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Effect of nitrogen with and without zinc and organic manure on growth, yield and quality of guava (*Psidium guajava* L.) cv. SARDAR

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ABSTRACT

In order to estimate the effect of nitrogen with and without zinc and organic manure the present experiment was conducted on 10 years old guava trees growing at Horticulture Garden of C.S. Azad University of Agriculture and Technology, Kanpur. The treatments consisted two levels each of N (400 g and 600 g), Zinc (0 and 20 g) and FYM (0 and 60 kg) per plant during two consecutive years of 2005-06 and 2006-07. N @ 400g, FYM 60 kg and zinc 20 g per plant individually caused significant improvement on fruits set, size and weight of fruit, TSS, total sugar, ascorbic acid and yield per plant. These attributes improved further in association of either zinc or FYM treatment. The combination of 400 g N + 60 kg FYM + 20 g zinc improved quality of fruit revealing significant improvement in the weight of individual fruit and yield per plant which increased by 28.6% over 400g N applied alone.

Key words : Nitrogen, Zinc, Organic manure, Yield , Quality, Guava.

Guava 'the apple of tropics' is one of the most common fruits in India. It is the fourth most important fruit in area and production after mango, banana and citrus in the country and covers an area of about 1,81,000 ha. with a production around 2,88,000 MT (Indian Horticulture Data Base, 2006). It is quite hardy and remunerative crop. But the yield and quality of fruit is poor due to either no manuring or unbalanced manuring. Use of organic manure plays pivotal role as it supplies all the essential nutrients in a balanced form maintaining the soil health physically as well as chemically. Nitrogen is required in relatively greater amount by fruit plants is universally accepted. Similarly zinc affects growth and development of plant in general and fruits in particular but it is highly toxic even in slight excess. An experiment was, therefore, planned to chalk out nutritional schedule with a view to improve the yield and quality of guava fruits.

MATERIALS AND METHODS

The experiments were carried out at Horticulture Garden, Department of Horticulture, C.S. Azad University of Agriculture and Technology, Kanpur on 10 years old guava trees of cv. SARDAR during the year 2005-06 and 2006-07. The treatments comprised two levels each of N (N_1 = 400g and N_2 = 600g), Zinc (Z_0=0g and Z_1=20g) and FYM (F_0=0kg and F_1 = 60 kg) replicated thrice in a Randomized Block Design. Half of the dose of nitrogen *i.e.* 200g and 300g as per treatment, uniform dose of phosphorus 125g and potash 250g along with full dose of 20 g of zinc and 60 kg FYM per plant as per treatment, were applied in the middle of June and remaining half of all the three major nutrients (NPK) were given after harvest in mid February. NPK were applied through urea, single super phosphate and muriate of potash, respectively and zinc through zinc sulphate. Observations were recorded on fruiting, yield and yield attributing characters as well as quality traits of fruit. The TSS was determined by hand refractometer and sugar, titrable acidity and ascorbic acid contents were estimated as per AOAC (1990) during both the years of study. The pooled analysis of the data obtained was done as per Panse and Sukhatme (1984).

RESULTS AND DISCUSSION

Nitrogen in guava influenced fruit set. Application of 400g N/plant could set 78.15% fruits against 77.80% noted under 600g N/plant (Table 1). Soil application of zinc 20g enhanced it significantly revealing 79.27% fruit set as compared to 76.67% noted under its control. FYM improved the fruit set further and the dose of 60 kg FYM gave 80.72% fruit set against 75.22% recorded under control. Among first order interactions F_1Z_1 gave fruit set of 82.65% whereas, the lowest of it was recorded under F_0Z_0 (74.55%).

