

Effect of micronutrients on yield and fruit quality of Banana (*Musa paradisiaca* L.) cv. BASRAI under pair row planting method

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ABSTRACT

A field experiment on the effect of micronutrients on yield and fruit quality of banana cv. BASRAI was carried out at Fruit Research Station, Navsari Agricultural University, Gandevi. Six treatment combinations of foliar spray and soil application of micronutrients viz., Fe and Zn with control were tried. The foliar application of ZnSO₄ (0.5%) + FeSO₄ (0.5%) was found to be best treatment for bunch weight (23.85 kg), bunch length (93.50 cm), bunch girth (114 cm), number of hands per bunch (11.70) and yield (149.078 t/ha). Foliar as well as soil application of ZnSO₄ (0.5%) + FeSO₄ (0.5%) treatments effectively increased the ascorbic acid content (25 mg/100 g) and total soluble solids (22.0325) in banana fruits. Higher cost benefit ratio (1:1.94) was obtained in foliar spray of ZnSO₄ (0.5%) + FeSO₄ (0.5%) treated plots.

Key words : Banana, Pair row method, Micronutrients, Yield, Fruit quality, Economics

Banana (*Musa paradisiaca* L.) belongs to family Musaceae, is the cheapest, plentiful and most nourishing fruit crop of the world. It is grown in more than 130 countries with total production of 97 million tones of fruits. India is the largest producer of banana in the world (23.20 MT) from an area of 6.46 lakh hectare. In Gujarat state the area under banana crop is 57,700 ha with an annual production of 31,57,700 tonnes, with the productivity of 54.8 t/ha. It is a premier fruit having great socio-economic significance in India. Owing to its shallow roots, banana is a moisture and nutrient loving plant so judicious doses of nutrients has to be applied at the proper stage to improve its productivity and quality of fruits. The major nutrients namely nitrogen, phosphorus and potassium as well as the micronutrients are essential for normal growth and fruiting of plants. Information regarding the effect of micronutrients on yield and quality of banana is meager. The present experiment was undertaken to study the effect of Zn and Fe application, alone or in their combinations on yield and quality of banana cv. BASRAI.

MATERIALS AND METHODS

A field experiment was conducted at Fruit Research Station, Navsari Agricultural University, Gandevi. The soil of experiment site was clayey, Gadat series which include deep to very deep, well drained clayey soil, having pH 7.1, EC 0.05 ds/m, available nitrogen 188 kg/ha, available phosphorus 109.01 kg/ha, available potash 244 kg/ha, available Fe 35.80 ppm and available Zn 1.36 ppm. The climate is typical monsoonal type with three well defined seasons viz., monsoon, winter and summer, characterized

by fairly warm humid monsoon, moderately cold winter and fairly hot summer. The rainfall received during crop growth was 3228 mm.

The treatments examined were (1) T₁ : Zn @ 0.5% (ZnSO₄) foliar spray at 3rd, 5th and 7th month after planting, (2) T₂ : Fe @ 0.5% (FeSO₄) foliar spray at 3rd, 5th and 7th month after planting, (3) T₃ : Zn @ 0.5% (ZnSO₄) + Fe @ 0.5% (FeSO₄) foliar spray at 3rd, 5th and 7th month after planting, (4) T₄ : 30 kg ZnSO₄/ha soil application at 3rd months after planting, (5) T₅ : 30 kg FeSO₄/ha soil application at 3rd months after planting, (6) T₆ : 30 kg ZnSO₄/ha + 30 kg FeSO₄/ha soil application at 3rd months after planting and (7) T₇ : control (no micronutrients application). The treatments were replicated four times and arranged in randomized block design. The planting material of "Basrai" banana (group Musa AAA, Cavendish subgroup) consisted of healthy sword suckers were planted during July at 1.0 m x 1.2 m x 2.0 m (pair row) spacing. The plot size was 6.4 m x 5.0 m (20 plants / plot). A uniform dose of N, P and K (200 g N : 90 g P : 200 g K/plant) was applied. Farm yard manure 10 kg per plant was given as basal in the pits dug prior to planting. The entire dose of phosphorus was applied at one month after planting while nitrogen and potash were applied in three equal splits 3rd, 4th and 5th month planting. Six plants were selected from each plot for recording observation on yield attributing characters. For recording quality parameters of fruits, fully ripped third hand fingers from the top of bunch were used. Economics was also worked out for each treatment considering prevailing market price. The data collected were subjected to statistical analysis using standard method of analysis of variance

for randomized block design.

