



E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(4): 638-640
Received: 15-05-2020
Accepted: 16-06-2020

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Deciphering the consequences of phyto bio regulators on physical parameters of Papaya cv. red lady

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Abstract

The present investigation has been conducted for two consecutive years (2018-19 and 2019-20) to determine the effect of various phyto bio regulator on physical parameters of papaya (*Carica papaya*) cv. Red Lady in a randomized block design using factorial arrangement with 11 treatments and 03 replications. The study revealed that phyto bio regulator significantly affect fruit length (cm), fruit weight (g), fruit volume (cc) as well as all the physical parameters under study in papaya fruits. Treatment details includes five phyto bio regulators with two different concentrations i.e. Naphthalene acetic acid (100 ppm and 150 ppm), Gibberellic acid (100 ppm and 150 ppm), Benzyl adenine (100 ppm and 150 ppm), Ethrel (100 ppm and 150 ppm) and 2,3,5-Triiodo benzoic acid (100 ppm and 150 ppm). It was observed that gibberellic acid @150 ppm significantly increased value of fruit length (cm), fruit diameter (cm), fruit weight (g), fruit volume (cc), peel weight (g) and pulp weight (g) of papaya however it decreases the number of seeds per fruit and seed weight (g) as compare to control in papaya cv. Red Lady.

Keywords: papaya, phyto bio regulator, physical characteristics.

Introduction

The papaya (*Carica papaya* L.) is a member of family Caricaceae, is native to south America, possess 04 genera and 31 species. In different part of the world, it is called with different names viz. Papaw, melon zapote, fruta mamboa, mamao, tree melon, etc. (Medina *et al.*, 2003) [20]. Due to its nutritional, medicinal and high remunerative value, it is currently grown in most of the tropical and subtropical countries (Gaudence *et al.*, 2019) [5]. Besides, these its cultivation is easy and can be grown year round, with good income generation (Drew *et al.* 1998) [4]. This may be one of the reasons that this plant had established its utility in the form of commercial plantations instead of garden dwelling plant of home.

The Plant Growth Regulators (PGRs) are organic compounds other than nutrients (supplying either energy or mineral elements) that in small amount promote, inhibit or otherwise modify any physiological processes in plants (Jain and Dashora, 2011) [18]. These bio regulators have proven to be an important component of modern fruit production technology both for altering parameters like vegetative growth (Hota *et al.*, 2017a [11]; Priyadarshi *et al.*, 2017 [24]), fruit set (Hota *et al.*, 2017b) [13], fruit drop (Hota *et al.*, 2017c) [14], yield attributing parameter (Hota *et al.*, 2017d [16], Priyadarshi *et al.*, 2018a [23]), physical parameters (Hota *et al.*, 2017e) [17], chemical parameters (Hota *et al.*, 2018 [12], Priyadarshi *et al.*, 2018b [22]) and physico-chemical parameters (Hota *et al.*, 2017f) [15]. Since phyto bio regulators have various diverse affects hence it has to be used at particular stage of production cycle to get maximum benefit out of them (Hota *et al.*, 2019) [10]. Moreover, with the advancement of technology, these chemicals can have supplied exogenously, in both natural and synthetic form (as their chemical analogs, hormone releasing agents, hormone sensitivity altering agents and hormone synthesis inhibitors (Hajam *et al.*, 2017) [7], in such a way that it can modify the plant production processes, thereby increasing the yield (Singh and Singh, 2009) [25]. Furthermore, various physical and morphometric properties like fruit length, fruit weight is useful to approximate the development and maturity index so as to ensure the commercial fruit quality and the consumer acceptability of papaya fruits, besides affecting its shelf life (Calegario *et al.*, 1997 [3], Olabode *et al.*, 2015 [21]). Considering this fact, the present investigation has been designed to determine the effect of phyto bio regulator on physical quality of papaya fruits.

Materials and method

The Mahasamund district of Chhattisgarh is located at 20°47' to 21°31' N latitude and 82°00' to 83°15' longitude having sub humid climatic conditions with an average annual rainfall of 1200 mm. The present investigation was conducted at Farm of Krishi Vigyan Kendra,

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Mahasamund for two consecutive years i.e. 2018-19 and 2019-20 in a moderately sloped land with appropriate drainage system.

The Papaya variety "Red Lady" was used for the experimental purpose. Red Lady is a gynodioecious variety of papaya and a one of the popular variety of papaya cultivated by the farmers. The polybags having saplings of papaya cv. Red Lady were regularly irrigated and utmost care of nursery plants is taken until they are ready for transplanting in the field. The experiment was conducted in 33 plots (03 replications each of 11 treatments) designed in a randomized block design (RBD) with a spacing of 2 mt. x 2 mt. The treatment combination used was as follows: T₀, Control (Water Spray); T₁, Naphthalene acetic acid (NAA) 100 ppm; T₂, Naphthalene acetic acid (NAA) 150 ppm; T₃, Gibberellic acid (GA₃) 100 ppm; T₄, Gibberellic acid (GA₃) 150 ppm; T₅, Benzyl adenine (BA) 100 ppm; T₆, Benzyl adenine (BA) 150 ppm; T₇, Ethrel 100 ppm; T₈, Ethrel 150 ppm; T₉, 2,3,5-Triiodo benzoic acid (TIBA) 100 ppm; T₁₀, 2,3,5-Triiodo benzoic acid (TIBA) 150 ppm.

