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Effect of growth regulators on post- harvest life of banana cv. Grand Naine and Bio-chemical changes during storage

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SUMMARY : Post-harvest treatment of GA_3 100 mg l^{-1} with fruit from 1st to 4th basal hands of the bunch (H_1) and stored at ambient temperature was found excellent in bio-chemical parameters *viz.,* total soluble solids (TSS %), reducing sugar (%), total sugar (%) and ascorbic acid (mg/100 g of fresh pulp). While, it increased the titrable acidity (%) during the storage period by without affecting the quality of banana fruits cv. Grand Naine.

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Banana is one of the most important fruit crops of the world. Its origin is the tropical region of South-East Asia. Banana crop has nutritional, medicinal, industrial as well as aesthetic value in Hindu religion. India is the largest banana consumer and producer in the world. A few main challenges faced by fruit industry are the enormous post-harvest losses, lack of scientific information on handling, packaging system and post-harvest treatments. Out of large number of varieties grown in India, Basari was the most popular variety among growers and consumers. But with the introduction of high yielding variety 'Grand Naine', the area of Basari is shriveled to greater extent. Grand Naine is the most popular in Gujarat and Maharashtra for domestic market and export. Besides the increasing production of banana, post harvest losses are the major problem. Since, banana is a climacteric and perishable fruit, application of post harvest treatments becomes necessary to extend shelf life with reduction in post-harvest losses. The present investigation was carried out to find out the possibility to improve the shelf life of 'Grand Naine' bananas by post harvest application of certain growth regulators.

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EXPERIMENTAL METHODS

Fully mature bunches of the Grand Naine variety were used for the study. The experiment was conducted in Completely Randomized Design with Factorial concept (FCRD). There were three repetitions and nine treatments with one control. Hands of banana were treated with growth regulating substances. All the fingers from the first basal four hands (H_1) and the succeeding four hands (H_2) were mixed together separately to find out whether any quality difference existed between hands of same banana bunch. The fingers in each treatment were dipped in the solutions for about 10 minutes and then taken out and kept separately for ripening at ambient temperature. Control fruit were dipped in distilled water. The quality was assessed with respect to different bio-chemical parameters.

EXPERIMENTAL FINDINGS AND ANALYSIS

The results obtained from the present investigation are presented below:

Total soluble solids (%) :

Banana fruits of first four hands significantly

Table 1: Effect of post-harvest treatments on total soluble solids (%), reducing sugar (%) and total sugar (%) of banana cv. Grand Naine

