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Short communication

Influence of de-navelling and stalk-end nutrient application on nutrient composition of 'Robusta' banana fruits

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ABSTRACT

The contents of N, P, Mg, S, Fe and Mn in banana fruit increased significantly due to denavelling from 0.32%, 0.086%, 0.12%, 0.024%, 52 ppm and 4.8 ppm, under 'control' to 0.37%, 0.085%, 0.13%, 0.027%, 59 ppm and 6.7 ppm, respectively. Dipping stalk end of the bunch in fresh cow dung enhanced these above nutrients to 0.40%, 0.086%, 0.14%. 0.028%, 63 ppm and 7.6 ppm, respectively. When cow dung was enriched with ammonium sulphate, the fruits showed 0.50-0.51% of N, 0.081-0.090% of P, 0.16-0.23% of Mg, 0.032-0.040% of S, 59-111 ppm of Fe and 8.1-17.8 ppm of Mn. Addition of potassium sulphate further enhanced this effect in respect of K (2.11-2.44%) and Fe (74-115 ppm) in fruit. Increasing level of ammonium sulphate in the blend significantly decreased Ca content of the fruit from 0.24% at 5 g to 0.10% at 25 g. When potassium sulphate was included in the blend, Ca content showed further reduction (0.19% at 5 g to 0.10% at 25g). At 15 g of ammonium sulphate and 7.5 g of potassium sulphate the maximum bunch weight of 27.993 kg was obtained (as against 16.724kg under retention of male bud throughout) corresponding to the enhanced nutrient composition of 2.44% of K, 0.12% of Ca, 0.18% of Mg, 0.033% of S, 115ppm of Fe and 14.9ppm of Mn that may have nutraceutical implications.

Key words: De-navelling, external feeding, nitrogen, potassium, sulphur, 'Robusta' banana, *Musa* sp. (AAA), composition of fruit

Manipulation of bunch size of banana to suit market demands is pratcised in South East Asian countries. Banana plant is supplied with nutrients through soil and foliage, de-navelling (removal of male inflorescence for nutrient diversion) and post-shooting feeding nutrients through the distal stalk-end of rachis (Venkatarayappa *et al*, 1976, Prasanna Kumari Amma *et al*, 1986, Ancy *et al*, 1998 and Ancy and Kurien, 2000) to achieve high yields. De-navelling serves dual purposes of saving mobilization of food into unwanted sink of banana plant as well as earning additional income when excised male bud is used as a vegetable (Singh, 2001). Therefore, an attempt was made to enhance the bunch yield by feeding N, K and S through the excised distal stalk-end of rachis after de-navelling and to determine influence of treatments on composition of mineral nutrients in fruits of "Robusta" banana.

A field experiment was taken-up during 1998-2002 on healthy 'Robusta' banana (*Musa* sp. AAA) plants at flowering stage. The crop was raised on a red clay loam having pH of 6.5, electrical conductivity of 0.3 dS/m, organic carbon of 1.2%, cation exchange capacity of 21.4 cmol (p+)/kg, exchangeable K of 1.3 cmol (p+)/kg, 1*N* KCl exchangeable acidity of 0.5 cmol (p+)/kg and available S of 38 ppm. Rachis at distal end of the bunch was excised along with male bud giving a slanted cut immediately after all the pistillate (female) flowers had set fruits and after 4 bracts were shed (about 15 days of flower emergence). Half a kilogram aliquots of fresh cow dung were blended to form slurry with required quantity of fertilizer [5-25 g of ammonium sulphate (AS) / 2.5 to 12.5 g of potassium sulphate (SOP)] and 100 ml of water. Cow dung contained about 1.4% of N, 0.5% of P, 0.9% of K, 1.8% of Ca, 0.8% of Mg, 0.4% of S, 250 ppm of Fe, 80 ppm of Mn, 64 ppm of Zn and 38 ppm of Cu. The blend was placed in a polythene bag and tied securely to dip the excised rachis into the slurry. The treatments were: control-1 (the male bud retained till harvest along with the male bud); control-2 (de-navelling by excision of rachis 10 cm after the last hand); control-3 (de-navelling and dipping excised distal end of rachis in the slurry of cow dung and 100 ml water); other 5 treatments receiving 5, 10, 15, 20 and 25 g of AS blended with cow dung (applied as in control-3); and another 5 treatments receiving 2.5, 5.0, 7.5, 10.0 and 12.5 g SOP in addition to 5 to 25 g of AS blended in cow dung as above (applied as in control-3), respectively. The treatments were arranged in a completely randomized design with 3 replications. The cow dung applied was retained till harvest. Uniform bunches carrying 10 hands (having an average number of fingers = 122 ± 2.57) were selected to receive treatments. Harvesting was taken-up at maturity (about 100 days after flowering). At harvest the fruit was sampled, cut into pieces, dried in oven at 70°C and powdered for N analysis by Kjeldahl method. Contents of other nutrients in the digest of the fruit sample in the di-acid (9:4 nitric: perchloric acid) were determined using standard analytical methods (Jackson, 1967).

