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Studies on the effect of pre-harvest spray of bio-regulators and bagging on yield and post-harvest quality of mango (*Mangifera indica* L.) cv. Banganpalli under high density planting system

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Abstract

An experiment on the effect of pre harvest bio regulator sprays (P₁ -Potassium sulphate K₂SO₄ @ 1%, P₂ - 6 Benzyl amino purine BA @ 50 ppm, P₃ -Sea weed sap extract @ 5%, P₄ -Potassium sulphate K₂SO₄ @ 1% + 6 Benzyl amino purine 6 BA @ 50 ppm + Sea weed sap extract @ 5% and bagging (B₁ - With two layers of brown paper Bagging, B₂ - No Bagging) on yield and postharvest quality of mango cv. Banganpalli was carried out at Fruit research station, Sangareddy, SKLTSHU, Telangana state during two successive seasons i.e 2019-20 and 2020-21. Data pertaining to yield, fruit quality and shelf life parameters were recorded. The statistical design adopted was randomized block design with factorial concept with three replications per treatment. Among the interaction between pre harvest bio regulator sprays and bagging, pre harvest spray of potassium sulphate + 6-benzylaminopurine+seaweed extract with two layers of brown paper bagging (P₄B₁) has significantly resulted in fruits with maximum TSS (17.65 °Brix), highest taste score (8.19) and overall acceptance (8.11) compared to control.

Keywords: 6-benzylamionpurine, pre harvest bio regulator sprays, bagging, sea weed sap extract

Introduction

Mango (*Mangifera indica* L) is the premier fruit among the tropical fruits and has been in cultivation in the Indian subcontinent since several centuries. Mango occupied an area of 2.26 million hectares with a production of 21.82 million tonnes (NHB, 2018). The fruit is highly valued because of its excellent flavor, appealing aroma, delicious taste, attractive shades of colour and nutritive value, which has attracted the world market. In Telangana, mango occupies an area of 0.18 million hectares with a production of 1.68 million tonnes (NHB, 2018) [10]. In Telangana state the commercial cultivar is Banganpalli which occupies about 70 per cent of total mango cultivated area. Of late, the production and productivity of mango cv. Banganpalli has been decreased in the past 4-5 years in Telangana (NHB, 2018) [10]. Productivity of Telangana state is 9.31 MT / ha which is very low when compared to mango growing states i.e., Uttar Pradesh (17.14 MT / ha), Andhra Pradesh (12.05 MT / ha), Karnataka (9.61 MT / ha), Bihar (16.37 MT / ha), Rajasthan (17.58 MT / ha) (NHB, 2018) [10]. Poor productivity in mango cv. Banganpalli in Telangana is influenced by several factors such as improper pruning, delayed vegetative growth, poor and erratic flowering coupled with poor fruit set. However, there is tremendous scope to boost the productivity, if this problem can be managed properly.

In mango, heavy fruit drop and low shelf life are the major factors contributing to low yield and fruit quality. In this aspect several scientists reported that pre harvest application of bio regulators and bagging improved the fruit yield and its quality. Pre harvest treatment of fruits with 1% K₂SO₄ + bagging recorded shelf life up to 12 days with lowest weight loss and highest organoleptic quality as against 6 days of untreated fruits (control) in mango cv. Amrapali (Jakhar and Pathak, 2016) [5]. Application of 200 ppm of 6- benzyl amino purine has significantly recorded maximum fruit firmness, lowest physiological loss in weight, highest organoleptic score in terms of colour and flavor over control and application of sea weed sap extract 5% recorded higher TSS, high ascorbic acid, reducing sugars, total sugars and low titrable acidity over control in mango cv. Kesar (Shankar Swamy and Neelavathi 2016) [16]. Mango fruits bagged with brown paper bag recorded maximum fruit length, fruit weight and pulp weight over control in mango cv. Kesar (Kireeti *et al.* 2018) [7].