Treatments	Total soluble solids (%)				Reducing sugar (%)				Total sugar (%)			
	Days after harvesting											
	3rd	6th	9th	12th	3rd	6th	9th	12th	3rd	6th	9th	12th
Hand treatment (H)												
Fruits from 1st to 4th hand of the bunch (H_1)	4.57	8.54	12.36	13.64	1.21	2.74	4.80	5.03	3.54	5.35	8.04	8.17
Fruits from 5th to 8th hand of the bunch (H_2)	4.39	8.38	12.23	13.52	1.14	2.59	4.66	4.98	3.45	5.24	7.95	8.08
S.Em.	0.015	0.023	0.035	0.038	0.006	0.009	0.015	0.012	0.012	0.016	0.022	0.028
C. D. at 5%	0.044	0.065	0.099	0.110	0.017	0.026	0.044	0.036	0.036	0.046	0.063	0.080
Chemical treatments (C)												
2,4,5-T 40 mg l^{-1}	5.80	9.76	13.16	21.68	1.65	3.77	5.55	7.96	3.94	5.85	8.80	14.24
2,4,5-T 60 mg l^{-1}	3.18	7.40	11.31	19.78	0.77	1.73	3.66	7.21	3.65	5.40	8.47	12.09
2,4-D 20 mg l^{-1}	3.51	7.82	11.67	0.00	1.04	2.48	4.35	0.00	3.29	5.03	7.23	0.00
2,4-D 40 mg l^{-1}	3.33	7.49	11.48	0.00	0.97	1.97	3.99	0.00	3.41	5.18	8.30	0.00
GA_3 50 mg l^{-1}	4.11	8.20	11.98	20.00	1.28	3.11	5.15	7.80	3.74	5.61	8.64	12.27
GA_3 100 mg l^{-1}	3.01	7.24	11.23	19.63	0.66	1.31	3.42	7.08	2.88	4.60	6.72	11.21
NAA 50 mg l^{-1}	4.85	8.82	12.19	20.35	1.11	2.70	4.71	7.39	3.22	4.91	7.03	11.87
NAA 100 mg l^{-1}	5.56	9.48	12.99	20.81	1.15	2.97	4.95	7.59	3.07	4.81	6.83	11.45
Control	6.96	9.96	14.67	0.00	1.94	3.96	6.81	0.00	4.28	6.29	9.95	0.00
S.Em.	0.03	0.04	0.07	0.081	0.013	0.019	0.032	0.026	0.026	0.034	0.046	0.059
C.D. at 5 %	0.09	0.14	0.21	0.23	0.04	0.06	0.09	0.07	0.075	0.098	0.133	0.171
Interaction (H x C)												
S.Em.	0.05	0.07	0.10	0.12	0.018	0.028	0.046	0.037	0.037	0.048	0.066	0.085
C. D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C.V. %	1.76	1.40	1.46	1.47	2.69	1.80	1.67	1.29	1.84	1.59	1.43	1.80

N.S. = Non-significant

Table 2: Effect of post harvest treatments on titrable acidity (%) and ascorbic acid (mg/100 g of fresh pulp) of banana cv. Grand Naine

Treatments	Titrable acidity (%)				Ascorbic acid (mg/100 g of fresh pulp)			
	Days after harvesting							
	3rd	6th	9th	12th	3rd	6th	9th	12th
Hand treatment (H)								
Fruits from 1st to 4th hand of the bunch (H_1)	1.26	1.13	1.04	0.47	10.89	12.29	12.33	8.28
Fruits from 5th to 8th hand of the bunch (H_2)	1.11	1.00	0.96	0.43	10.79	12.18	12.21	8.21
S.Em.	0.005	0.004	0.005	0.005	0.032	0.037	0.040	0.024
C. D. at 5%	0.016	0.012	0.014	0.014	0.09	0.11	0.11	0.07
Chemical treatments (C)								
2,4,5 T 40 mg l^{-1}	1.22	1.10	1.03	0.67	10.78	12.23	12.26	12.52
2,4,5 T 60 mg l^{-1}	1.17	1.06	1.01	0.66	10.85	12.36	12.39	12.69
2,4 D 20 mg l^{-1}	1.20	1.08	1.00	0.00	11.27	12.73	12.80	0.00
2,4 D 40 mg l^{-1}	1.26	1.14	1.05	0.00	10.99	12.49	12.52	0.00
GA_3 50 mg l^{-1}	1.13	1.03	0.96	0.64	10.64	11.90	11.93	12.21
GA_3 100 mg l^{-1}	1.20	1.09	1.02	0.72	10.47	11.77	11.80	12.08
NAA 50 mg l^{-1}	1.15	1.05	0.98	0.69	10.74	12.10	12.14	12.42
NAA 100 mg l^{-1}	1.25	1.11	1.04	0.70	10.70	11.98	12.00	12.31
Control	1.11	0.97	0.95	0.00	11.15	12.57	12.62	0.00
S.Em.	0.012	0.009	0.011	0.010	0.067	0.078	0.084	0.052
C.D. at 5 %	0.033	0.026	0.030	0.030	0.19	0.22	0.24	0.15
Interaction (H x C)								
S.Em.	0.016	0.013	0.015	0.015	0.095	0.110	0.119	0.073
C. D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS
C.V. %	2.39	2.10	2.57	5.61	1.52	1.56	1.68	1.53

