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Application of micronutrients on growth, yield and quality of banana

M. PATHAK*, F. K. BAURI, D. K. MISRA, B. BANDYOPADHYAY AND K. CHAKRABORTY

**Dept. of Fruits & Orchard Management, Faculty of Horticulture*
AICRP on Tropical Fruits, Directorate of Research
Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal

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ABSTRACT

An investigation was carried out to study the effect of foliar application of micronutrients viz., Zn, Fe and B singly or in combination on growth, yield and quality of banana cv. Martaman (AAB, Silk). Combined application of Fe (0.5%) and Zn (0.5%) showed the best response on plant growth in terms of plant height, basal girth of pseudostem, number of leaves produced per plant and minimum duration between emergences of two successive leaves. The micronutrient induced marked improvement in days to shooting, days to bunch harvest and total crop duration (days). The leaf micronutrients content increased due to application of different micronutrients except in case of boron. Application of Fe (0.5%) + Zn (0.5%) recorded maximum bunch weight (16.30kg), hands (9.2/bunch), fingers (129.2/bunch), yield (40.75t/ha), finger length (14.80cm), finger breadth (13.10cm), days to ripening (8.1days) and highest B: C ratio (3.61). Spraying of Fe (0.5%) and Zn (0.5%) in combination showed maximum sugar:acid ratio (47.698), non-reducing sugar (10.040%) also showed considerable improvement on total soluble solids (25.53°Brix) and total sugar (17.241%) content of pulp. In view of observations recorded, it can be concluded that combined application of Fe (0.5%) + Zn (0.5%) at 3.5 and 7th month after planting of suckers gave better result in respect of growth, yield, quality and B: C ratio of banana (AAB, Silk) in Gangetic Plain of West Bengal.

Key words: Growth, micronutrient, yield

Micronutrients are required by plants in minute quantities, although these are very effective in regulating plant growth as they form a part of the enzyme system and thus regulate plant life. Micronutrients like Cu, Zn, Mo, B and Mn are necessary for healthy growth of banana (Srivastava, 1964). Deficiencies of Zn, Cu, Fe and Mo affected the growth and production in banana (Charpentier and Martin, 1965). However, no such research results are available for the new alluvial zone of West Bengal. Therefore, the present experiment was carried out to study the response of Zn, Fe and B singly or in combination on growth, yield and quality of banana.

MATERIALS AND METHODS

The experiment was conducted in simple Randomized Block Design with four replications and 5 treatments in the experimental field of AICRP on Tropical Fruits at the Teaching farm, Mondouri of Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal during 2006 – 2008 .The uniform healthy 2months old sword suckers of cv. Martaman (AAB, Silk) 1.5kg weight were planted in pit (size $1ft^3$) at a spacing of 2m x 2m after treating them in 10g carbendazim+1g streptocycline +10 ml monocrotophos in 10 liters of water for 30 minutes. Five kg farm yard manure + 250g N, 50g P_2O_5 and 300g K_2O $plant^{-1}$ was applied. Full dose of FYM and phosphate was applied before planting of sucker in the pits .The nitrogen and potash were applied in 4 splits i.e. at 2, 4, 6 and 9th months after planting. The micronutrients *viz.* Zn (0.5%), Fe (0.5%) and Borax (0.1%) were applied after adjusting the solution p^H singly or in combination as foliar spray at 3, 5 and 7thmonth after planting of suckers. Control plants were sprayed with water only. Recommended plant protection measures and cultural operations were made throughout the period of study. Observation on plant height, basal girth and leaf number were recorded at shooting. Fully developed leaf laminas from each plant under different parameters were collected for estimation of Zn, Fe and B contents at shooting. Harvesting of banana bunch was done as and when they attained marketable maturity. Days to shooting and crop duration were calculated from the date of planting. Economics of different treatments was calculated by calculating the cost of production and sale price of banana.

