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Bunch Feeding Can Improve the Quality of Banana CV. Robusta (AAA-Group) Under Hill Zone of Karnataka (Zone-09)

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ABSTRACT

A field experiment was conducted at farmer field to determine the effect of different bunch stalk feeding with different growth regulators on yield of banana cv. Robusta (AAA-group) under hill zone of Karnataka. The experiment was laid in RCBD with 16 treatments and three replications. Urea (2.0, 4.0 and 6.0 %), sulphate of potash (1.5, 2.0 and 2.5 %), 2, 4-D (10, 20 and 30 ppm), panchagavya (2.0, 4.0 and 6.0 %) and banana special (0.2, 0.4 and 0.6 %) and compared with control (without bunch stalk feeding). Results revealed that, at the time of harvest, bunch fed with 2.5 per cent sulphate of potash recorded significantly lowest physiological loss in weight (10.44 %), more days to ripe (14.33 days) under ambient condition, longer shelf life (8.67 days), highest total sugars (18.49 %), less titratable acidity (0.25 %), highest Sugar : acid ratio (73.14), reducing sugar (15.86 %) and non-reducing sugar (2.63 %) compared to control (13.20 %, 10.67 days, 6.67 days, 15.21 %, 0.33 %, 45.62, 13.01 % and 2.20 % respectively). Bunches fed with 2.0 per cent sulphate of potash recorded significantly highest pulp weight (109.16 g), peel weight (42.31 g), pulp to peel ratio (2.58) and TSS (23.51 ^{0}Brix) compared to control (90.81 g, 38.00 g, 2.39 and 19.88 ^{0}Brix respectively).

Key words: *Bunch, Feeding, Banana, Robusta, Fingers, Hands, Hill Zone and Quality.*

INTRODUCTION

Banana is one of the major commercial fruit crops grown in tropics, subtropics and considered as one of the most economical source of food. In India bananas are cultivated in an area of 8.3 lakh hectares and producing 29.78Million tones and 1.2 lakh hectares and production of 2.28 Million tonnes in Karnataka, with average national and state productivity of 35.9 MT/ha and 2 0.4 MT /ha respectively[4] with average national and state productivity of 35.9MT/ha and 20.4 MT/ha respectively[4]. Banana plant is supplied with nutrients through soil and foliage, *denavelling* (removal of male inflorescence for nutrient diversion) and post-shooting feeding nutrients through the distal stalk-end of rachis[2,3,11,20] to achieve high yields.

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De - navelling serves du al 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[17]. Therefore, an attempt was made to enhance the bunch yield by feeding Urea, sulphate of potash (SOP), 2,4D, panchagavya and Banana special (micronutrient mixture) through the excised distal stalk-end of rachis after de-navelling and to determine influence of treatments on quality of "Robusta" banana.

Details of Treatments in the Study as Fallows

T_1- Control (without bunch stalk feeding)
T_2- Urea - 2 %
T_3- Urea - 4 %
T_4- Urea - 6 %
T_5- Sulphate of Potash - 1.5 %
T_6- Sulphate of Potash – 2.0 %
T_7- Sulphate of Potash - 2.5 %
T_8-2, 4-D - 10ppm
T_9-2, 4-D - 20ppm
T_{10}-2, 4-D - 30ppm
T_{11}- Panchagavya - 2 %
T_{12}- Panchagavya - 4 %
T_{13}- Panchagavya - 6 %
T_{14}- Banana special - 0.2 %
T_{15}- Banana special - 0.4 %
T_{16}- Banana special - 0.6 %

MATERIALS AND METHODS

The experiment was conducted in the farmer field during the year 2011-2012 at Palguni village (Tq. Mudigere, Dist. Chikmagalur) which situated at 13°North latitude and 77° 38' East longitude at an altitude of 980 m above mean sea level in the hill zone (Zone 9) of Karnataka state with an average rainfall of 3833.40 mm annual average temperature of the area varies from 27.0 to 36.6 °C. The soil was sandy clay loam and slightly acidic in nature (pH 5.70) with safe level of 0.35 dSm-1 electrical conductivity (EC) and high in organic carbon content (1.70%). The experiment was laid in the existing plantation, spaced at 2.2 X 1.2 m, the land was ploughed twice and harrowed to bring it to good tilth. Uniform sized suckers had been procured from previously grown crop in the same farm. Before a week of planting 20 kg of well decomposed farm yard manure (FYM) was added to each pit. Inorganic fertilizers were applied at 2nd, 4th and 6 th months after planting with recommended dose per plant (180: 108: 225 g NPK). And no further organic and inorganic fertilizers were applied. At 7th month after planting. Protective irrigation was given at weekly intervals. The experiment was laid out in RCBD with 16 treatments replicated twice. Total no of plots was 16 per each replication. Out of 9 plants in a plot, 3 plants were selected for recording observation. For bunch stalk feeding, uniform bunches from each treatment were selected. Rachis at the distal end of the bunch was excised along with male bud giving a slant cut. (De-navelling by excision of rachis 10 cm after the last hand) immediately after all the pistillate (female) flowers had set fruits *i.e.,* after four bracts were shed (about 15 days after flower emergence). The prepared 250ml solution was placed in a thick polythene bag and tied securely by dipping the excised rachis and maintained till harvest.

