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Macronutrient Estimation in Post-Harvest Banana Corms of Different Genotypes

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ABSTRACT

Banana corm act as a storage material for supporting new side shoot/sucker. It nourishes them by providing the reserved nutrients elements, however amounts of nutrients reserve in corms are not known. The experiment was conducted to evaluate dry matter and essential macronutrients elements (N, P, K, Ca and Mg) of thirty-three corms of different banana genotypes belonging to three different genomic composition. Dry matter content in the corms of the genotypes varied between 5.54 % in Madhuranga bale (AAB) and 23.81 % in Giant Governor (AAA). The nitrogen level in the corms of the genotypes varied between 0.17 % in Champa-IV (AAB) and 1.08 % in Alpan-Manhar (AAB). The phosphorus level in the corms of the genotypes varied between 3.65ppm in H531 (AAB) and 46.33ppm in Matta Poovan (AAB). The potassium level in the corms of the genotypes varied between 1.50% in Grand Naine (AAA) and 4.84% in Champa-I (AAB). The calcium level in the corms of the genotypes varied between 0.27% in Giant Governor and 1.20% in Martaman (AAB). The magnesium level in the corms of the genotypes varied between 0.38% in Giant Governor (AAA) and 1.13% in Green Bombay (ABB). The composition state that banana corm has sufficient nutrient for promoting propagules /suckers from the mother corm.

Keywords Corms, Dry matter, Genomic groups, Genotypes, Macronutrients.

INTRODUCTION

Musa species are grouped according to their “ploidy” and the relative proportion of *Musa acuminata* (A) and *Musa balbisiana* (B) in their genome. Most familiar, seedless cultivars are triploid hybrids (AAA, AAB, ABB). Their diploid (AA, AB, BB) and tetraploid (AAAA, AAAB, AABB, ABBB) versions are much rarer. Fruits of cultivated *Musa* species are typically sterile or have extremely low fertility. They produce fruit pulp without pollination and fruits lacking seed.

Banana is a very popular fruit due to its low price

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and high nutritive value. It is consumed in fresh or cooked form both as ripe and raw fruit. As a diet, banana is rich in carbohydrates (22.84 g/100 g), provides energy about 370 kJ/100 g and it is considered to be one of the best sources of potassium (358 mg/100 g) that fulfils 8% of the daily recommended value (Muhammad *et al.* 2020). It is also a good source of phosphorus, calcium and magnesium. A small size banana can provide good amounts calories of energy (Mateljan 2007). Intake of two bananas could provide energy sufficient for 90 minutes of workout (Kumar *et al*. 2012). Consumption of two banana a day result in 10% drops in blood pressure within a week (Sharrock and Frison 1999).

Banana corm (rhizome) is the site which produces "suckers," or offshoots of young banana plants that grow in clusters around the "mother" plant. Corm act as storage reserve material for nourishing new young sucker. However, amount of nutrients reserve in the corm are not known as there are hardly any works on the composition of banana corm. With the aim to estimate macronutrients reserved in post-harvest banana corms the title macronutrients estimation in post-harvest banana corms of different genotypes were taken into the experiment.

MATERIALS AND METHODS

The experiment was conducted between March 2019 to May 2019. The corms for the experiment were collected from the banana plants raised and maintained at banana plantation garden of AICRP – Fruit Crops, Horticulture Research Station, BCKV, Mandouri Farm, West Bengal. The estimation of nitrogen, phosphorus, potassium, magnesium and calcium was done in the Arsenic laboratory at Kalyani Research Building of BCKV, West Bengal.

A total of thirty-three post-harvest banana corms of different genotypes belong to three different genomic groups listed in Table 1 were evaluated for their dry matter content and essential macronutrient elements. After harvesting of the bunch, banana plants left in the field were detopped just above the juncture of the corm and ariel shoot. These corms were then removed from the soil and clean properly under running tap water to discard dirt and other substances

Table 1. Names and the genomic compositions of the banana genotypes.

