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## Effect of different month of ratooning with bunch spray of ga<sub>3</sub> and BA on quality of banana (*Musa paradisiaca* L.) cv. Grand Nain

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### Abstract

A field experiment entitled “RESPONSE OF DIFFERENT MONTH OF RATOONING WITH BUNCH SPRAY OF GA<sub>3</sub> AND BA ON QUALITY OF BANANA (*Musa paradisiaca* L.) cv. GRAND NAIN” was carried out at the Instructional Farm and Regional Horticultural Research Station of the Navsari Agricultural University, Navsari, Gujarat, India during 2018-19 and 2019-20. The results revealed that M<sub>2</sub> treatment (7 month after planting) gave maximum fruit firmness, fruit volume and minimum physiological loss of weight. While, M<sub>3</sub> treatment (8 months after planting) gave maximum ascorbic acid, non-reducing sugar, total sugar and sugar: acidity ratio.

Foliar application of GA<sub>3</sub> 100 mg l<sup>-1</sup> + BA 25 mg l<sup>-1</sup> (S<sub>3</sub>) after complete opening of the significantly gave the maximum fruit firmness, TSS, ascorbic acid, pulp weight, peel weight, sugar: acidity ratio and shelf life of banana fruits and minimum physiological loss of weight and acidity.

When banana cv. Grand Nain ratoon kept at 6 month after planting and foliar spray of GA<sub>3</sub> 100 mg l<sup>-1</sup> + BA 25 mg l<sup>-1</sup> after complete opening of banana bunch (M<sub>1</sub>S<sub>3</sub>) gave significantly maximum fruit firmness and shelf life of fruits. However, M<sub>2</sub>S<sub>3</sub> (7 month after planting and GA<sub>3</sub> 100 mg l<sup>-1</sup> + BA 25 mg l<sup>-1</sup>) significantly gave the minimum physiological loss of weight.

**Keywords:** Ratooning, foliar application, ga<sub>3</sub>, Ba and quality

### 1. Introduction

Banana is traditionally propagated through the suckers produced from the auxiliary buds of underground rhizomes, once the plant crop attains maturation. The planting of banana through tissue cultured plantlets on commercial scale was started from 1988 in Maharashtra. However, due to increased cost of tillage operations, labour and tissue culture plants, the banana growers are now gradually diverting towards taking one ratoon crop. Keep ratoon with or after fresh crop reduces the cost of plants and other cultivation operations like, tillage and planting. It also reduces the crop duration if we keep the ratoon with fresh crop. Some of the growers are keeping the ratoon randomly at any stage of plant crop without knowing the effect of ratoon on the growth and yield of crop.

Plant growth regulators such as gibberellic acid and benzyladenine plays important role in case of yield and quality. Gibberellic acid has been reported to influence vegetative growth, flowering, fruiting and various disorders in many fruit crops. Foliar sprayed of gibberellic acid at complete opening of bunch produced maximum yield contributed by bigger size bunch, having superior quality fruits and higher shelf life of banana (Patel *et al.*, 2011) [6]. Benzyladenine (BA) is one of the most active cytokinins which regulates various growth processes in plant and improve yield and chemical constituents of many crops and recently, BA has been identified as a natural cytokinin in a number of plants. Nevertheless, physiological responses to BA application may be associated with increased endogenous cytokinin concentrations (Mahmoud *et al.*, 2015) [5].

### Material and methods

A field experiment was carried out at the Instructional Farm and Regional Horticultural Research Station of the Navsari Agricultural University, Navsari, Gujarat, India during 2018-19 and 2019-20. The experiment was conducted in Split Plot Design (SPD) with three replications, which included 15 treatment combinations *viz.*, Main Plot (M): Different month of ratooning (M<sub>1</sub> - 6 month after planting, M<sub>2</sub> - 7 month after planting and M<sub>3</sub> - 8 month after planting); Sub Plot (S): Plant Growth Regulators (S<sub>1</sub>- Control, S<sub>2</sub>- GA<sub>3</sub>50 mg l<sup>-1</sup> +

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BA 25 mg l<sup>-1</sup>, S<sub>3</sub>- GA<sub>3</sub> 100 mg l<sup>-1</sup> + BA 25 mg l<sup>-1</sup>, S<sub>4</sub>- GA<sub>3</sub> 50 mg l<sup>-1</sup> + BA 50 mg l<sup>-1</sup>, S<sub>5</sub>- GA<sub>3</sub> 100 mg l<sup>-1</sup> + BA 50 mg l<sup>-1</sup>).