The contents of N, P, Mg, S, Fe and Mn increased significantly due to denavelling (‘control 2’) from 0.32%, 0.086%, 0.12%, 0.024%, 53ppm and 4.8ppm, under ‘control 1’ to 0.37%, 0.085%, 0.13%, 0.027%, 59 ppm and 6.7 ppm, respectively (Table 1). Dipping the stalk end of the bunch in cow dung (‘control 3’) enhanced the contents of these nutrients to 0.40%, 0.086%, 0.14%. 0.028%, 63 ppm and 7.6 ppm, respectively. This effect was pronounced when the cow dung was enriched with ammonium sulphate and the fruits showed 0.50-0.51% of N, 0.080-0.090% of P, 0.16-0.23% of Mg, 0.032-0.040% of S, 59-111ppm of Fe and 8.1-17.8ppm of Mn. Addition of SOP further enhanced this effect in respect of K (2.11-2.44%) and Fe by showing 74-115ppm in fruit. Increasing level of ammonium sulphate in the blend significantly decreased Ca content of the fruit from 0.24% at 5g to 0.10% at 25 g. Between enrichment of cow dung with ammonium sulphate and ammonium sulphate + potassium sulphate, the latter appeared to enhance the composition of P, K, Ca, Fe and Mn. In the case of P and Ca the differences were not significant. No changes were discernible for Cu and Zn as the content of these nutrients in fruit was in traces.

In respect of N content of fruit, the improvement was fairly uniform at 0.50-0.51% when ammonium sulphate was blended in the cow dung and at 0.49-0.50% when ammonium sulphate + potassium sulphate were used for enrichment of the cow dung in the entire range of these additions. The highest P content of 0.090% was observed when 10g of ammonium sulphate or 5 g of ammonium sulphate + 5 g of potassium sulphate were added to cow dung. In both Ca and Mg, the addition of 5 g of ammonium sulphate to cow dung produced the maximum increase of 0.24% and 0.23%, respectively, while these contents were reduced to 0.15% and 0.19% in the presence of potassium sulphate. Sulphur content was the highest at 20 g of ammonium sulphate (0.04%) followed by 20 g of ammonium sulphate + 10 g of potassium sulphate (0.038%) addition to cow dung. Similarly, the contents of Fe and Mn peaked at 15 g of ammonium sulphate and/or potassium sulphate (111 and 115 ppm), respectively. No changes were discernible for Cu and Zn as the content of these nutrients in fruit was in traces. Substantial enhancement of bunch weight resulted by de-navelling (19.041 kg) and dipping the stalk end in cow dung only (19.904 kg) and enriched cow dung (21.948-27.993 kg). When 15 g of ammonium sulphate and 7.5 g of potassium sulphate were blended in cow dung and applied the maximum bunch weight of 27.993kg was obtained (as against 16.724 kg under ‘control 1’).

Table 1. Effect of de-navelling and feeding ammonium sulphate and potassium sulphate on composition of ‘Robusta’ banana fruit

