1}$) and maximum number of fruits (327.00 $plant^{-1}$) were recorded at N_2 Zn_2 Mn_2 (600 g N + 4 g Zn + 4 g Mn $plant^{-1}$) treatment combination. Rest of the parameters were found unaffected with the treatment combinations of N, Zn and Mn.

The beneficial effects on growth and yield of guava, with increased levels of N, Zn and Mn, may be due to the fact that nitrogen is a constituent of carbohydrates, proteins, enzymes and chlorophylls, and is involved in all the processes associated with photosynthesis and growth. It helps assimilate more food, resulting in bigger-sized fruits and consequently in higher yield (Tassar *et al.*, 1989). Zinc is known to activate several enzymes, viz., carbonic anhydrite, dehydrogenases and RNA synthesis, which in turn improve the protein synthesis (Pamila *et al.*, 1992). Manganese, being an essential factor in respiration and nitrogen metabolism, activates a number of enzymes. Manganese also plays an important role in synthesis of chlorophyll molecules which increase the photosynthesis and consequently plant growth and yield (Devlin, 1972).

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