## Results and Discussion

### Effect of month of ratooning

The data presented in Table 1 and Table 2 clearly revealed that there were significant difference due to different month of ratoon on fruit firmness, fruit volume, physiological loss of weight, ascorbic acid, non-reducing sugar, total sugar and sugar: acidity ratio. Significantly maximum fruit firmness, fruit volume and minimum physiological loss of weight were observed in M<sub>2</sub> treatment (7 month after planting). While, M<sub>3</sub> treatment (8 months after planting) gave maximum ascorbic acid, non-reducing sugar, total sugar and sugar: acidity ratio. The similar results were observed by Borah *et al.* (2020) [2] in banana.

### Effect of bunch spray of GA<sub>3</sub> and BA

A perusal of data presented in Table 1 and Table 2 revealed that foliar application of GA<sub>3</sub> 100 mg l<sup>-1</sup> + BA 25 mg l<sup>-1</sup> (S<sub>3</sub>) after complete opening of the significantly gave the maximum fruit firmness, TSS, ascorbic acid, pulp weight, peel weight, sugar: acidity ratio and shelf life of banana fruits and minimum physiological loss of weight and acidity.

### Interaction effect

It is apparent from the data presented in Table 3 that when banana cv. Grand Nain ratoon kept at 6 month after planting and foliar spray of GA<sub>3</sub> 100 mg l<sup>-1</sup> + BA 25 mg l<sup>-1</sup> after complete opening of banana bunch (M<sub>1</sub>S<sub>3</sub>) gave significantly maximum fruit firmness and shelf life of fruits. However, M<sub>2</sub>S<sub>3</sub> (7 month after planting and GA<sub>3</sub> 100 mg l<sup>-1</sup> + BA 25 mg l<sup>-1</sup>) significantly gave the minimum physiological loss of weight.

Spray of GA<sub>3</sub> and BA enhances firmness by middle lamella of fruit cell wall thicker by increased deposition of pectate and thus, maintain the firmness of fruits (Yadav *et al.*, 2001) [9]. The increased in sugar content could be attributed to enzymatic conversion of starch to reducing sugar to increase in total soluble solids. Since, the reducing sugar constituted a major part of solid present in banana. BA helped in synthesis of more sugar in the fruit and thus helps in increasing total soluble solids (Kumar and Singh, 1993) [4]. The decreased in acidity might be due to increase in the total soluble solids and it was also because of GA<sub>3</sub> and BA which might have either involved in fast conversion of metabolites into sugar and their derivatives (Yadav *et al.*, 2001 and Kumar and Singh, 1993) [9, 4]. In present investigation ascorbic acid content of fruit was found minimum in control because rapid destruction of ascorbic acid during ripening of banana fruit due to presence of active enzymes, the conversion of starch to dextrose, levulose and sucrose (Yadav *et al.*, 2001 and Kumar and Singh, 1993) [9, 4]. Increased in physical characteristics of fruit like pulp weight of fruit by BA and GA<sub>3</sub> application was probably due to rapid cell division, cell expansion and increased in the volume of intercellular spaces mesocarp cells and accumulation of water and nutrients in these intercellular spaces (Singh, 2008) [7]. Minimum physiological weight of banana fruits with BA and GA<sub>3</sub> might be due to growth regulators minimized physiological loss in weight, spoilage loss, shriveling to the possible extent through the catalytic influence of plant growth regulators on biosynthesis of ascorbic acid from sugar and inhibition of oxidative enzymes (Bhanja and Lenka, 1994) [1]. BA enhances shelf life due to its action as anti-ethylene and ultimately delays ripening process. (Dhekney and Zhijian, 2000) [3]. Spray of BA resulted in slower respiration rate and dehydration of banana fruit which ultimately leads longer shelf life (Sudha *et al.*, 2007) [8].

**Table 1:** Effect of different month of ratooning and bunch spray of GA<sub>3</sub> and BA on quality of banana cv. Grand Nain (mean of two years)