RESULTS AND DISCUSSION

The data presented in table 1 revealed that combined spraying of Zn (0.5%) + Fe (0.5%) showed highest basal girth (74.50cm) at shooting. Anon (2005) reported beneficial effect of micronutrients on height of pseudostem at shooting. Mandal *et al.* (2002) observed the beneficial effect of micronutrients and their combination on pseudostem girth over control. The number of leaves at shooting was also recorded maximum (13.4) in combined spraying of Fe (0.5%) +Zn (0.5%). Improvement in growth of banana plant might be due to enhancement of photosynthetic and other metabolic activities which lead to an increase in various plant metabolites responsible for cell division and cell elongation. Boron increases photo synthetic activity and respiration in plants and thus improves the growth (Lal and Rao, 1954).The lowest duration (8.50days) between emergence of two successive leaves was recorded in combined spraying of Fe (0.5%) + Zn (0.5%).

Email : fkb_aicrp@rediffmail.com

Table 1: Effect of micronutrients on growth of banana

Treatment	Height at shooting(m)	Girth at shooting(cm)	Leaf no. at shooting	Phyllocron (days)
T_1=$ZnSO_4$ (0.5%)	2.89	69.90	11.50	9.00
T_2=$FeSO_4$ (0.5%)	2.98	71.20	11.80	8.90
T_3=Borax (0.1%)	2.87	73.10	12.30	9.20
T_4=$ZnSO_4$(0.5%)+$FeSO_4$(0.5%)	2.99	74.10	13.40	8.50
T_5=Control(water spray)	3.12	68.40	10.90	9.40
SEm(±)	**0.90**	**1.83**	**1.19**	**0.20**
LSD(0.05)	**NS**	**5.42**	**NS**	**0.59**

Data in table 2 revealed that the earliest shooting (325.60days), minimum days to bunch harvest (89.70days) and also the crop duration (415.3days) were noticed by foliar application of $ZnSO_4$(0.5%) whereas control treatment recorded maximum crop duration (437.7days) than other treatments

Table 2: Effect of micronutrients on crop duration of banana

Treatment	Days to shooting	Days to bunch harvest	Crop duration (days)
T_1=$ZnSO_4$ (0.5%)	332.80	96.60	428.40
T_2=$FeSO_4$ (0.5%)	325.60	89.70	415.30
T_3=Borax (0.1%)	329.80	99.20	429.00
T_4=$ZnSO_4$ (0.5%)+$FeSO_4$(0.5%)	342.30	94.80	437.10
T_5=Control(water spray)	335.60	102.10	437.70
SEm (±)	**10.80**	**3.59**	**4.80**
LSD(0.05)	**NS**	**NS**	**14.23**

All the treatments have significant effects on bunch weight over control (14.2kg). Combined spraying of $ZnSO_4$(0.5%)+$FeSO_4$(0.5%) produced highest (16.3kg) bunch weight followed by Borax (0.1%). The significant variation in yield under different treatments were due to spraying of micronutrient (singly or in their combinations) were recorded over control (Table3). However, the highest yield (40.75t/ha) produced in combined application of $ZnSO_4$ (0.5%) +$FeSO_4$ (0.5%) followed by Borax (0.1%). The highest B:C ratio (3.61) observed in combined spraying of $ZnSO_4$(0.5%)+$FeSO_4$(0.5%).

Table 3: Effect of micronutrients on bunch characteristics, yield and B: C ratio.

Treatment	Bunch weight (kg)	Yield (t ha^{-1})	Bunch length (cm)	Bunch breadth (cm)	Hands/ bunch	Fingers/ bunch	B:C ratio
T_1=$ZnSO_4$ (0.5%)	14.70	36.75	45.30	42.10	8.60	98.30	3.30
T_2=$FeSO_4$ (0.5%)	15.10	37.75	44.80	41.30	8.80	93.10	3.36
T_3=Borax (0.1%)	15.90	39.75	45.90	41.70	9.10	115.10	3.56
T_4=$ZnSO_4$(0.5%)+$FeSO_4$ (0.5%)	16.30	40.75	48.50	43.30	9.20	129.20	3.61
T_5=Control(water spray)	14.20	35.50	45.70	42.20	8.50	100.50	3.17
SEm (±)	**0.43**	**0.35**	**0.33**	**0.41**	**0.14**	**1.20**	
LSD(0.05)	**1.27**	**1.03**	**0.97**	**NS**	**0.42**	**2.52**	