The foliar spray was done at different time slots i.e. 45, 75 and 125 days after transplanting. The solutions of different concentrations were sprayed to wet the whole plant with care to avoid its drooping on the soil surface. The Fruit weight was taken using digital balance, fruit volume was measured by the water displacement method and expressed in cc. The pulp weight was obtained by subtracting the peel weight and seed from the fruit weight. The data pertaining to physical parameters was recorded by their standard methods.

The data generated from these investigations were appropriately computed, tabulated and analyzed as described by Gomez and Gomez (1983) [6] using MS-Excel and OPSTAT in Randomized Block Design (RBD).

Results and Discussion

The phyto bio regulator poses significant effect on various physical parameters of papaya fruit which is clearly evident from the pooled values of two years experimental findings and is shown in Table-1. It has been observed that significantly high value of fruit length (25.35 cm), diameter (19.70 cm), weight (1120.05 g) and volume (1378 cc), peel weight (83.63g) and pulp weight (1112.85g) as well as lowest seed weight (54.42 g) and number of seeds per fruit (292.24)

was obtained with application of 150 ppm of gibberellic acid. The fruit length was found to be highest for T₄ treatment (Gibberellic acid; 150 ppm), while minimum with T₀ treatment (Water spray). As per Ahmed *et al.*, (2012) [2] the gibberellic acid by virtue of its property, increases the process of cell division and cell elongation, along with increased level of carbohydrates. Hence, increasing the photo assimilates supply in the fruit treated with Gibberellic acid, results in the greater length and volume of fruit. This finding was in accordance with Hazarika *et al.* (2016) [8] and Hetram (2017) [9], where both of them had independently observed higher fruit length with Gibberellic acid on papaya (*Carica papaya*) cv. Red lady.

The highest fruit diameter and volume had been observed in case of treatment with treatment T₄ (Gibberellic acid; 150 ppm), while minimum with T₀ treatment (Control/Water spray). The Gibberellic acid regulates the semi-permeability of cell wall, thereby increasing the mobilization of water into fruits, hence increasing the diameter and volume of fruit. Moreover, due to increased rate of photosynthesis it increases the greater accumulation of carbohydrates, leads to greater diameter and volume. Similar observations were also recorded by Vishwakarma *et al.* (2000) [28], Syamal *et al.* (2010) [27] in papaya fruits and Khajehyar *et al.* (2015) [19] while working on apricot.

The fruit weight of papaya was found to be highest in case of treatment T₄ (Gibberellic acid; 150 ppm) while minimum with treatment T₀ (Control/Water spray). As discussed earlier, the Gibberellic acid promotes the process of cell elongation, thereby promoting the growth of all vegetative parts along with inflow of more food material for development of fruit due to its anabolic nature. Hence, the fruits with maximum weight were obtained. This finding was in accordance with Singh and Bal (2006) [26] in ber and Hetram (2017) [9] in papaya fruits.

The maximum peel weight and pulp weight has been observed with the application of treatment T₄ (Gibberellic acid; 150 ppm). This maximum pulp could be attributed due to the increased length, diameter, volume and weight of fruit along with greater translocation and accumulation of photosynthates into the sink (fruit). The present observations are in close conformity with Agrawal and Dikshit (2010) [1] and Hazarika *et al.* (2016) [8] in papaya fruit.

Table 1: Effect of phyto bio regulators on physical parameters of fruits

Treatment	Fruit length (cm)	Fruit diameter(cm)	Fruit weight (g)	Fruit Volume (cc)	Peel Weight (g)	Pulp Weight (g)	No. of seed per fruit	Seed Weight (g)
T ₀ Control (Water)	15.82	11.64	844.08	1057.53	68.16	768.78	545.46	75.91
T ₁ NAA 100 ppm	23.15	18.08	1020.82	1274.34	78.05	965.04	477.21	68.06
T ₂ NAA 150 ppm	23.96	18.40	1039.47	1286.20	80.90	982.35	447.03	67.46
T ₃ GA3 100 ppm	24.94	19.10	1203.78	1342.02	81.99	1008.15	313.03	57.44
T ₄ GA3 150 ppm	25.35	19.70	1220.05	1378.88	83.63	1112.85	292.24	54.42
T ₅ BA 100 ppm	19.45	14.95	910.91	1093.95	71.13	832.61	513.45	71.08
T ₆ BA 150 ppm	20.66	16.22	916.40	1126.91	73.21	840.31	492.61	69.38
T ₇ Ethrel -100 ppm	17.32	13.61	873.85	1074.52	70.04	806.62	388.44	63.58
T ₈ Ethrel -150 ppm	18.71	14.84	886.65	1087.65	70.95	826.63	374.17	61.07
T ₉ TIBA 100 ppm	20.79	17.33	927.34	1167.17	74.35	899.21	342.92	59.45
T ₁₀ TIBA 150 ppm	21.49	17.45	953.45	1187.82	76.16	943.46	324.17	58.50
SE(m)	0.27	0.18	5.13	6.88	1.41	4.17	4.77	0.06
CD	0.79	0.53	15.12	20.30	4.16	12.30	14.07	0.16

Conclusion

From the above investigation, it can be concluded that exogenous application of phyto bio regulator acts as a useful tool not only to improve the physical quality of fruits but also to helps in fetching the better prices in the market as

improved physical appearance helps to improves the consumer acceptability of fruits. However, it should be used judiciously to prevent any adverse effects on plant which may arises because of improper application of exogenous synthetic phyto bio regulators.

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