Sl. No.	Genomic composition	Cultivar name
1		Srimanti
2		Jahaji Clone-I
3		Jahaji Clone-II
4		Grand Naine
5	AAA	Giant Governor
6		Amrit Sagar Clone-I
7		Amrit Sagar Clone-III
8		Robusta Clone-II
9		Lacaton
10		Arunachal P. colln
11		Chang Monoa
12		CO-1
13		Madhuranga bale
14		Papalou
15		Kalibhog
16		Sabri
17		Martaman
18		Matta Poovan
19	AAB	Poovan –B9
20		Champa –B11
21		Champa-I
22		Champa-II
23		Champa-III
24		Champa-IV
25		Champa-V
26		Alpan-Mahnar
27		H531
28		Cooking III
29		Kothia
30		Green Bombay
31	ABB	Baish Chhara
32		NRCB-08
33		BCB-2

left on the corm. The roots and a layer of the corm was peeled and removed with the help of a knife to remove debris. The starchy corm left was then resized up to 500 g and further chopped into small pieces and kept for drying in the oven. The dried sample were used for the following estimation.

Estimation	Method followed
Nitrogen:	Kjeldahl method (1883)
Phosphorus:	Vanadate-molybdate method based on APHA standard method 4500-PC
Potassium:	Flame Photometry
Magnesium and calcium :	DTPA extractable (diethylenetriaminepenta-acetic acid)

$$\text{Dry matter content (\%)} = \frac{\text{Dry weight}}{\text{Fresh weight-Dry weight}} \times 100$$

Table 2. Dry matter and essential macronutrient contents of the banana genotypes.

Sl. No.	Genomic composition	Cultivar name	Dry matter (%)	N (%)	P (ppm)	K (%)	Mg (%)	Ca (%)
1		Srimanti	10.00	0.39	189.33	2.82	0.57	0.51
2		Jahaji Clone-I	8.57	0.45	27.33	3.55	0.72	0.62
3		Jahaji Clone-II	13.44	0.72	18.00	2.18	0.60	0.94
4		Grand Naine	10.67	0.71	58.00	1.50	0.99	1.09
5	AAA	Giant Governor	23.81	0.50	94.67	1.81	0.38	0.27
6		Amrit Sagar Clone-I	10.82	0.66	204.33	3.94	0.51	0.40
7		Amrit Sagar Clone-III	10.49	0.79	221.00	4.08	0.62	0.41
8		Robusta Clone-II	14.24	0.57	17.00	2.15	0.91	0.43
9		Lacaton	10.63	0.37	128.67	3.13	1.07	0.46
10		Arunachal P. colln	10.08	0.67	39.33	2.75	0.50	0.93
11		Chang Monoa	8.33	0.88	8.00	3.71	0.48	1.09
12		CO-1	6.00	0.78	6.33	4.59	0.86	0.80
13		Madhuranga bale	5.54	1.06	12.33	3.88	0.60	0.71
14		Papalou	12.01	0.62	61.33	3.83	0.63	0.49
15		Kalibhog	10.67	0.75	50.33	2.11	0.53	0.33
16		Sabri	6.80	0.66	28.67	2.77	0.75	0.52
17		Martaman	13.33	0.86	35.50	3.67	0.52	1.20
18		Matta Poovan	8.50	0.71	246.33	3.15	1.08	0.39
19	AAB	Poovan –B9	11.67	0.76	52.33	3.50	0.51	0.73
20		Champa	13.72	0.65	33.00	3.14	0.38	0.73
21		Champa-I	8.00	0.99	120.33	4.84	0.63	1.02
22		Champa-II	6.80	0.66	95.33	3.39	0.98	0.89
23		Champa-III	10.40	0.66	60.67	2.83	0.86	0.33
24		Champa-IV	7.20	0.17	210.67	4.66	0.39	0.45
25		Champa-V	9.42	0.58	15.55	3.92	0.54	0.60
26		Alpan-Mahnar	8.77	1.08	37.00	4.58	0.75	0.33
27		H531	8.67	0.98	3.67	4.18	0.55	0.70
28		Cooking III	6.65	0.25	233.00	4.08	1.00	1.00
29		Kothia	6.56	0.37	13.40	2.92	0.56	0.37
30		Green Bombay	8.61	0.84	51.67	2.78	1.13	0.42
31	ABB	Baish Chhara	7.00	0.39	17.00	3.35	0.38	0.29
32		NRCB-08	5.67	0.48	35.00	4.55	0.69	0.35
33		BCB-2	7.43	0.66	13.00	4.05	0.87	1.11
34		Range	5.54- 23.81	0.17- 1.08	3.67-246.33	1.50– 4.84	0.38-1.13	0.27-1.20