Materials and Methods

The experiment was conducted on ten years old well grown, uniform statured trees of mango cv. Banganpalli. Trees are spaced with 5m and planted in square system. The statistical design adopted was factorial randomized block design with 10 treatments which were replicated thrice. 50 mg of 6-BA was dissolved in 50 ml of hydroxy acetone and diluted it in 1 liter of water to get 50 ppm of 6-BA. Ten grams of Potassium sulphate (K_2SO_4) was dissolved in 1 litre of water to get 1% of K_2SO_4 . The marine alga *S. wightii* belongs to Phaeophyceae was collected from KN bioscience, Hyderabad. Sea weed extract of 5% concentration was prepared by dissolving 1 litter in 5 litres of water. All the bio regulators were sprayed at BBCH- 705 phenophase stage of the fruit development 30 days before harvesting. 10 litres solution of each treatment was sprayed per tree uniformly at the time of application. After spraying of bio regulators, bagging was done with two brown paper bags per fruit 30 days before harvesting. Two small holes are made at the bottom of the bags for aeration.

Treatments

T₁: P₁ B₁ -Potassium Sulphate K_2SO_4 @ 1% + two layers of brown paper

T₂: P₁ B₂ - Potassium Sulphate K_2SO_4 @ 1% + No bagging

T₃: P₂ B₁ -6 Benzyl amino purine 6-BA @ 50 ppm + two layers of brown paper

T₄: P₂ B₂ -6 Benzyl amino purine 6-BA@ 50 ppm + No bagging

T₅: P₃ B₁ -Sea weed Sap extract @ 5% +two layers of brown paper

T₆: P₃ B₂ -Sea weed Sap extract @ 5% + No bagging

T₇: P₄ B₁ - Potassium Sulphate K_2SO_4 @ 1% + 6 Benzyl amino purine 6- BA @ 50 ppm + Sea weed Sap extract @ 5% + two layers of brown paper

T₈: P₄ B₂ - Potassium Sulphate K_2SO_4 @ 1% + 6 Benzyl amino purine 6-BA @ 50 ppm + Sea weed Sap extract @ 5% + No Bagging

T₉: P₅ B₁ - Control (No bio regulator spray) + two layers of brown paper

T₁₀: P₅ B₂ -Control (No bagging and no bio regulator spray)

Note: All the recommended packages of practices were implemented equally to total plants in the experiment.

Data on physico chemical properties, shelf life, organoleptic characters of fruits were recorded.

Results and Discussion

Physical characteristics of fruits

The results on fruit length (cm) and fruit breadth (cm) of mango cv. Banganpalli after application of pre harvest bio-regulators and bagging are presented in the table 1 and 2. Significant differences were not observed in the interaction effect between pre harvest bio-regulator sprays and bagging with respect to fruit length and breadth. The results on fruit weight (g) of mango cv. Banganpalli after application of pre harvest bio-regulators and bagging are presented in the table 3. Significant difference was observed among interaction effect of the pre-harvest spray of different bio-regulators and bagging with respect to fruit weight in mango cv. Banganpalli. Among interaction effect of the pre-harvest spray of different bio-regulators and bagging, maximum fruit weight (292.23 grams) was recorded with the pre-harvest