Table 4: Effect of micro-nutrients on fruit morphological characters and days to ripening of banana

Treatment	Finger length (cm)	Finger breadth (cm)	Finger weight (gm)	Pulp weight (gm)	Peel weight (gm)	Pulp: peel ratio	Days to ripening
T_1=$ZnSO_4$ (0.5%)	13.60	12.10	132.20	97.60	34.60	2.89	7.60
T_2=$FeSO_4$ (0.5%)	14.10	11.90	143.90	105.00	38.90	2.79	7.20
T_3=Borax (0.1%)	13.70	12.40	125.40	93.33	32.07	2.91	6.90
T_4=$ZnSO_4$ (0.5%) +$FeSO_4$ (0.5%)	14.80	13.10	113.00	84.03	28.97	2.90	8.10
T_5=Control (water spray)	13.90	12.70	124.30	92.18	32.12	2.87	6.10
SEm (±)	**0.19**	**0.32**	**0.71**	**1.38**	**0.68**		**0.22**
LSD(0.05)	**0.58**	**0.91**	**2.11**	**4.08**	**2.01**		**0.65**

Micronutrients significantly influenced the yield parameters (Table 3). Combined application of $ZnSO_4$ (0.5%)+$FeSO_4$ (0.5%) produced the highest number (129.2) of fingers and hands /bunch followed by Borax (0.1%). Anon (2005) reported highest fingers (107) in Zn+Fe+Cu+B treatment. It was observed from the results that length, breadth and weight of bunch were significantly influenced by most of the treatments. The longest bunch (48.5cm) was produced in combined application of $ZnSO_4$(0.5%)+$FeSO_4$ (0.5%), while shortest bunch (44.8 cm) produced in single application of

$FeSO_4$(0.5%). Significant improvement in finger length (14.80cm), breadth (13.10cm) and days to ripening (8.1) were also recorded by spraying of $ZnSO_4$(0.5%)+$FeSO_4$(0.5%).

Data in table 5 showed that single application of $FeSO_4$ (0.5%) recorded the maximum TSS content of fruit (25.66) compared with control (25.10). A significant improvement in non-reducing sugar and total sugar content of fruit were noticed due to application of micronutrients. Combined spraying of $ZnSO_4$ (0.5%) +$FeSO_4$ (0.5%) exhibited best response in case of non-reducing sugar and single application of $FeSO_4$ (0.5%) showed highest total soluble solids. However, reducing sugar content of fruits content exhibited lowest (6.202%) in combined application of $ZnSO_4$ (0.5%) + $FeSO_4$(0.5%). This combined treatment also showed highest sugar :acid ratio(47.689) and lowest (30.363%) titrable acidity in fruits. The highest (6.739mg) ascorbic acid content recorded in Borax(0.1%) treatment. Ghanta and Dwivedi (1993) reported significant effect of micronutrient on reducing sugar content of fruit and the best result (6.99%) in combined spraying of Zn+Cu+B.

Table 5: Effect of micronutrients on chemical composition of fruits of banana

Treatment	T.S.S (°Brix)	Reducing sugar (%)	Non-reducing sugar (%)	Total sugar (%)	Sugar: acid ratio	Ascorbic acid (mg g^{-100} pulp)	Total titrable acidity (%)
T_1=$ZnSO_4$ (0.5%)	24.80	6.673	9.418	16.940	39.230	6.580	0.441
T_2=$FeSO_4$ (0.5%)	25.66	6.570	9.376	17.860	42.234	6.423	0.424
T_3=Borax (0.1%)	23.59	6.313	9.142	16.411	37.692	6.739	0.438
T_4=$ZnSO_4$(0.5%) +$FeSO_4$ (0.5%)	25.53	6.202	10.040	17.241	47.698	6.639	0.363
T_5=Control (water spray)	25.10	6.292	9.583	15.881	36.383	6.427	0.438
SEm (±)	**0.44**	**0.18**	**0.28**	**0.15**		**0.17**	**0.01**
LSD(0.05)	**1.30**	**NS**	**0.82**	**0.44**		**NS**	**NS**

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