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Improving yield and quality of banana cv. Martaman (*Musa* AAB, Silk) through micronutrient and growth regulator application

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ABSTRACT

An experiment was conducted with eight treatments to study the effect of micronutrient and growth regulators for yield and quality in banana cv. Martaman (Musa AAB, Silk) during 2011-2012. The treatments were, T_1 – Borax (0.1%), T_2- KH_2PO_4 (0.5%), T_3 - KNO_3 (0.5%), T_4 - K_2SO_4 (0.5%), T_5 - GA_3 (30 ppm), T_6– 2,4-D (30 ppm), T_7– Dehanding and T_8– Control (water spray). Micronutrient and growth regulator have got significant influence over yield and fruit quality. Maximum increase in bunch weight (17.72kg), yield (44.30t/ha), number of hands (8.88), number of finger per bunch (133.66) and finger length (13.45cm) was recorded by KH_2PO_4 (0.5%) application. With regard to physicochemical characters of fingers, Borax (0.1%) showed maximum influence for total soluble solids (26.72 °Brix), total sugar (14.57 %) and sugar: acid ratio (45.53). The maximum vitamin C content (8.60 mg/100g pulp), shelf life (6.40 days) and benefit: cost (1.48) was recorded by the treatment of 2, 4-D (30 ppm).The same treatment was also found to be next most influencing treatment in increasing bunch weight, yield, hands number and finger length after KH_2PO_4 (0.5%) . It may be concluded that the application of 2,4-D @ 30 ppm was effective in modifying the finger characters thereby improving the yield, fruit quality and B: C ratio of banana cv. Martaman.

***Keywords*:** Banana,dehanding, manipulation, Martaman (AAB), quality, yield

Banana and plantain is one of the most important fruit crops grown in India as well as in West Bengal. It is so predominant and popular among people that it is liked both by poor and rich alike. It is also cheap, highly nutritive and easily digestible fruit having refreshing aroma. It has also high production potentiality and profitability. In banana, fruit size and quality is of great important though consumer acceptance varies from place to place. However finger characters such as grade, colour and free from disease and insect pest attack and post harvest life the priority characters that govern the preferences. Hence, disease treatment that can improve finger characteristics may have a role not only on improving yield but also on consumer preference and thereby pronounced effects on net returns are considered as bunch management. Application of micronutrients in banana increase the growth, yield and quantity of banana (*Pathak et.al*.,2011) Chemical manipulation and removal of hands have been found to increase in yield both qualitatively and quantitatively (Choudhury *et al*., 1996 and Singh, 2001). Thus, keeping in view all the above aspects an investigation was conducted in banana cv. Martaman to study the influence of micronutrients and growth regulators in finger development and fruit quality improvement.

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MATERIALS AND METHODS

The present experiment was carried out in the Research Station of All India Coordinated Research Project on Tropical Fruits at Mondouri of Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal during the year 2011- 2012. The soil of the Research Station was new alluvium and sandy loam in texture having sufficient depth, moderately fertile and having proper drainage. The temperature ranged from 13.2 to 34.5 °C and relative humidity varied from 36.6 to 97.8% during the experimental period. The treatment details were- T_1 – Borax (0.1%), T_2 - KH_2PO_4 (0.5%), T_3 - KNO_3 (0.5%), T_4 - K_2SO_4 (0.5%), T_5 - GA_3 (30 ppm), T_6 – 2,4-D (30 ppm), T_7 – Dehanding and T_8 – Control. Two sprays of chemical were applied at 5 and 20 days after last hand opening. Recommended cultivation and cultural practices like weeding (power tiller operation and spraying of glyphosate @ 4 m1 lit^{-1}), irrigation (7 days interval in summer and 10 interval in winter) and plant protection measures (Monocrotophos @1.5 m1 $litre^{-1}$ and Propiconazole @1 m1 $litre^{-1}$ of water for control of scarring beetle and sigatoka respectively) were

followed as and when required. The experimental design was RBD with three replications and eight treatments. Each treatment having twelve numbers of plants with a spacing of 2m x 2m. The observations were recorded on bunch characters, finger characters, physico-chemical composition and shelf life of fruit. Economics and benefit: cost ratio of different treatments were estimated by calculating the cost of production and sell proceed of banana fruit. The data obtained was analyzed statistically and test of significance was done by following the statistical method, as described by (Panse and Sukhatme, 1989).

