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Effect of Potassium Spray on Fruit Quality and Shelf Life of Banana cv Grand Naine (AAA)

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Abstract An experiment was conducted during 2012-2014 with use of different forms of pottassium and their combinations to study the post shooting spray application effect on fruit quality and shelf life of banana cv Grand Naine (AAA). The treatments used were T_1 (1% SOP), T_2 (2% KH_2PO_4), T_3 (1% KCI), T_4 (1% SOP + 2% KH_2PO_4 + 1% KCl), T_5 (1% SOP+2% KH_2PO_4), T_6 (1%SOP + 1% KCl), T_7 (2% KH_2PO_4 + 1%KCl) and T_8 (Control). Treatments were given as post shooting spray application after last hand opening and repeated the same after 30 days of first spray. Observations recorded divulged that post shooting spray application showing significant influence in improving the bunch characters and fruit quality. Among all treatments, T_6 resulted in higher quality parameaters like TSS, and suger to acid ratio, whereas highest results of total sugars in T_1, reducing sugars in T_7 and non-reducing sugars in T_2 were observed compared to all treatments. Bunches treated with different nutrients showed significant results with extended green life and shelf life over control. Treatment T_6 showed more desirable improvement in maintaining the green life and shelf life of fruits with minimum PLW.

Keywords Spray, Shelf life, SOP, KH_2PO_4, KCI.

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Introduction

Banana (*Musa* spp.), belongs to family Musaceae is one of the oldest fruits of the world. Often it is referred as "Kalpatharu" (Plant of Virtue) due to its multifaceted uses from underground stem up to the male flower. Banana is the most important fruit crop in India and accounts for 31.7% of the total fruit production. Tamil Nadu has the largest area (118.4 thousand hectares) followed by Maharashtra and Karnataka. Tamil Nadu also ranks first in production, followed by Maharashtra. However, the highest productivity (66 MT/ha) is Madhya Pradesh [1]. Being an exhaustive crop, banana requires huge amount of fertilizers. Potassium is considered as the most important plant nutrient in banana production due to high potassium accumulation in fruits and plant tissues. Fruit removal of potassium from soil alone can be 400 kg/ha/year with 70 tons of production. Banana requires nearly 1500kg of K_2O per hectare. Nearly 6 lake tonnes of K_2O is required for banana production in India which in terms of K fertilizer comes to be about 10 lakh tonnes of KCl or 12 lakh tonnes of K_2SO_4 per year. Under traditional farming system, banana crop receives its last dose of fertilizers (nitrogen and potassium) at 7th month after planting i.e. just before shooting, which has to support the requirement of nutrients until harvest since large quantity of photosynthates are to move from the source to the sink i.e. developing bunches at this phase. Any limitation in the supply of nutrients at this crucial stage affects the bunch size and quality. Because of this problem, poor filling and develop-

Table 1. Effect of post shooting application of nutrients on quality characters and shelf life of banana cv Grand Naine (AAA).

Treatments	Yield (t/h)	TSS (°Brix)	Total sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)	Acidity (%)	Sugar : acid ratio	Green life (days)	Shelf life (days)
T_1	81.85	19.53	17.20	6.16	9.78	0.30	57.30	7.467	9.867
T_2	82.23	18.95	15.15	4.82	11.15	0.33	45.88	7.267	9.633
T_3	78.23	19.85	15.16	5.73	10.15	0.31	48.90	7.200	9.100
T_4	85.62	19.75	15.88	6.21	9.59	0.28	56.70	7.600	9.733
T_5	87.47	18.80	15.04	6.48	8.56	0.34	44.23	6.967	9.500
T_6	81.30	20.10	16.08	5.13	10.95	0.25	64.23	8.667	10.367
T_7	84.08	19.17	15.94	6.58	9.36	0.30	53.13	7.800	9.800
T_8	75.60	18.50	15.12	4.11	10.95	0.35	43.20	6.133	7.800
SE Mean	0.802	0.783	1.251	0.381	0.612	0.051	0.755	0.390	0.438
CD at 5%	2.455	NS	NS	1.166	NS	NS	2.313	1.196	1.342

ment of fingers is often reported. Hence an additional dose of fertilizer after shooting has become imperative. However, it is not advisable to go for soil application of fertilizers at finger development stage, since the uptake is slow and low at this stage. From above all points it is clearly referring that optimum amounts of potassium is required at before shooting for proper yield but not advisable as soil application, thus present investigation was carried out by applying potassium based nutrients as spray by trying different combinations on Grand Naine variety of banana with an objective to supply required quantity of potassium nutrition in view to increase quality, green life and shelf life of fruits.