spray of potassium sulphate + 6-benzylaminopurine + seaweed extract (P₄) with bagging with two layers of brown paper (B₁) (292.26 gms) whereas the control treatment (no chemical spray and no bagging) recorded minimum fruit weight (240.32). Similar increase in fruit weight was reported with potassium sulphate in mango was reported by Shinde *et al.* (2018) [17] in mango cv. Alphonso, Nasreen *et al.* (2014) in mango cv. Baari aam. Similar increase in fruit weight by 6-benzylaminopurine was reported by Shankar Swamy and Neelavathi (2016) [16] in mango cv. Kesar. Similar increase in fruit weight by seaweed extract was reported by Norrie *et al.* (2002) [11] in grape, Norrie and Keathley (2006) [12] in grape, Pawar and Singh (2017) [13] in mango cv. Dashehari. And Shankar Swamy and Neelavathi (2016) [16] in mango cv. Kesar. Similar results with bagging was earlier reported by Fallahi *et al.* (2001) [2] stating that the highest average fruit weight was recorded in bagged fruit of 'BC-2 Fuji' apple as compared to non-bagged fruit and by Watanawan *et al.* (2008) [20] who reported that highest fruit weight was recorded with 2-layer paper bag compared to control in mango cv. 'Nam Dok Mai'. The crucial importance of potassium in quality fruit formation stems from its role in promoting synthesis and their transport to fruit, thereby increasing the fruit growth. These effects of potassium in fruit growth might be dedicated to its role in increasing tolerance to stresses and improving formation and accumulation of sugars (Saleh and Monem 2003, Wahdan *et al.* 2011) [15, 19]. The increase in fruit weight with sulphur in potassium sulphate might be due to the fact that SO_4^{2-} ions participate in the synthesis of chlorophyll and formation of the ferredoxin complex, which helps the transport of electrons during the production of reducing power in the photosynthetic process and favors the accumulation of carbohydrates and other N components (Lester *et al.* 2005) [8] and better partitioning of the photosynthates to the fruit (zenda *et al.* 2021) [21]. Increase in fruit weight by 6-benzylaminopurine might be due to faster rate of fruit growth due to rapid cell division and cell enlargement which is regulated by cytokinins in 6-benzylaminopurine, which itself is a synthetic cytokinin. 6-BA, being a synthetic cytokinin stimulates protein synthesis and participates in cell cycle control in a cell division (George *et al.* 2008) [4]. Increase in fruit weight by seaweed extract might be due to faster rate of fruit growth due to rapid cell division and cell enlargement which is regulated by cytokinins present in seaweed extract and also the fact that enhancement in fruit size during and later stages of fruit development is contributed by the intercellular spaces, accumulation of carbohydrates and other metabolites in expanded cells (Shankar Swamy and Neelavathi, 2016) [16]. Increase in fruit weight due to bagging can be attributed to improvement in a microclimate around the fruit bagging (Gethe *et al.* 2021 and Kireeti *et al.* 2016) [3, 6]. The increase in fruit weight with potassium sulphate + 6-benzylaminopurine+seaweed extract (P₄) with bagging with two layers of brown paper (B₁) might be due to synergistic effect of pre harvest bio-regulator sprays and bagging in combination with respect to their interaction effect in the present investigation. The results on fruit weight (g) of mango cv. Banganpalli after application of pre harvest bio-regulators and bagging are presented in the table 4. Significant difference was not observed among interaction effect of the pre-harvest spray of different bio-regulators and bagging with respect to yield per tree in mango cv. Banganpalli.

Biochemical parameters

The results on TSS (⁰Brix) of mango cv. Banganpalli after application of pre harvest bio-regulators and bagging are presented in the table 5. Significant difference was found in TSS (⁰Brix) among the treatments with the interaction effect of the pre-harvest spray of different bio-regulators and bagging in mango cv. Banganpalli. Maximum TSS (⁰Brix) was recorded with application of potassium sulphate+6-benzylaminopurine+seaweed extract (P₄) with two layers of brown paper bagging (B₁) (17.65 ⁰Brix) whereas the control treatment (no chemical spray and no bagging) (P₅B₂) recorded minimum TSS (⁰Brix) (15.49 ⁰Brix). The results obtained are in conformity with the findings of Jakhar and Pathak (2016) [5] who reported maximum TSS content of fruits with pre-harvest spray of 1% K₂SO₄ followed by bagging with brown paper bags in mango cv. Amrapali. The increase in TSS content might be due to the breakdown of starch and polysaccharides into simple sugars and organic acid by plant bio-regulators (Jakhar and Pathak 2016) [5] and congenial microclimate created by the bagging treatment for fruit growth and development (Ravikanth, 2022) [14]. The increase in TSS with potassium sulphate + 6-benzylaminopurine + seaweed extract (P₄) with bagging with two layers of brown paper (B₁) might be due to combined effect of pre harvest bio-regulator sprays and bagging in combination with respect to their interaction effect in the present investigation.

The results on titratable acidity of mango cv. Banganpalli after application of pre harvest bio-regulators and bagging are presented in the table 6. Significant difference was not observed in the interaction effect between pre harvest bio-regulator sprays and bagging with respect to titratable acidity. The results on ascorbic acid content of mango cv. Banganpalli after application of pre harvest bio-regulators and bagging are presented in the table 7. The results on reducing sugars content of mango cv. Banganpalli after application of pre harvest bio-regulators and bagging are presented in the table 8. Significant difference was not observed in the interaction effect between pre harvest bio-regulator sprays and bagging with respect to reducing sugars content. The results on shelf life of fruits of mango cv. Banganpalli after application of pre