The Physiological loss in weight of fruits was expressed in percent loss of weight from day of harvest to 7th day after harvest. The fully matured hands were taken and kept for ripening under ambient condition and the days taken for ripening was recorded. Days to ripe (Greenlife) has been defined as the time a harvested fruit takes to reach maturity under defined conditions[19]. Shelf life of fruits was decided based on the appearance and marketability of the fruits. When the fruits attained beyond edible ripe stage, then those fruits were considered to have reached the end of their shelf life.

The Shelf life can be defined as the time over which the ripe fruit remains acceptable for consumption[19]. The reducing sugar and total sugar content of the fruit was estimated by following the method of Ranganna[15]. The percentage of non-reducing sugars was obtained by subtracting the percentage of reducing sugars from the total sugars. The standard method of A.O.A.C. was followed to estimate the acidity. The acidity of the fruit and was expressed as percentage of citric acid

on fresh weight of sample. The Sugar/acid ratio of the pulp was arrived at by dividing the value of total sugars by that of acidity and this was reckoned as a measure of fruit quality. The total soluble solids were recorded with the extracted juice using a 'Zeiss' hand refractometer at room temperature and expressed in percentage.

The pulp weight and peel weight were recorded separately from the ripened fruits and expressed in grams. The pulp to peel ratio was worked out by dividing the mean weight of pulp by mean weight of peel. The data in respect of all the above parameters were tabulated and subjected to the statistical analysis using methods of analysis of variance (ANOVA) for randomized block design by Fisher and Yates[5]. Whenever 'F' test was found significant for comparing the means of two treatments critical difference (C.D. at 5%) were worked out.

RESULTS AND DISCUSSION

Results revealed that, at the time of harvest, bunch fed with 2.5 per cent sulphate of potash recorded significantly lowest physiological loss in weight (10.44 %), more days to ripe (14.33 days) under ambient condition, longer shelf life (8.67days), highest total sugars (18.49 %), less titratable acidity (0.25 %), highest Sugar: acid ratio (73.14), reducing sugar (15.86 %) and non-reducing sugar (2.63 %).

Ramesh and Kumar[12], reported that extended shelf life by bunch fed with sulphate of potash might be due to the lesser Physiological loss in weight experienced in fruits. Similarly, the extended shelf life was found in Ney Poovan banana by Ramesh and Kumar[12,14] by spraying 1.5 % sulphate of potash, Kumar *et al*[13]., in Robusta, Nandan *et al*[9]., in cv. Nanjanagudu Rasabale and Sateesh and Bangarusamy[16] in cv. Rasthali by spraying 1 % potassium chloride.

Days to ripe of harvested fruit is an important attribute decides the market value of the produce. It is desired to have longer days to ripe to withstand longer transit time from field to consumer.

However, more number of days to ripe was noticed in the bunches fed with 2.5 % sulphate of potash (T_7) which remained green till 14.33 days, and lesser days to ripe was noticed in urea 6 % (T_4) which remained green only for 9.33 days.

Reduced number of days to ripe in 6 % urea might be due to high N content of fruits accelerated ripening by promoting autocatalytic ethylene synthesis, which might be the reason for early ripening of fruits in urea sprayed treatments in banana, this were opined by Dominguez and Vendrell. These results were supported by Sateesh and Bangarusamy[16] by 4 per cent urea spraying in cv. Rasthali. High levels of N have been shown to reduce green life (days to ripe)[19].

Application of sulphate of potash was also found to be good in increasing sugar per cent as potassium plays a major role in carbohydrates synthesis, breakdown and translocation and synthesis of protein and neutralization of physiologically important organic acids. This finding agreed with that of Tisdale and Nelson[18]. Going further, potassium when supplied in the form of sulphate of potash favours conversion of starch into simple sugars during ripening by activating the sucrose synthatase enzyme thus resulting in higher sugar percentage. Potassium is involved in phloem loading and unloading of sucrose and amino acids, and storage in the form of starch in developing fruits by activating the enzyme starch synthase[7]. In plants supplied with potassium, the osmotic potential of the phloem sap and the volume flow are higher than in bunches with low K supply, and as a result, sucrose concentration in content of fruits is increased[6]. Similar results were found by Ramesh and Kumar[12,14] in banana cv. Neypoovan, Nandan *et al*[9]., in cv. Nanjanagudu Rasabale and Ramesh *et al*[13]., in cv. Robusta. Enhanced quality of fruits particularly the sugar content may be due to the role of sulphate (SO_4) ions released from sulphate of potash as sulphate favours, while chloride reduces, the activity of anabolic enzymes, resulting in accumulation of highly polymerized carbohydrates (starch), which

would have subsequently disintegrated into sugars on ripening[1].