RESULTS AND DISCUSSION

The data presented in the table-1 showed maximum bunch weight (17.72kg), yield (44.30t.ha^{-1}), number of hands (8.88) and number of fingers per bunch (133.6) was obtained in the treatment T_2 - KH_2PO_4 (0.5%) followed by T_6 -treatment *i.e.* 2,4-D (30 ppm). Dehanding *i.e* (T_7) treatment produced highest finger weight (146.40g). Hasan *et al.* (2007) conducted the experiment consisted of different intensities of hand removal and found dehanding was beneficial for increase of finger weight which was in tune with the present observation.

The data presented in table-2 revealed that highest finger length (13.45 cm) was recorded with treatment of KH_2PO_4 (0.5%) followed by 13.33 cm in T_6 – 2,4-D (30 ppm). The significant increase in fruit diameter (4.33cm) was observed by dehanding treatment over control (3.90cm). Removal of hand also had a tendency to enhance pulp weight of fingers. The data regarding pulp weight varied from 79.23 g (control) to 120.70 g (dehanding treatment). The highest peel weight (25.30g) was recorded in T_7 –Dehanding, followed by T_6 – 2,4-D (30 ppm) in which the peel weight was 24.76 g. Pulp: peel ratio of fruit differed significantly in the present investigation. However, the highest value (4.77) was recorded in T_7 dehanding and the minimum value (3.36) in T_3 – KNO_3 (0.5%). The maximum shelf life (6.4days) was recorded in the bunch treated with T_6 – 2,4-D (30 ppm) followed by 4.4 days in T_3 – KNO_3(0.5%). This observation was in

Table 1: Effect of micronutrient and growth regulators on bunch characters of banana cv. Martaman (AAB)

Treatments	Bunch weight (kg)	Yield (t ha^{-1})	No. of hands per bunch	No. of fingers per bunch	Weight of finger(g)
T_1- Borax (0.1%)	15.57	39.92	8.33	120.66	116.03
T_2 -KH_2PO_4 (0.5%)	17.72	44.30	8.88	133.66	122.00
T_3 -KNO_3 (0.5%)	14.45	36.12	8.66	128.33	101.30
T_4 - K_2SO_4 (0.5%)	14.94	37.35	8.66	115.24	116.27
T_5 - GA_3 (30ppm)	14.83	37.08	8.66	118.22	112.50
T_6 –2,4-D (30ppm)	16.66	41.65	8.75	125.11	121.50
T_7 –Dehanding	13.83	34.57	6.00	84.00	146.40
T_8 –Control	14.25	35.62	8.70	127.41	101.24
SEm(±)	**1.13**	**2.14**	**0.15**	**2.78**	**3.01**
LSD(0.05)	**3.42**	**6.48**	**0.45**	**8.44**	**9.15**

Table 2: Effect of micronutrient and growth regulator on finger characters and shelf life of banana cv. Martaman (AAB)

Treatments	Fingerlength (cm)	Finger diameter(cm)	Pulpweight (g)	Peel weight(g)	Pulp: peelratio	Shelf life(days)
T_1-Borax (0.1%)	11.83	4.16	92.86	23.14	4.01	5.2
T_2-KH_2PO_4 (0.5%)	13.45	4.26	97.25	24.11	4.03	4.9
T_3-KNO_3 (0.5%)	11.16	3.96	76.64	22.80	3.36	4.4
T_4 - K_2SO_4 (0.5%)	11.63	3.85	94.46	21.56	4.38	5.1
T_5 -GA_3 (30ppm)	12.00	4.13	90.96	22.33	4.07	5.3
T_6–2,4-D (30ppm)	13.33	4.00	96.24	24.76	3.88	6.4
T_7–Dehanding	12.66	4.33	120.70	25.30	4.77	4.7
T_8 –Control	11.50	3.90	79.23	22.77	3.47	6.2
SEm(±)	**0.38**	**0.08**	**3.10**	**0.43**	**0.04**	**0.22**
LSD(0.05)	**1.15**	**0.27**	**9.41**	**1.33**	**0.14**	**0.67**

agreement with the observation of Geetha and Nair (2002) where they concluded that shelf life increased with 2, 4-D application along with reduction in ripening period.