harvest bio-regulators and bagging are presented in the table 9. Significant difference was not observed in the interaction effect between pre harvest bio-regulator sprays and bagging with respect to shelf life of mango. The results on taste score and overall acceptance were presented in the tables 10 and 11. Significant difference were observed in the interaction effect between pre harvest bio-regulator sprays and bagging with respect to sensory evaluation of organoleptic characters of mango. The results on taste score, overall acceptance of fruits of mango cv. Banganpalli after application of pre harvest bio-regulators and bagging are presented in the table 10 and 11. Potassium sulphate + 6 benzyl amino purine + seaweed extract (P₄) with two layers of brown paper bagging (B₁) has resulted in highest taste score (8.19) and overall acceptance (8.11). These results are in conformity with the findings of Jakhar and Pathak (2016) [5] who reported that pre-harvest spray of 1% K₂SO₄ followed by bagging with brown paper bags resulted in best quality fruits superior in organoleptic quality with good acceptability. The crucial importance of potassium in quality fruit formation stems from its role in promoting synthesis and their transport to fruit. In addition, potassium influences on fruit quality can be also indirect as a result of its positive interaction with other nutrients (Usherwood *et al.* 1985) [18]. Potassium also imparts quality characters like attractive colour, flavour, sugar texture, weight and keeping quality of fruits (Balasubramanian 1985) [1]. The reduction in acidity with the above treatments of 6-Benzylaminopurine, seaweed extract plays a great role in acid: sugar balance which consequentially influences the taste and flavour of the fruit (Shankarswamy and Neelavathi 2016) [16]. The increased fruit size due to more dry matter accumulation, uniform colour development, increased fruit TSS and total sugars improved the appearance, flavour and sweetness of fruit resulting in better taste with overall acceptance (Ravikanth, 2022) [14]. The improved physical, chemical and quality attributes of fruits with pre-harvest spray of potassium sulphate + 6-benzylaminopurine+seaweed extract (P₄) with bagging (B₁) might have resulted in fruits attaining the highest scores for evaluated organoleptic characters in the present investigation.

Table 1: Effect of pre harvest spray of bio-regulators and bagging on fruit length (cm) at the time of harvest of mango cv. Banganpalli

Treatments	Fruit length								
	2019			2020			Pooled		
	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P
P ₁	8.43	8.37	8.40 ^d	8.53	8.46	8.50 ^d	8.50	8.43	8.47 ^d
P ₂	8.67	8.59	8.63 ^b	8.88	8.74	8.81 ^b	8.79	8.70	8.75 ^b
P ₃	8.54	8.51	8.53 ^c	8.66	8.59	8.63 ^c	8.62	8.57	8.60 ^c
P ₄	8.88	8.73	8.81 ^a	9.03	8.90	8.97 ^a	8.98	8.86	8.92 ^a
P ₅	8.32 ^a	8.20 ^b	8.26 ^e	8.42	8.33	8.38 ^e	8.39	8.28	8.34 ^e
Mean of B	8.57 ^a	8.48 ^b		8.70 ^a	8.61 ^b		8.66 ^a	8.57 ^b	
Factors	S.Em ±	C.D. at 5%		S.Em ±	C.D. at 5%		S.Em ±	C.D. at 5%	
P	0.01	0.02		0.02	0.06		0.02	0.05	
B	0.00	0.01		0.01	0.04		0.01	0.03	
PXB	0.01	0.03		0.03	NS		0.02	NS	

Figures with same alphabet did not differ significantly

P₁ - K₂SO₄ @ 1%

P₂ - BA @ 50 ppm

P₃ - Sea weed extract @ 5%

P₄ - K₂SO₄ @ 2% + BA @ 50 ppm+ Sea weed Sap extract @ 5%

P₅ - Control (no chemical spray)

B₁ - Two layers of brown paper

B₂ - No bagging

Table 2: Effect of pre harvest spray of bio-regulators and bagging on fruit breadth (cm) at the time of harvest of mango cv. Banganpalli