RESULTS AND DISCUSSION

Dry matter content

The dry matter content of the corms of the genotypes (Table 2) varied between 5.54 % in Madhuranga bale (AAB) and 23.81 % in Giant Governor (AAA). Among the genotypes with AAA genomic composition, it ranged between 8.57 and 23.81 the genotypes with AAB genomic composition ranged between 5.54 and 13.72, the genotypes with ABB genomic composition ranged between 5.67 and 8.61. The genotypes with ABB genomes were found to have less dry matter conten (%). Among the cultivars with genomic composition AAA, Jahaji Clone-I and Giant Governor shows to have lowest and highest content of dry matter respectively, and the rest shows the moderate level. Among the cultivars with genomic composition AAB, Madhuranga bale CO-1 Champa-II Sabri were found to have low content of dry matter and the rest shows at moderate level. The cultivars with genomic composition of ABB genomic composition shows to have low content of dry matter. Pratibha *et al.* (2013) report that dry matter in various Taro corm ranged from 20.10 % to 22.59 %. Potato varieties K. Chipsona1 and K. Frysona contain 23.74% and 20.01% respectively dry matter content (Kapoor *et al.* 2019).

Nitrogen content of the corms

The nitrogen content of the corms of the genotypes

(Table 2) varied between 0.17 in Champa-IV (AAB) and 1.08 % in Alpan-Mahnar (AAB). Among the genotypes with AAA genomic composition, it ranged between 0.37 and 0.79, the genotypes with AAB genomic composition ranged between 0.17 and 1.08, the genotypes with ABB genomic composition ranged between 0.25 and 0.84.There appeared to have no pattern in nitrogen among the genomic groups: The high, moderate and low values for this content were almost equally distributed. Among the cultivars with genomic composition AAA, Srimanti and Lacaton were found to have low nitrogen content and the rest are in moderate level. Similarly, among the cultivars with genomic composition AAB Champa-IV was found to have low nitrogen content and Madhuranga bale, Champa-I, Alpan-Mahnar, and H531 bale was found to have higher nitrogen content. The cultivars with genomic composition ABB were found to have low nitrogen content except BCB-2 which have moderate and Green Bombay with high nitrogen content. Castillo-Gonzalez *et al.* (2011) report similar nitrogen content with 1.15% in the corm of banana cultivar 'Dominoco'.

Phosphorus content of the corms

The phosphorus content of the corms of the genotypes (Table 2) varied between 3.67 ppm in H531 (AAB) and 246.33 ppm in Matta-Poovan (AAB). The genotypes with higher phosphorus content were Matta Poovan, Champa-IV, Cooking–III and Amrit Sagar Clone-I. The genotypes with lower phosphorus was Jahaji Clone-II, Robusta Clone-II, Arunachal P. colln, Chang Monoa, CO-1. Madhurangabale, Kothia, Baish- Chhara, BCB-2 and H531.The high, moderate and low values for this content in all the genomic group was almost equally distributed. Among the cultivars with genomic composition AAA, Jahaji Clone-I, Jahaji Clone-II, Robusta Clone-II were found to have low phosphorus content and Amrit Sagar Clone-I, Amrit Sagar Clone-II have higher phosphorus content. Similarly, among the cultivars with genomic composition AAB, CO-1, Madhuranga bale, Chang Monoa, Champa-V and H531 was found to have low phosphorous content and higher in Matta Poovan, Champa-IV. The cultivars with genomic composition ABB were found to have low phosphorus content in Kothia, Baish Chhara and BCB2 and highest in Cooking–III. Castillo-Gonzalez *et al.* (2011) report that phosphorus content in the corm of banana cultivar 'Dominoco' was found at 0.45%. Phosphorus content in raw potato were observed at 30–60mg/g FW (Buckenh¨uskes 2005). Mesta *et al.* (2018) reported that different varieties of *Amorphophallus paeoniifolius* (elephant foot yam) was estimated for their phosphorus content and found that it ranged from 112.95-398.66 mg/100g. Phosphorus content in taro ranged from 72.21-340 mg/100g (Melese and Negussie 2015).