Treatments	Firmness (%)	TSS (°Brix)	Acidity (%)	Reducing sugar (%)	Non-Reducing sugar (%)	Total sugars (%)	Ascorbic acid(mg/100g pulp)
<b>Main Plot (M)</b>							
M <sub>1</sub>	1.58	18.29	0.172	6.05	8.08	14.17	6.03
M <sub>2</sub>	1.62	18.45	0.173	5.91	7.98	13.86	6.35
M <sub>3</sub>	1.58	18.36	0.170	5.94	8.52	14.45	6.44
S.E.m.±	0.01	0.06	0.001	0.06	0.11	0.14	0.05
C.D. at 5 %	0.03	NS	NS	NS	0.37	0.45	0.18
CV%	2.75	1.69	2.53	5.52	7.67	5.33	4.79
<b>Sub Plot (S)</b>							
S <sub>1</sub>	1.66	17.98	0.174	5.86	8.19	14.05	5.38
S <sub>2</sub>	1.73	18.64	0.173	5.93	8.27	14.19	6.18
S <sub>3</sub>	1.73	18.67	0.168	5.99	8.10	14.14	7.02
S <sub>4</sub>	1.41	18.43	0.171	5.98	8.38	14.36	6.57
S <sub>5</sub>	1.43	18.13	0.173	6.09	8.03	14.06	6.19
S.E.m.±	0.01	0.08	0.001	0.06	0.09	0.10	0.09
C.D. at 5 %	0.03	0.21	0.003	NS	NS	NS	0.26
<b>Interaction M x S</b>							
S.E.m.±	0.02	0.13	0.002	0.11	0.15	0.17	0.16
C.D. at 5 %	0.06	NS	NS	NS	NS	NS	NS
CV%	2.98	1.73	2.58	4.43	4.57	2.89	6.23

**Table 2:** Effect of different month of ratooning and bunch spray of GA<sub>3</sub> and BA on quality of banana cv. Grand Nain (mean of two years)

Treatments	Pulp weight (g)	Peel weight (g)	Pulp: peel ratio	Sugar acidity ratio	Fruit volume (ml)	Physiological loss in weight (%)	Shelf life (days)
<b>Main Plot (M)</b>							
M <sub>1</sub>	108.53	32.43	3.35	82.50	139.78	14.76	11.08
M <sub>2</sub>	110.69	32.71	3.39	80.35	144.00	14.52	11.01
M <sub>3</sub>	109.77	32.81	3.35	84.87	143.19	15.23	10.98
S.Em.±	0.96	0.29	0.05	1.16	0.86	0.11	0.05
C.D. at 5 %	NS	NS	NS	3.79	2.80	0.35	NS
CV%	4.79	4.81	7.65	7.70	3.30	4.01	2.65
<b>Sub Plot (S)</b>							
S <sub>1</sub>	98.02	30.90	3.17	80.64	130.94	16.21	9.95
S <sub>2</sub>	106.26	32.34	3.29	82.30	139.59	14.73	11.42
S <sub>3</sub>	119.66	34.26	3.50	84.37	140.46	13.09	11.68
S <sub>4</sub>	116.93	33.19	3.54	84.07	147.91	14.30	11.25
S <sub>5</sub>	107.44	32.56	3.30	81.49	152.72	15.86	10.82
S.Em.±	0.82	0.31	0.04	0.84	1.00	0.12	0.09
C.D. at 5 %	2.34	0.89	0.12	2.38	2.84	0.35	0.25
<b>Interaction M x S</b>							
S.Em.±	1.42	0.54	0.07	1.45	1.73	0.21	0.15
C.D. at 5 %	NS	NS	NS	NS	NS	0.61	0.43
CV%	3.18	4.05	5.17	4.30	2.98	3.52	3.36

**Table 3:** Interaction between different month of ratooning and bunch spray of GA<sub>3</sub> and BA on quality of banana cv. Grand Nain (mean of two years)

Treatments	Firmness (%)	Physiological loss in weight (%)	Shelf life (days)
M <sub>1</sub> S <sub>1</sub>	1.65	16.51	9.70
M <sub>1</sub> S <sub>2</sub>	1.47	14.90	11.39
M <sub>1</sub> S <sub>3</sub>	1.89	12.94	11.98
M <sub>1</sub> S <sub>4</sub>	1.46	14.19	11.58
M <sub>1</sub> S <sub>5</sub>	1.42	15.29	10.76
M <sub>2</sub> S <sub>1</sub>	1.81	16.07	10.05
M <sub>2</sub> S <sub>2</sub>	1.87	14.52	11.49
M <sub>2</sub> S <sub>3</sub>	1.71	12.51	11.64
M <sub>2</sub> S <sub>4</sub>	1.36	13.84	11.18
M <sub>2</sub> S <sub>5</sub>	1.35	15.66	10.67
M <sub>3</sub> S <sub>1</sub>	1.53	16.04	10.09
M <sub>3</sub> S <sub>2</sub>	1.84	14.78	11.39
M <sub>3</sub> S <sub>3</sub>	1.60	13.83	11.43
M <sub>3</sub> S <sub>4</sub>	1.40	14.88	10.98
M <sub>3</sub> S <sub>5</sub>	1.51	16.63	11.03
S.Em.±	0.02	0.21	0.15
C.D. at 5 %	0.06	0.61	0.43
CV%	2.98	3.52	3.36

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