Treatments	Fruit Breadth								
	2019			2020			Pooled		
	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P
P ₁	7.45	7.41	7.43 ^b	7.53	7.59	7.56 ^b	7.5	7.49	7.50 ^c
P ₂	7.63	7.58	7.61 ^b	7.75	7.69	7.72 ^a	7.64	7.69	7.67 ^b
P ₃	7.51	7.47	7.49 ^b	7.68	7.79	7.74 ^a	7.63	7.60	7.62 ^b
P ₄	7.87	8.16	8.02 ^a	7.91	7.72	7.82 ^a	7.94	7.89	7.92 ^a
P ₅	7.41	7.37	7.39 ^b	7.57	7.56	7.56 ^b	7.47	7.49	7.48 ^c
Mean of B	7.57	7.60		7.69	7.67		7.64 ^a	7.63 ^a	
Factors	S.Em±	C.D. at 5%		S.Em±	C.D. at 5%		S.Em±	C.D. at 5%	
P	0.08	0.23		0.04	0.12		0.04	0.13	
B	0.05	NS		0.03	NS		0.03	0.08	
PXB	0.11	NS		0.06	NS		0.06	NS	

*Figures with same alphabet did not differ significantly

P₁ – K₂SO₄ @ 1%B₁ - Two layers of brown paperP₂ – BA @ 50 ppmB₂ - No baggingP₃ – Sea weed extract @ 5%P₄ - K₂SO₄ @ 2% + BA @ 50 ppm + Sea weed Sap extract @ 5%P₅ - Control (no chemical spray)**Table 3:** Effect of pre harvest spray of bio-regulators and bagging on fruit weight (gm) of mango cv. Banganpalli

Treatments	Fruit Weight (gm)								
	2019			2020			Pooled		
	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P
P ₁	242.51	240.65	241.58 ^d	261.37	258.18	259.77 ^d	251.94	249.42	250.68 ^d
P ₂	266.13	261.17	263.65 ^b	283.56	278.34	280.95 ^b	274.85	269.76	272.30 ^b
P ₃	253.92	251.18	252.55 ^c	277.46	273.52	275.49 ^c	265.70	262.35	264.03 ^c
P ₄	289.07	275.29	282.18 ^a	295.39	289.98	292.68 ^a	292.23	282.64	287.44 ^a
P ₅	233.19	232.52	232.85 ^e	249.25	248.11	248.68 ^c	241.22	240.32	240.77 ^e
Mean of B	256.97 ^a	252.16 ^b		273.41 ^a	269.63 ^b		265.19 ^a	260.90 ^b	
Factors	S.Em±	C.D. at 5%		S.Em±	C.D. at 5%		S.Em±	C.D. at 5%	
P	1.04	3.11		0.24	0.72		0.56	1.66	
B	0.66	1.97		0.15	0.46		0.35	1.05	
PXB	1.47	4.40		0.34	1.02		0.79	2.35	

*Figures with same alphabet did not differ significantly

P₁ K₂SO₄ @ 1%B₁ - Tam layers of brown paperP₂- BA @ 50 ppmB₂ - No baggingP₃- Sea weed extract @ 5%P₄ - K₂SO₄ @ 2% + BA + 50 ppm + Sea weed Sap extract @ 5%P₅ - Control (no chemical spray)**Table 4:** Effect of pre harvest spray of bio-regulators and bagging on yield (kg) per tree of mango cv. Banganpalli

Treatments	Yield (kg per tree)								
	2019			2020			Pooled		
	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P
P ₁	33.37	32.99	33.18	34.24	33.56	33.90	32.50	32.41	32.45 ^d
P ₂	36.72	35.76	36.24	37.52	36.09	36.80	35.93	35.43	35.68 ^b
P ₃	35.45	34.64	35.05	36.53	35.46	36.00	34.36	33.83	34.10 ^c
P ₄	40.39	38.15	39.27	41.45	38.87	40.16	39.32	37.44	38.38 ^a
P ₅	32.02	31.58	31.80	32.57	32.01	32.29	31.48	31.16	31.32 ^e
Mean of B	35.59	34.62		36.46	35.20		34.72 ^a	34.05 ^b	
Factors	S.Em±	C.D. at 5%		S.Em±	C.D. at 5%		S.Em±	C.D. at 5%	
P	0.40	1.20		0.78	2.34	0.78	0.23	0.68	
B	0.25	0.76		0.50	NS	0.50	0.14	0.43	
PXB	0.57	NS		1.11	NS	1.11	0.32	NS	