Potassium content of the corms

The potassium content of the corms of the genotypes (Table 2) varied between1.50 % in Grand Naine (AAA) and 4.84% in Champa-I (AAB). Among the genotypes with AAA genomic composition, it ranged between 1.50% and 4.08%, the genotypes with AAB genomic composition ranged between 2.11% and 4.84%, and the genotypes with ABB genomic composition ranged between 2.78% and 4.55%. There appeared to have no pattern in potassium content among the genomic groups: The high, moderate and low values for this content were almost equally distributed. Among the cultivars with genomic composition AAA, Grand Naine and Giant Governor were found to have low potassium content and Amrit Sagar Clone-I, Amrit Sagar Clone-III have higher potassium content. The cultivars with genomic composition AAB were found to have moderate level of potassium except in the four cultivars namely CO-1, Alpan-Mahnar, Champa-I and H531 which have higher content of potassium. The cultivars with genomic composition ABB were also found to have moderate level of potassium except in cooking- III, NRCB-08 and BCB2 which is higher. Castillo-Gonzalez *et al.* (2011) report similar potassium content with 3.86% in the corm of banana cultivar 'Dominoco' . Potassium content in raw potato (564 mg/g FW) (Buckenh¨uskes 2005). Potassium content in taro (*Colocasia esculenta*) ranged from 2271-4276.06mg/100g (Melese and Negussie 2015).

Magnesium content of the corms

The magnesium content of the corms of the genotypes (Table 2) varied between 0.38% in Giant Governor

(AAA) and 1.13% in Green Bombay (ABB). Among the genotypes with AAA genomic composition, it ranged between 0.50% and 0.99%. The genotypes with AAB genomic composition ranged between 0.38% and 1.08%, the genotypes with ABB genomic composition ranged between 0.38% and 1.13%. There appeared to have no pattern in magnesium content among the genomic groups: The high, moderate and low values for this content were almost equally distributed. The cultivars with genomic composition AAA, shows to have moderate level of magnesium, except in Giant Governor which shows the lowest. Among the cultivars with genomic composition AAB, Champa and Champa- IV were found to have low content of magnesium and Matta Poovan shows the highest. Similarly in the cultivars with genomic composition of ABB, Baish Chhara shows the poorest content of magnesium and Green Bombay and Cooking- III shows the richest content. Castillo-Gonzalez *et al.* (2011) report similar magnesium content with 0.76 % in the corm of banana cultivar 'Dominoco'. Magnesium content of *Colocasia esculenta* were found to be 543.9 mg/ 100g (Million and Tesfaye 2017). Magnesium content both in Cassava and yam is 21mg/ 100 g and 25mg /100g in sweet potato (USDA) 105. Magnesium content in taro ranged from (118-415.07mg/100g), (Melese and Negussie 2015).

Calcium content of the corms

The calcium content of the corms of the genotypes (Table 2) varied between 0.27% in Giant Governor (AAA) and 1.20% in Martaman (AAB). Among the genotypes with AAA genomic composition, it ranged between 0.27% and 1.09%. The genotypes with AAB genomic composition ranged between 0.33% and 1.20%, the genotypes with ABB genomic composition ranged between 0.29% and 1.11%. There appeared to have no pattern in calcium among the genomic groups: The high, moderate and low values for this content were almost equally distributed. Among the cultivars with genomic composition AAA, Giant Governor shows to have low level of calcium and Grand Naine shows the highest and the rest are all in moderate level. Similarly among the cultivars with genomic composition AAB, Alpan-Mahnar, Kalibhog, Champa-III, Matta Poovan were found to have low content of calcium and Champa-I, Chang Monoa, Martaman shows the highest. Among the cultivars with genomic composition of ABB, Baish Chhara, kothia and NRCB-08 shows the poorest content of calcium and Cooking –III and BCB2 shows the richest in content. Castillo-Gonzalez *et al.* (2011) report similar calcium content with 0.9% in the corm of banana cultivar 'Dominoco'. Calcium content of *Colocasia esculenta* were found to be 782.15 mg/ 100g (Million and Tesfaye 2017). Calcium content in raw potato were found at 6–18 mg/g FW (Buckenh¨uskes 2005). Calcium content in raw cassava is 16 mg/100g and raw yam is 17 mg/100g and 9 to 10mg / 100g (USDA)105.

CONCLUSION

The essential macronutrients content of corms of different banana genotypes were found to be highly variable. This may state that some banana genotypes has sufficient macronutrients reserved in their corms for nurturing new developed suckers from the mother corm. Banana corm were mostly studied for their conventional vegetative propagation through various application. Therefore, this macronutrient estimation content experiment can be of service to scholars or scientist for utilizing left over banana corm and for further advance research on many aspects.

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