Materials and Methods

Investigation was carried out in two seasons from 2012 to 2014 at Research Station of All India Coordinated Research Project on Tropical Fruits, Mondouri of Bhidan Chandra Krishi Viswavidyalayam, West Bengal on new alluvial and sandy loam textured soils to evaluate the effect of post shooting nutrient spray on quality and shelf life of banana cv Grand Naine (AAA) which is one of the high yielding Cavendish banana variety introduced to India from Israel. The experiment was conducted in randomized block design (RBD)with eight treatments and three replications. The treatments were T_1 (1% SOP), T_2 (2% KH_2PO_4), T_3(1% KCl), T_4 (1% SOP +2% KH_2PO_4 + 1% KCI), T_5 (1% SOP + 2% KH_2PO_4) T_6 (1% SOP=1% KCl), T_7 (2% KH_2PO_4 + 1% KCl) and T_8 (Control). Treatments were given as post shooting spray application after last hand opening and repeated the same after 30 days of first spray. The entire plant canopy including the developing bunches was sprayed. To avoid the waxy nature of the leaf surface, a wetting agent was added @ 2 ml per 10 litres of spray solution. Weight of the bunch including the peduncle at last scar of bract leaf above the first hand was recorded and expressed in kilogram (kg). Thus, Total fruit yield per hectare was computed by multiplying the average bunch for each treatment with total number of plants per hectare. The middle fingers in the top and bottom rows of the second hand were selected as representative fingers. Representative fingers were allowed for natural and uniform ripening and these fruits were utilized for determining different quality parameters. The Total Soluble Salts (TSS) was determined by using Carl-Zeiss Hand Refractometer and the results were expressed in percentage. The total, reducing, non-reducing sugars and titrable acidity was estimated and expressed in terms of percentage. The sugar/acid ratio was computed by dividing the total sugars by the acidity. Number of days taken by the fruits to turn yellow after harvest was noted as green life of bunch and represented in days. Shelf life of bunch is recorded in days by calculating number of days remained from day of harvest to full ripe stage of the hand. The data obtained was analyzed statistically and test of significance was done. Cost : Benefit ratio is calculated for all the treatments by dividing Net Returns (Rs/h) divided by Total cost of

Table 2. Economics of post shooting application of nutrients on quality characters of banana cv Grand Naine (AAA). Parameters used for calculaing economics. Sale price of banana + Rs 7/kg, Cost of KH_2PO_4 = Rs 960/kg Spray solution for two sprays per plant = 1 liter, Total no.of banana plants per hectare = 3086, Cost of SOP = Rs 504/kg, Cost of KCL = Rs 396/kg, Cost of cultivation per hectare = Rs 216020.

Treat-ments	Yield (t/h)	Return (Rs/h)	Cost of chemical used (Rs/h)	Cost of cultivation (Rs/h)	Total cost of cultivation (Rs/h)	Net return (Rs/h)	B : C ratio
T_1	81.85	572950	15553	216020	231573	341377	1.47
T_2	82.23	575610	59250	216020	275270	300340	1.09
T_3	78.23	547610	12220	216020	228240	319370	1.40
T_4	85.62	599340	87024	216020	303044	296296	0.97
T_5	87.47	612290	74804	216020	290824	321466	1.10
T_6	81.30	569100	27773	216020	243793	325307	1.33
T_7	84.08	588560	71471	216020	287491	301069	1.04
T_8	75.60	529200	–	216020	216020	313180	1.44

cultivation (Rs/h).

Results and Discussion

Post-shooting spray application of all potassium combinations showed significant results in improving yield, quality and shelf life of banana compared to control (T_8) and respective data is depicted in Table 1. Highest yield was recognized in treatment T_{5-} SOP (1%) + KH_2PO_4 (2%) (87.47 t/ha). Application of T_6 –SOP (1%) + KCl (1.0%) observed highest TSS (20.10° Brix) and sugar to acid ratio (64.23). Potassium supply increases, the sugar/acid ratio increases because of increase in sugars as well as decrease in acidity . T_6 -SOP (1%) + KCl (1.0%) results in lowest total titrable acidity in with 0.25%, whereas control showed highest acidity among all treatments. Reduced acid content of fruits under low K regimes could be explained by an apparent shunting of phosphoenol pyruvate (PEP) into alternate pathways resulting in a shortage of acetyl CO-A. Hence, oxaloacetate appeared to be preferentially formed from PEP in plants with low levels of K and this organic acid derivative accumulated. Neutralization of organic acids due to high K level in tissues could have also resulted in a reduction in acidity. T_1 -SOP (1%) showed the highest 17.20% total sugar. K also favours the conversion of starch into simple sugars during ripening by activating sucrose synthase enzyme, resulting in higher sugar content in fruits. Potassium appears to have profound influence in increasing the total sugars and vitamin contents. Parameters like reducing sugars noted highest (6.58%) in T_7 (2% KH_2PO_4 +1% KCl) and non-reducing sugars (11.15%) in T_2 –KH_2PO_4 (2.0%) compared to all treatments. Higher fruit quality especially higher sugar content can be explained by the role of potassium which is involved in carbohydrate synthesis, breakdown and translocation and synthesis of protein and neutralization of physiologically important organic acids. Bunches treated with different nutrients showed significant results with extended green life and shelf life over control. Treatment T_6 (1% SOP + 1% KCl) showed more desirable improvement in maintaining the green life (8.6 days) and shelf life (10.3 days) as potassium helps in increase of storage life of banana and similar results are recorded in work of [2]. Economics is the most important single factor which decides the adoption of any improved practice by the grower. the B : C ratio of the treatments is another important factor that determines it usefulness and acceptance by a grower. The data presented in Table - 2 showed that the highest B : C ratio (1.47) was observed in SOP (1.0%)treatment followed by control (1.44). The same results of highest B : C ratio was recorded in SOP (1.5%) treatment [3].

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