*Figures with same alphabet did not differ significantly

P₁ – K₂SO₄ @ 1%B₁ - Two layers of brown paperP₂ – BA @ 50 ppmB₂ - No baggingP₃ – Sea weed extract @ 5%P₄ - K₂SO₄ @ 2% + BA @ 50 ppm+ Sea weed Sap extract @ 5%P₅ - Control (no chemical spray)

Table 5: Effect of pre harvest spray of bio-regulators and bagging on TSS (⁰Brix) of mango cv. Banganpalli

Treatments	TSS (⁰ Brix)								
	2019			2020			Pooled		
	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P
P ₁	16.47	16.34	16.40 ^d	16.67	16.53	16.60 ^c	16.60	16.44	16.52 ^c
P ₂	17.62	17.25	17.44 ^b	17.03	16.82	16.93 ^b	17.31	17.05	17.18 ^b
P ₃	17.16	16.98	17.07 ^c	15.99	15.91	15.95 ^d	16.57	16.42	16.50 ^c
P ₄	18.22	17.98	18.10 ^a	17.08	16.99	17.04 ^a	17.65	17.49	17.57 ^a
P ₅	15.57	15.36	15.46 ^e	15.71	15.62	15.66 ^c	15.62	15.49	15.56 ^d
Mean of B	17.01 ^a	16.78 ^b		16.50 ^a	16.38 ^b		16.75 ^a	16.58 ^b	
Factors	S.Em±	C.D. at 5%		S.Em±	C.D. at 5%		S.Em±	C.D. at 5%	
P	0.02	0.06		0.02	0.06		0.01	0.03	
B	0.01	0.04		0.01	0.04		0.01	0.02	
PXB	0.03	0.09		0.03	NS		0.02	0.04	

*Figures with same alphabet did not differ significantly

P₁ - K₂SO₄ @ 1%B₁ - Two layers of brown paperP₂ - BA @ 50 ppmB₂ - No baggingP₃ - Sea weed extract @ 5%P₄ - K₂SO₄ @ 2% + BA @ 50 ppm+ Sea weed Sap extract @ 5%P₅ - Control (no chemical spray)**Table 6:** Effect of pre harvest spray of bio-regulators and bagging on titratable acidity (%) of mango cv. Banganpalli

Treatments	Titratable acidity (%)								
	2019			2020			Pooled		
	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P
P ₁	0.46	0.45	0.45 ^a	0.47	0.48	0.47 ^c	0.46	0.47	0.47 ^c
P ₂	0.43	0.44	0.44 ^a	0.44	0.45	0.45 ^b	0.44	0.45	0.44 ^a
P ₃	0.44	0.45	0.45 ^a	0.45	0.45	0.45 ^b	0.45	0.45	0.45 ^b
P ₄	0.42	0.43	0.43 ^a	0.42	0.42	0.42 ^a	0.42	0.43	0.43 ^a
P ₅	0.46	0.47	0.47 ^b	0.50	0.51	0.50 ^d	0.48	0.49	0.49 ^d
Mean B	0.44	0.45		0.45 ^a	0.46 ^a		0.45	0.46	
Factors	S.Em±	C.D. at 5%		S.Em±	C.D. at 5%		S.Em±	C.D. at 5%	
B	0.01	0.02		0.00	0.01		0.01	0.01	
P	0.00	NS		0.00	0.01		0.00	NS	
BXP	0.01	NS		0.01	NS		0.01	NS	

*Figures with same alphabet did not differ significantly

P₁ - K₂SO₄ @ 1%B₁ - Two layers of brown paperP₂ - BA @ 50 ppmB₂ - No baggingP₃ - Sea weed extract @ 5%P₄ - K₂SO₄ @ 2% + BA @ 50 ppm+ Sea weed Sap extract @ 5%P₅ - Control (no chemical spray)**Table 7:** Effect of pre harvest spray of bioregulators and bagging on Ascorbic acid content (mg/100 g. F.W.) of mango cv. Banganpalli