Application of borax (0.1%) showed the highest T.S.S (26.72 ^{0} Brix) in fruits followed by T_4 - K_2SO_4 (0.5%) treatment in which T.S.S was 25.52^0 Brix. Similar observation was also reported by Shira et.al (2012). Application of Borax (0.1%) also resulted maximum total sugar (14.57%) and maximum sugar acid ratio (45.53). Borax (0.1%) application on bunch had got significant change over other treatments in terms of sugar: acid ratio of the fruits. This may be due to translocation of more sugar to the fruits by sugar-borax complex formation. The data in the table-3 revealed that application of T_6 – 2, 4-D (30 ppm) recorded the significantly highest vit.C (8.60 mg per 100g of pulp) followed by 8.03 mg per100g in T_3 - KNO_3 (0.5%) and the lowest vitamin C content (5.18 mg per100g) was recorded in T_7 (dehanding). The maximum physiological loss in weight (29.36g) was observed in T_3 - KNO_3 (0.5%) followed by T_{7-} dehanding (25.87 g), whereas the minimum loss was found in the control (14.96g).

The benefit: cost ratio of different bunch management treatments varied from 0.74 to 1.48. Maximum B:C ratio (1.48) was recorded in T_6 –2, 4-D (30 ppm) followed by T_1- Borax (0.1%) i.e. 1.12, whereas minimum B: C ration (0.74) was observed in T_3 -KNO_3 (0.5%) treatment. Geetha and Nair (2002) as well as Kumar and Kumar (2010) also reported that 2,4-D, sprayed to fruits showed the highest benefit: cost ratio.

Hence considering the overall performance, application of 2, 4-D @ 30 ppm at 5 and 20 days after

Table 3: Effect of micronutrient and growth regulators on chemical composition of banana cv Martaman (AAB)

Treatments	T.S.S(^{0}Brix)	Total sugar (%)	Acidity (%)	Sugar:acid ratio	Vit.C(mg/ 100g^{-1} of pulp)	PLW (g)
T_1-Borax (0.1%)	26.72	14.57	0.32	45.53	6.21	23.23
T_2 -KH_2PO_4(0.5%)	25.20	12.97	0.30	43.18	6.38	18.42
T_3 -KNO_3 (0.5%)	24.41	10.62	0.26	40.84	8.03	29.36
T_4 -K_2SO_4 (0.5%)	25.52	11.42	0.35	32.62	5.20	24.31
T_5 -GA_3 (30ppm)	25.13	9.39	0.30	33.52	5.86	24.98
T_6–2,4-D (30ppm)	24.34	10.46	0.27	38.74	8.60	17.36
T_7–Dehanding	25.50	9.55	0.25	36.73	5.18	25.87
T_8 –Control	25.50	8.59	0.25	34.30	6.45	14.96
SEm(±)	**0.37**	**0.71**	**0.02**	**1.62**	**0.14**	**0.85**
LSD(0.05)	**1.12**	**2.17**	**0.086**	**4.91**	**0.43**	**2.58**

Table 4: Economics of micronutrient and growth regulator in banana cv. Martaman (AAB)

Treatments	Yield (t ha^{-1})	Cost of cultivation (` ha^{-1})	Gross return (` ha^{-1})	Net return (` ha^{-1})	B:C ratio
T_1-Borax (0.1%)	39.92	104325	239520	135195	1.29
T_2-KH_2PO_4(0.5%)	44.30	141250	265800	124550	0.88
T_3-KNO_3 (0.5%)	36.12	123850	216720	92870	0.74
T_4 -K_2SO_4 (0.5%)	37.35	120250	224100	103850	0.86
T_5 -GA_3 (30ppm)	37.08	127000	222480	95480	0.75
T_6 -2,4-D (30ppm)	41.65	100750	249900	149150	1.48
T_7-Dehanding	34.57	105000	207420	102420	0.97
T_8-Control	35.62	100500	213900	113400	1.12

Economic parameters for estimation of B:C ratio
Cost of cultivation `1, 00,000/-, Sale price of banana- ` 6000/ton, Borax ` 576/- (1kg), $Ga_3$ ` 120/- (1g), 2,4-D ` 1800/- (1kg), $KH_2PO_4$ ` 1020/- (1kg), KNO_3 ` 636/-(1kg), $K_2SO_4$ ` 540/-(1kg), Labour wages `167/- per day.

last hand opening was found most effective in modifying the bunch characters thereby improving the yield and quality of banana cv. Martaman (*Musa* AAB Silk).

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