The size of fruits (length and width) increased significantly under both the doses of N but did not differ statistically with each other. N @ 400g showed slightly greater improvement in these attributes (6.17 and 6.09 cm) than 600g N (6.15 and 6.05 cm) under respective attributes. Zinc 20g produced bigger fruits (6.25 cm length and 6.17cm width) than control. FYM 60 kg applied alone produced significantly bigger fruits expressing 6.32 cm

Table 1 : Effect of nitrogen with and without zinc and organic manure on growth, yield and quality of guava cv. SARDAR

Treatments	Fruit set (%)					Length of fruit (cm)					Width of fruit (cm)				
	N_1	N_2	Mean	F_0	F_1	N_1	N_2	Mean	F_0	F_1	N_1	N_2	Mean	F_0	F_1
Z_0	76.65	76.70	76.67	74.55	78.80	6.05	6.10	6.07	5.90	6.25	5.98	5.95	5.97	5.90	6.03
Z_1	79.65	78.90	79.27	75.90	82.65	6.30	6.20	6.25	6.10	6.40	6.20	6.15	6.17	6.05	6.30
F_0	74.80	75.65				5.95	6.05				5.95	6.00			
F_1	81.50	79.95				6.40	6.25				6.23	6.10			
Mean	78.15	77.80		75.22	80.72	6.17	6.15		6.00	6.32	6.09	6.05		5.97	6.17
C.D. (P=0.05)	N	Z	O	NxZ	NxO	ZxO	N	Z	O	NxZ	N	Z	O	NxZ	NxO	ZxO	N	Z
	1.569	1.589	1.569	2.219 (NS)	2.219 (NS)	2.219 (NS)	0.053 (NS)	0.053	0.053	0.076	0.059 (NS)	0.059	0.059	0.084 (NS)	0.084	0.084 (NS)	0.069 (NS)	0.059

Treatments	T.S.S. of fruit (^{0}Brix)					Sugar content (%)					Acidity (%)				
	N_1	N_2	Mean	F_0	F_1	N_1	N_2	Mean	F_0	F_1	N_1	N_2	Mean	F_0	F_1
Z_0	9.31	9.28	9.29	9.07	9.52	7.56	7.53	7.54	7.46	7.63	0.15	0.16	0.16	0.17	0.14
Z_1	9.47	9.43	9.45	9.27	9.63	7.70	7.65	7.68	7.68	7.79	0.14	0.14	0.14	0.15	0.12
F_0	9.11	9.23				7.50	7.52				0.16	0.16			
F_1	9.67	9.48				7.76	7.66				0.13	0.14			
Mean	9.39	9.35				7.63	7.59		7.51	7.71	0.15	0.15		0.16	0.13
C.D. (P=0.05)	O	NxZ	NxO	ZxO		N	Z	O	NxZ	N	Z	O	NxZ	NxO	NxO	ZxO	
	0.059	0.063 (NS)	0.083	0.069 (NS)		0.036	0.036	0.036	0.050 (NS)	0.050	0.050	(NS)	0.009	0.009	0.009	(NS)	(NS) (NS)

Treatments	Ascorbic (mg/100g pulp)					Weight of fruits (g)					Yield / tree (kg)				
	N_1	N_2	Mean	F_0	F_1	N_1	N_2	Mean	F_0	F_1	N_1	N_2	Mean	F_0	F_1
Z_0	160.55	157.05	158.80	148.55	169.05	174.17	174.63	174.40	166.92	181.87	76.70	77.51	77.10	71.68	82.33
Z_1	170.04	171.54	170.79	158.05	183.53	181.21	180.91	181.06	174.37	187.75	82.62	82.45	82.52	76.76	88.27
F_0	151.07	155.53				168.56	172.73				72.58	76.07			
F_1	179.53	173.06				186.82	182.80				86.74	83.86			
Mean				153.30	176.29	177.69	177.70		170.65	184.81	79.66	79.96		74.32	85.30
C.D. (P=0.05)	N	Z	O	NxZ	NxO	ZxO	Z	O	NxZ	NxZ	N	Z	O	NxZ	NxO	N	0.943	0.943
	0.025 (NS)	0.025	0.025	0.863	0.863	0.863	2.145 (NS)	2.145	2.145	2.145	3.146	3.146	2.081 (NS)	2.081	2.081	0.943 (NS)	(NS)	(NS)

NS = Non-significart

length and 6.17cm width against 6.00 and 5.97cm, respectively noted under control. The interaction of 400g N and 60kg FYM increased the fruit size further expressing 6.40 and 6.23 cm values, respectively. Zinc in association with FMY (Z_1F_1) showed marked increase in fruit size exhibiting 6.40 and 6.30cm values, respectively. These findings are in agreement with the reports of Rajput and Chand (1976) in guava.