Treatment	N	P	K	Ca	Mg	S	Fe	Mn	Bunch yield (kg)
	%						mg/kg		
Control 1	0.32	0.086	1.73	0.09	0.12	0.024	53	4.8	16.724
Control 2	0.37	0.085	1.87	0.10	0.13	0.027	59	6.7	19.041
Control 3	0.40	0.086	1.98	0.10	0.14	0.028	63	7.6	19.904
5g AS*	0.51	0.081	2.00	0.24	0.23	0.031	87	8.1	23.600
10g AS	0.51	0.090	2.19	0.10	0.16	0.034	74	10.4	25.403
15g AS	0.51	0.080	2.30	0.14	0.19	0.032	111	17.8	25.791
20g AS	0.50	0.082	2.12	0.13	0.17	0.040	73	9.6	24.166
25g AS	0.51	0.086	2.10	0.10	0.16	0.034	59	8.2	22.484
5g AS + 2.5g SOP**	0.49	0.090	2.11	0.15	0.19	0.034	103	13.1	25.545
10 g AS + 5.0g SOP	0.50	0.081	2.17	0.12	0.15	0.036	86	12.1	25.824
15 g AS + 7.5g SOP	0.49	0.086	2.44	0.12	0.18	0.033	115	14.9	27.993
20 g AS + 10.0g SOP	0.50	0.080	2.14	0.10	0.16	0.038	84	12.1	24.837
25 g AS + 12.5g SOP	0.49	0.085	2.13	0.10	0.15	0.029	74	10.6	21.948
SEm (±)	0.005	0.0011	0.028	0.003	0.002	0.0004	1.6	0.021	0.5492
CD (p = 0.05)	0.015	0.0030	0.082	0.010	0.005	0.0012	4.6	0.060	1.6027

*AS – Ammonium sulphate; ** SOP – Sulphate of potash

Removal of male bud caused an increase in the nutrient composition of fruits as also of the weight of the bunch because of: (i) conservation and utilization of energy of nutrients for finger development which would be otherwise lost for opening of the remainder of the flower and (ii) removal of a strong and active competing sink for photosynthates and mineral nutrients despite its smaller size relative to the bunch (Kurien *et al*, 2000; Ancy and Kurien, 2000; Singh, 2001). Further, the translocation of nutrients into the infructescence from such exogenous feeding in 'Poovan (AB)', 'Monthan (AAB)' and 'Nendran (AAB)' varieties has been reported by Buragohain and Shanmugavelu (1986), Sobhana and Arvindakshan (1989). Substantial response of yield of banana fruits as well as the composition of the fruit may be attributed to the presence of other mineral and bio-chemical ingredients of cow dung. The ripening of the fruits after harvest was normal and the fruit quality was not affected by the treatments.

The results indicate that de-navelling and feeding nutrients using enriched cow dung enhanced the mineral composition of banana fruits which can have nutraceutical implications. There is also scope to manipulate the nutrient composition of the fruit further by appropriately modifying the composition of the cow dung blend since the nutrient translocation into the fruits has been demonstrated in this study.

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REFERENCES

Ancy T.K, Kurien, S., Augustin, A. and Balachandran P.V. 1998. Urease activity in banana fruit. *J. Plt Nutr.*, **21**:2127-2140

Ancy T.K. and Kurien, S. 2000. Bunch stalk feeding of urea in banana *Musa* (AAB group) 'Nendran'. *Sci. Hort.*, **84**:205-212

Buragohain, R. and Shanmugavelu, K.G. 1986. Studies on the effect of post-shooting application of urea in 'Vayal vazhai' banana (ABB). *Banana Newslett.*, **9:**16-18

Jackson, M.L. 1967. *Soil chemical analysis*. Prentice Hall of India, New Delhi

Kurien, S., Anil B.K., Rajeevan, R.K., Bharathan and Krishnan, S. 2000. Phosphorus mobilization to uneconomic tissues and effects of bunch trimming regimes in banana. *Sci. Hort.*, **82**:25-35

Prasanna Kumari Amma. S., Babylatha, A.K., Pushkaran, K. and Kurien, T.K. 1986. Studies on the effect of removing terminal hands and male bud on the yield and fruit size of banana, *Musa* (AAB group) 'Palayankodan'. *South Ind. Hort.*, **34**:204-209

Singh, H.P. 2001. Banana. In: *Handbook of Horticulture*, Chadha, K.L. (Ed.). p.152, Indian Council of Agricultural Research, New Delhi

Sobhana, A. and Aravindakshan, M. 1989.Translocation of banana after shooting. *J. Nucl. Agril. Biol.*, **18**:243-245

Venkatarayappa, T., Narasham, B. and Venkatesan, C. 1976. Effect of post-shooting application of urea on development and composition of banana fruit. *South Ind. Hort.*, **19**:109-117

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