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been summarized under following heads.

Yield attributing characters of banana:

The various yield attributing characters were greatly influenced by the foliar spray as well as soil application of micronutrients (Table 1). Foliar spray of Zn @ 0.5% + Fe @ 0.5% at 3rd, 5th and 7th month after planting and application of 30 kg FeSO₄/ha at 3rd month after planting significantly increased the bunch weight per plant. The same treatments also recorded highest fruit yield / ha and other ancillary character *i.e.* bunch length and girth as well as number of hands and flingers per bunch. Other micronutrient treatments were also found beneficial to increase the yield. These might be due to important role of micronutrients in increasing the cell elongation and division as suggested by Abdel Kadar *et al.* (1992). Hernandez and Lugolopez (1969). Turner (1969) and Abdel Kadar *et al.* (1992) also obtained increased in weight and number of fruits, hands per bunch and yield with combined spray and soil application of Fe, Cu, Zn, Mn, B and Mo. Similarly, increased bunch weight, higher number of hands and fingers were obtained by Ghanta and Dwivedi (1993), Subramaniam and Pillai (1997), Kumar and Jayakumar (2001) due to application of micronutrients.

Fruits quality of banana:

The quality of the fruit was very much influenced by the application of micronutrients, except not reducing sugar and total sugar (Table 2). The ripening days after

harvest was also not significantly influenced by all the treatment. However, maximum days to ripening after harvest were recorded in control. There was reduction in tritribable acidity (fruit acidity) in soil application of 30 kg FeSO₄/ha, the same effectiveness was noticed in all other treatments of micronutrients. Reduction acidity might be due to more accumulation of sugar in fruit (Singh and Rajpur, 1977). A considerable improvement in ascorbic acid and total soluble solids content of fruit were also noticed due to treatment with micronutrients. All the treatments found promising to improve the ascorbic acid and total soluble solids content of fruit as compared to control. The highest ascorbic acid content was observed in foliar application of Zn @ 0.5% + Fe @ 0.5%. Improvement in ascorbic acid content and fruit quality of banana by application of micronutrients like Zn, Cu, Fe and Mo was also reported by Ghanta and Dwivedi (1993). Total soluble solids content of fruit increased significantly due to single and combined application of micronutrients. Foliar spraying of Zn @ 50% recorded maximum TSS content of fruit compared to control. Similar effects of various micronutrients on quality of banana in terms of increased TSS have been reported by Ghanta and Dwivedi (1993), Das (1995) and Kumar and Jayakumar (2001).

A significant improvement in reducing sugar but non-significant effects on non-reducing sugar and total sugar content of the fruits were noticed due to application of micronutrients. Combined foliar spray of Zn @ 0.5% + Fe @ 0.5 % exhibited best response to increased reducing sugar content followed by foliar spray of Fe @ 0.5% as well as soil application of 30 kg ZnSO₄/ha or 30 kg FeSO₄/ha. However, non reducing sugar and total sugar were not significantly influenced by application micronutrients.

Table 1 : Effect of micronutrients on yield attributing characters of banana cv. "BASRAI" under pair row planting method

Treatments	Bunch length (cm)	Bunch girth (cm)	No. of hands per bunch	No. of fingers per bunch	Bunch weight (kg)	Fruit yield (t/ha)
T ₁ : Zn @ 0.5% (ZnSO ₄) foliar spray	86.75	106.50	10.66	185.00	21.67	135.423
T ₂ : Fe @ 0.5% (FeSO ₄) foliar spray	86.25	108.50	9.60	151.00	21.56	134.750
T ₃ : Zn @ 0.5% (ZnSO ₄) + Fe @ 0.5% (FeSO ₄) foliar spray	93.50	114.00	11.70	197.50	23.85	149.078
T ₄ :30 kg ZnSO ₄ /ha soil application	87.25	107.00	10.46	172.25	21.03	131.408
T ₅ :30 kg FeSO ₄ /ha soil application	88.50	109.25	10.21	172.00	22.54	140.875
T ₆ :30 kg ZnSO ₄ /ha + 30 kg FeSO ₄ /ha soil application	84.25	106.75	10.31	166.50	21.22	132.628
T ₇ :Control	79.00	103.00	9.04	141.00	18.39	114.955
S.E. ±	2.10	1.74	0.29	8.10	0.63	3.95
C.D. (P=0.05)	6.24	5.18	0.86	24.06	1.88	11.73
C.V. %	4.86	3.23	5.68	9.56	5.88	5.88