The improvement in fruit set, size and weight of guava fruit was fortified under the influence of individual element and their interactions. Nitrogen application responded favourably on all the growth attributes. Its beneficial effect is certainly increased number of leaves and consequently more leaf area and rapid synthesis of carbohydrates which might have converted into protein and protoplasm thereby producing vigorous plants.

Zn is involved in many enzymes in plant metabolism. It regulates indirectly water relations in plant. It is involved in protein synthesis and it is important constituent of protoplasm enzyme and plays significant role in photosynthesis.

The organic manure in the form of FYM containing all the essential elements for plants in balanced form applied alone or in association with N encouraged fruiting, yield and quality of guava. The findings of the present investigation are in line with the reports of Hayes (1970) and Wagh and Mahajan (1985) in guava and Ratan *et al*. (2008) in banana.

N @ 400g remaining at par with 600g dose revealed 9.39°B TSS and 7.63% total sugar. Zinc treatment improved both the metabolites significantly inducing 9.45°B and 7.68% values against 9.29°B and 7.54%, respectively noted under control. FYM 60 kg enhanced the metabolites significantly revealing 9.57°B TSS and 7.71% total sugar content.

The interaction of 400g N with 20g zinc caused numerical increase. Application of 400g N + 60kg FYM induced relatively higher TSS (9.67°B) and total sugar (7.76%). FYM 60 kg + zinc 20 g enhanced the total sugar content significantly with a value of 7.79% against 7.46% noted under control. Nitrogen failed to cause significant effect on acidity and ascorbic acid. Applying zinc 20 g alone produced less acidic fruits (0.14%) but increased vitamin 'C' significantly (170.79 mg). Similarly FYM treatment reduced acidity (0.13%) and increased vitamin 'C' (176.29 mg).

FYM 60 kg interacting with 400g N gave less acidic fruits (0.13%) enhancing the ascorbic acid content (179.53 mg). N 600 g + FYM 60 kg on the contrary increased the acidity and decreased ascorbic acid. FYM in conjunction with zinc showed beneficial effect by reducing acidity (0.12%) and increasing ascorbic acid (183.53 mg) significantly.

The beneficial role of FYM in association with fertilizer and zinc may be attributed to the activity of soil enzymes like urease, dehydrogenase, cellulase and amylase which might have helped in decomposition of organic matter and release of nutrients in the soil. However, this phenomenon would have been absent when only inorganic fertilizers were used.

Nitrogen did not cause significant variation on the weight of individual fruit as well as yield per plant, where as, zinc promoted it showing 181.06g and 82.52kg values, respectively. 400g N + 60 kg FYM increased these attributes recording 186.82g and 86.74kg values, respectively. These attributes were improved further under 60 kg FYM + 20 g zinc expressing 187.75 g fruit weight and 88.27 kg yield. These findings are in line with the reports of Rajput and Chand (1976) in guava and Banik *et al*. (1997**)** in mango.

The improvement in yield and yield components may be attributed to integrated use of nitrogen, zinc and organic manure which influenced the plant metabolism favourably, individually and collectively increasing the photosynthesis which ultimately improved the quality parameters and yield. The second order interaction showed non significant result in all the attributes studied barring the weight of fruit and yield per plant where $F_1N_1Z_1$ excelled all the treatments significantly excepting $N_2Z_1F_1$ in yield. Thus, under the integrated nutritional management where 400g N + 20 g Zinc + 60 kg FYM ($N_1F_1O_1$) was applied, fruit set, size of fruit, TSS, total sugar, ascorbic acid and yield per plant were improved. Srivastava (1998) is also of the opinion that if inorganic fertilizers are combined with organic manures, the yield and quality of the fruits are found to improve along with the improvement in soil health.

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