Treatments	Ascorbic acid (mg/100 g. F.W.)								
	2019			2020			Pooled		
	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P
P ₁	16.26	16.12	16.19 ^d	16.83	16.51	16.67 ^d	16.55	16.32	16.43 ^d
P ₂	17.24	17.16	17.20 ^b	17.46	17.31	17.39 ^b	17.35	17.24	17.30 ^b
P ₃	16.50	16.35	16.43 ^c	17.05	16.92	16.99 ^c	16.78	16.64	16.71 ^c
P ₄	17.87	17.52	17.69 ^a	17.72	17.63	17.68 ^a	17.80	17.57	17.69 ^a
P ₅	15.87	15.52	15.69 ^e	16.31	16.20	16.25 ^c	16.09	15.86	15.98 ^e
Mean of B	16.75 ^a	16.53 ^b		17.08 ^a	16.91 ^b		16.91 ^a	16.73 ^b	
Factors	S.Em±	C.D. at 5%		S.Em±	C.D. at 5%		S.Em±	C.D. at 5%	
P	0.04	0.13		0.02	0.04		0.02	0.07	
B	0.03	0.08		0.01	0.03		0.01	0.04	
PXB	0.06	NS		0.02	0.06		0.03	NS	

*Figures with same alphabet did not differ significantly

P₁ - K₂SO₄ @ 1%B₁ - Two layers of brown paperP₂ - BA @ 50 ppmB₂ - No baggingP₃ - Sea weed extract @ 5%P₄ - K₂SO₄ @ 2% + BA @ 50 ppm+ Sea weed Sap extract @ 5%P₅ - Control (no chemical spray)

Table 8: Effect of pre harvest spray of bio-regulators and bagging on reducing sugars of mango cv. Banganpalli

Treatments	Reducing Sugars %								
	2019			2020			Pooled		
	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P
P ₁	2.64	2.56	2.60 ^b	2.56	2.57	2.57 ^b	2.61	2.56	2.59 ^b
P ₂	2.37	2.30	2.34 ^d	2.53	2.47	2.50 ^b	2.42	2.42	2.42 ^d
P ₃	2.49	2.42	2.46 ^c	2.54	2.57	2.56 ^b	2.53	2.48	2.51 ^c
P ₄	2.87	2.77	2.82 ^a	2.82	2.80	2.81 ^a	2.83	2.8	2.82 ^a
P ₅	2.36	2.27	2.32 ^d	2.38	2.4	2.39 ^c	2.38	2.33	2.36 ^e
Mean of B	2.55 ^a	2.46 ^b		2.57	2.56		2.56 ^a	2.52 ^b	
Factors	S.Em±	C.D. at 5%		S.Em±	C.D. at 5%		S.Em±	C.D. at 5%	
P	0.01	0.03		0.03	0.09		0.02	0.05	
B	0.01	0.02		0.02	NS		0.01	0.03	
PXB	0.02	NS		0.04	NS		0.02	NS	

*Figures with same alphabet did not differ significantly

P₁ - K₂SO₄ @ 1%

B₁ - Two layers of brown paper

P₂ - BA @ 50 ppm

B₂ - No bagging

P₃ - Sea weed extract @ 5%

P₄ - K₂SO₄ @ 2% + BA @ 50 ppm+ Sea weed Sap extract @ 5%

P₅ - Control (no chemical spray)

Table 9: Effect of pre harvest spray of bio-regulators and bagging on shelf life of mango cv. Banganpalli

Treatments	Shelf life								
	2019			2020			Pooled		
	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P
P ₁	12.00	10.33	11.17 ^d	10.33	9.67	10.00 ^d	11.17	10.00	10.58 ^d
P ₂	14.00	12.67	13.33 ^b	12.67	11.67	12.17 ^b	13.33	12.17	12.75 ^b
P ₃	13.67	11.00	12.33 ^c	11.67	11.00	11.33 ^c	12.67	11.00	11.83 ^c
P ₄	15.33	13.67	14.50 ^a	13.67	13.33	13.50 ^a	14.50	13.50	14.00 ^a
P ₅	10.67	9.33	10.00 ^e	9.33	9.00	9.17 ^e	10.00	9.17	9.58 ^e
Mean of P	13.13 ^a	11.40 ^b		11.53 ^a	10.93 ^b		12.33 ^a	11.17 ^b	
Factors	S.Em±	C.D. at 5%		S.Em±	C.D. at 5%		S.Em±	C.D. at 5%	
P	0.24	0.73		0.22	0.66		0.17	0.52	
B	0.15	0.46		0.14	0.42		0.11	0.33	
PXB	0.34	NS		0.31	NS		0.25	NS	