Increased level of potassium application results in reduced acid content of fruits. This could be due to the fact that under low potassium regime, phosphoenol pyruvate (PEP) was apparently shunted into alternate pathways resulting in a shortage of acetyl CO-A[10]. Hence, oxalo acetate appeared to be preferentially formed from PEP in plants with low levels of potassium and this organic acid derivative accumulated. Neutralization of organic acids due to a high potassium level in tissues could have also resulted in the reduction in acidity[18]. This results were agreed with Nalina and Kumar[8] in cv. Robusta, Ramesh and Kumar[12,14] in cv. Neypoovan, Ramesh *et al*[13]., in cv. Robusta and Nandan *et al*[9]., in cv. Nanjanagudu Rasabale. In this context we can recall that the control treatment which recorded highest acid percentage (0.33 %) also showed lowest total sugar percentage (15.21 %). Meanwhile, maximum sugar to acid ratio (73.14) was obtained in treatment (T_7) with 2.5 % sulphate of potash and minimum sugar to acid ratio (45.62) was obtained in (T_1) control.

Bunch fed with 2.0 per cent sulphate of potash recorded significantly highest pulp weight (109.16 g), peel weight (42.31 g), pulp to peel ratio (2.58) and TSS (23.51 ^{0}Brix). As such Robusta pulp is very thick and they become still thicker at the edible stage. This indicates the beneficial role of potassium and panchagavya to get good pulp recovery. This might be due to less experienced physiological loss in weight by fruits may contribute towards the more pulp weight. The results were in conformity with those obtained by Kumar *et al*[13]. in Robusta, Nandan *et al*[9]., in cv. Nanjanagudu Rasabale and Ramesh and Kumar *et al*[12,14]., in cv. Neypoovan.

The total soluble solids (TSS) a prime factor which determine the quality of fruits. Nandan *et al*[9]., reported that increase in TSS shows that sulphate of potash when supplied exogenously increased the flow of plant assimilates into the developing fruits especially when assimilate flow from other parts of plant becomes limited in banana cv. Nanjangudu rasabale. The findings were closely conformity with Ramesh and Kumar[12,14] in cv. Neypoovan and Ramesh *et al*[13]., in cv. Robusta.

While 2 and 2.5 % per cent sulphate of potash improved most of the quality parameters of banana cv. Robusta under hill zone of Karnataka.

Effect of bunch feeding on quality parameters of banana cv. Robusta

Treatments	Total sugars(%)	Titratable acidity(%)	Sugar : acid ratio	TSS (^{0}Brix)	Reducing sugar(%)	Non-reducing sugars (%)	Pulp weight (g)	Peel weight (g)	Pulp to peel ratio
T_1 - Control	15.21	0.33	45.62	19.88	13.01	2.20	90.81	38.00	2.39
T2 - Urea - 2 %	16.98	0.32	53.24	20.41	14.63	2.35	99.06	40.11	2.47
T3 - Urea - 4 %	17.65	0.30	58.86	22.17	15.18	2.47	102.47	41.15	2.49
T4 - Urea - 6 %	17.05	0.31	55.02	20.43	14.71	2.34	93.47	38.15	2.45
T5 - Sulphate of Potash - 1.5 %	18.26	0.27	66.96	23.08	15.69	2.57	105.09	41.71	2.52
T6 - Sulphate of Potash - 2.0 %	18.41	0.26	70.09	23.51	15.80	2.61	109.16	42.31	2.58
T7 - Sulphate of Potash - 2.5 %	18.49	0.25	73.14	23.11	15.86	2.63	102.66	40.91	2.51
T8 - 2, 4-D - 10ppm	16.81	0.31	54.91	20.44	14.54	2.27	95.12	38.98	2.44
T9 - 2, 4-D - 20ppm	17.15	0.30	57.88	20.73	14.79	2.36	96.07	39.21	2.45
T10 - 2, 4-D - 30ppm	17.28	0.29	60.38	20.96	14.84	2.44	97.81	39.78	2.46
T11 - Panchagavya - 2 %	17.54	0.28	62.89	22.98	15.03	2.51	99.64	39.86	2.50
T12 - Panchagavya - 4 %	17.95	0.27	66.75	23.08	15.41	2.54	102.75	40.79	2.52
T13 - Panchagavya - 6 %	18.14	0.26	70.04	23.18	15.55	2.59	104.23	41.03	2.54
T_{14} - Banana special - 0.2 %	17.42	0.30	58.78	22.77	14.94	2.47	99.15	40.31	2.46
T_{15} - Banana special - 0.4 %	17.72	0.29	61.16	22.99	15.23	2.49	102.17	40.88	2.50
T_{16} - Banana special - 0.6 %	18.03	0.27	65.98	23.18	15.46	2.57	106.15	42.21	2.52
F- test	**	**	**	**	**	**	**	**	**
S.Em±	0.14	0.01	1.99	0.18	0.13	0.06	0.87	0.39	0.02
CD at 5 %	0.40	0.02	5.74	0.51	0.38	0.16	2.50	1.13	0.05

** Highly significant

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