Table 2 : Effect of micronutrients on fruit quality of banana cv. Basarai under pair row planting method

Treatments	Ripening days (after harvesting)	Acidity (%)	Ascorbic acid (mg/100g)	TSS (Brix)	Reducing sugar (%)	Non reducing sugar (%)	Total sugar (%)
T ₁ : Zn @ 0.5% (ZnSO ₄) foliar spray	9.1225	0.2815	15.00	22.1675	7.3325	6.2175	13.5500
T ₂ : Fe @ 0.5% (FeSO ₄) foliar spray	8.9550	0.2825	17.50	20.7100	7.8500	5.0575	12.9075
T ₃ : Zn @ 0.5% (ZnSO ₄) + Fe @ 0.5% (FeSO ₄) foliar spray	8.4975	0.1567	25.00	21.7900	7.9000	5.9575	13.8575
T ₄ :30 kg ZnSO ₄ /ha soil application	8.2950	0.2017	14.00	21.0825	7.4625	5.6975	13.1600
T ₅ :30 kg FeSO ₄ /ha soil application	8.8750	0.1507	18.50	20.750	7.5800	5.4725	13.0525
T ₆ :30 kg ZnSO ₄ /ha + 30 kg FeSO ₄ /ha soil application	8.9125	0.2332	18.50	22.0325	7.2050	5.8475	13.0525
T ₇ :Control	9.2500	0.2912	10.00	20.0850	6.6900	6.4825	13.1725
S.E. ±	0.5051	0.0202	1.36	0.2611	0.2282	0.33	0.2307
C.D. (P=0.05)	NS	0.0600	4.04	0.7759	0.6779	NS	NS
C.V. %	11.42	17.79	16.07	2.46	6.14	11.49	3.48

Table 3 : Effect of micronutrients on cost benefit ratio

Treatments	Expenditure on micronutrient fertilizer (Rs.)		Labour charge (Rs.)	Other common expenditure (Rs.)	Total expenditure (Rs.)	Fruit yield (t/th)	Gross income (Rs.)	Net profit (Rs.)	CBR
	ZnSO ₄	FeSO ₄							
T ₁ : Zn @ 0.5% (ZnSO ₄) foliar spray	600	-	12750	106687	120037	135.423	320952	200915	1 : 1.67
T ₂ : Fe @ 0.5% (FeSO ₄) foliar spray	-	200	12750	106687	119637	134.750	319357	199720	1 : 1.67
T ₃ : Zn @ 0.5% (ZnSO ₄) + Fe @ 0.5% (FeSO ₄) foliar spray	600	200	12750	106687	120237	149.078	353315	233078	1 : 1.94
T ₄ :30 kg ZnSO ₄ /ha soil application	900	-	12750	106687	119737	131.408	311437	191700	1 : 1.60
T ₅ :30 kg FeSO ₄ /ha soil application	-	300	12750	106687	119137	140.875	333874	214737	1 : 1.80
T ₆ :30 kg ZnSO ₄ /ha + 30 kg FeSO ₄ /ha soil application	900	300	12750	106687	120037	132.628	314328	194291	1 : 1.62
T ₇ :Control	-	-	12750	106687	118837	114.955	272443	153606	1 : 1.29

Price of urea Rs. 4.97 per kilogram, Price of muriate of potash Rs. 4.32 per kilogram,
Price of single super phosphate Rs. 3.15 per kilogram, Selling rate of banana Rs. 2370 for tonne

The present findings are in close conformity with those reported by Ghanta and Dwivedi (1993). The expressed improvement in fruit quality due to increase in reducing sugar and sugar to acid ratio in banana with foliar application of Zn, Cu and B. Similar beneficial effect of application of Zn, Mn and Fe micronutrients on quality of mango, orange, banana and pineapple fruits have been reported by Singh and Rajput (1977).

Economics :

Economics of present investigation on various treatments of micronutrients in terms of cost benefit ratio

revealed that foliar application of Zn @ 0.5% (ZnSO₄) + Fe @ 0.5% (FeSO₄) at 3rd, 5th and 7th month after planting gave maximum gross income and net profit with higher cost benefit ratio as compared to other treatment.

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