*Figures with same alphabet did not differ significantly

P₁ - K₂SO₄ @ 1%

B₁ - Two layers of brown paper

P₂ - BA @ 50 ppm

B₂ - No bagging

P₃ - Sea weed extract @ 5%

P₄ - K₂SO₄ @ 2% + BA @ 50 ppm+ Sea weed Sap extract @ 5%

P₅ - Control (no chemical spray)

Table 10: Effect of pre harvest spray of bio-regulators and bagging on taste score of mango cv. Banganpalli

Treatments	Taste score								
	2019			2020			Pooled		
	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P
P ₁	7.00	6.97	6.98 ^c	7.06	7.00	7.03 ^c	7.03	6.99	7.01 ^d
P ₂	8.09	8.00	8.05 ^a	8.20	8.13	8.17 ^a	8.15	8.07	8.11 ^b
P ₃	7.81	7.55	7.68 ^b	7.99	7.92	7.95 ^b	7.91	7.74	7.82 ^c
P ₄	8.16	8.07	8.11 ^a	8.22	8.16	8.19 ^a	8.19	8.12	8.16 ^a
P ₅	6.50	6.31	6.41 ^d	6.75	6.55	6.65 ^d	6.63	6.43	6.53 ^c
Mean of B	7.51 ^a	7.38 ^b		7.65 ^a	7.55 ^b		7.58 ^a	7.47 ^b	
Factors	S.Em±	C.D. at 5%		S.Em±	C.D. at 5%		S.Em±	C.D. at 5%	
P	0.03	0.10		0.01	0.03		0.02	0.05	
B	0.02	0.06		0.01	0.02		0.01	0.03	
PXB	0.05	NS		0.01	0.04		0.02	0.07	

*Figures with same alphabet did not differ significantly

P₁ - K₂SO₄ @ 1%

B₁ - Two layers of brown paper

P₂ - BA @ 50 ppm

B₂ - No bagging

P₃ - Sea weed extract @ 5%

P₄ - K₂SO₄ @ 2% + BA @ 50 ppm+ Sea weed Sap extract @ 5%

P₅ - Control (no chemical spray)

Table 11: Effect of pre harvest spray of bio-regulators and bagging on overall acceptance of mango cv. Banganpalli

Treatments	Overall acceptance								
	2019			2020			Pooled		
	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P	B ₁	B ₂	Mean of P
P ₁	7.07	6.90	6.98 ^d	7.14	7.07	7.10 ^d	7.10	6.99	7.05 ^d
P ₂	7.80	7.66	7.73 ^b	7.95	7.87	7.91 ^b	7.88	7.77	7.82 ^b
P ₃	7.47	7.27	7.37 ^c	7.65	7.53	7.59 ^c	7.56	7.40	7.48 ^c
P ₄	8.07	7.99	8.03 ^a	8.15	8.07	8.11 ^a	8.11	8.03	8.07 ^a
P ₅	6.17	6.00	6.09 ^e	6.92	6.55	6.74 ^e	6.55	6.28	6.41 ^e
Mean of B	7.32 ^a	7.16 ^b		7.56 ^a	7.42 ^b		7.44 ^a	7.29 ^b	
Factors	S.Em±	C.D. at 5%		S.Em±	C.D. at 5%		S.Em±	C.D. at 5%	
P	0.03	0.08		0.01	0.03		0.01	0.03	
P	0.02	0.05		0.01	0.02		0.01	0.02	
PXB	0.04	NS		0.02	0.05		0.02	0.05	

Figures with same alphabet did not differ significantly

P₁ - K₂SO₄ @ 1%

P₂ - BA @ 50 ppm

P₃ - Sea weed extract @ 5%

P₄ - K₂SO₄ @ 2% + BA @ 50 ppm+ Sea weed Sap extract @ 5%

P₅ - Control (no chemical spray)

B₁ - Two layers of brown paper

B₂ - No bagging

Conclusion

The present study indicated that interaction between pre harvest bio-regulator sprays and bagging, pre harvest spray of potassium sulphate+6-benzylaminopurine + seaweed extract with two layers of brown paper bagging (P₄B₁) has significantly resulted in fruits with maximum TSS (17.65 °Brix), highest taste score (8.19) and overall acceptance (8.11) compared to control.

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