N.S. Non significant

exhibited the higher total soluble solids during storage period and increased gradually upto 12th day (Table 1). This might be due to accumulation of more starch in fruit set earlier, while the fruits of next 5th to 8th hand showed the lower total soluble solids (%). Likewise GA_3 100 mg l^{-1} maintained minimum TSS content at the end of storage period *i.e.* at 12th day. The minimum accumulation of TSS might be due to reduced rate of hydrolysis of starch and delay in ripening of banana fruits with GA_3 treatment. These findings are in line with Rao and Chundawat (1986), Das *et al.* (1996), Unitthan and Desai (2002), Patel (2004) in banana. On the other hand, the fruits treated with 2,4-D @ 20 and 40 mg l^{-1} and control did not reach to 12th day of storage.

Reducing sugar (%) :

The data of Table 1 revealed that reducing sugar (%) was the maximum in fruits of first hand than the fruits of 5th to 8th hands. The fruits treated with GA_3 100 mg l^{-1} recorded the minimum reducing sugar percentage (7.08) on 12th day of storage. It might be due to less utilization of reducing sugar in the process of respiration. Accumulation of reducing sugar is a function of starch metabolism, which is slower in treated fruits as compared to control [Unitthan and Desai, (2002) and Patel, (2004)] in banana supported the present findings.

Total sugar (%) :

Sweeter of banana fruits is earmarked based on total sugar (%). The highest sugar (8.17 %) was significantly recorded in fruits of 1st to 4th hand (H_1) as compared to fruits from 5th to 8th hand (H_2) treatment (Table 1). On other hand, minimum total sugar was recorded in the fruits treated with GA_3 100 mg l^{-1} (11.21 %) which was at par with GA_3 50 mg l^{-1} (11.27 %). In present study, the level of total sugars showed an increasing trend during storage. This might be due to the consequence of release of sugars by the hydrolysis of starch reserve during the post-harvest stage. The slower rate of acceleration in GA_3 treated fruits may be due to starch hydrolysis and low rate of respiration and oxidation in treated fruits. The results gained are in close proximity of those obtained by Rao and Chundawat (1986), Unitthan and Desai (2002) and Patel (2004) in banana.

Titrable acidity (%) :

The titrable acidity showed a constant decrease during the storage period. In the fruits of 1st to 4th hand (H_1) and 5th to 8th hand (H_2) as well as treated with different growth regulators (Table 2). At the end of storage period, GA_3 100 mg l^{-1} retained higher percentage of acidity. Higher level of acidity in GA_3 treated fruits might be due to less utilization of organic acids in respiration due to delayed ripening. These results are in close proximity with the findings of Das *et al.* (1996), Patil and Hulmani (1998), Unitthan and Desai (2002), Patel (2004) in banana.

Ascorbic acid (Vitamin-C) content (mg/100 g of fresh pulp) :

In post harvest storage of banana fruits, ascorbic acid content gradually increased upto 9th day which sharply declined in the fruits of different hands and growth regulators used in present study. On the contrary, ascorbic acid gradually increased in all treatments. However, minimum ascorbic acid at the 12th day of storage was 12.08 mg/100g of pulp. The decline in ascorbic acid might be due to utilization of organic acid in the process of respiration during ripening in the presence of reduced supply of sugars. GA_3 retarded the ripening process and therefore, higher level of ascorbic acid in treated fruits was observed. These findings are line with and supported by Parmar and Chundawat (1989), Roy and Joshi (1989), Kapse (1993), Kumar Dinesh (1998) and Patil (2005) in mango, Sarkar *et al.* (1995) in sapota.

In general, the fruits treated with 2,4-D at 20 and 40 mg l^{-1} as well as control fruits did not reach to 12th day of storage. It showed that 2,4-D did not exert any significant effect on shelf life of banana under storage.

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