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Influence of Pre and Postharvest Treatments of various Chemicals and Growth Regulators on Physical and Quality characteristics of Sapota Fruits cv. PKM-1

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ABSTRACT: Sapota is grown in a variety of tropical and subtropical climates around the world. It is delicious, nutritive and it is primarily cultivated for fresh consumption. Sapota has a very short postharvest life due to its highly perishable nature. Proper pre- and postharvest treatments are essential to extend the shelf life and improve the quality of sapota. Hence the present investigation was conducted "To develop a process for uniform ripening and enhancing the shelf-life and quality of Sapota" at the Horticultural College and Research Institute (HC & RI), TNAU, Coimbatore to find out the influence of pre and post harvest chemical treatments on physical characteristics of sapota fruit (var. PKM-1). The experiment was laid out in Factorial Randomized Block Design with three replications. Among seven different pre harvest treatments, the treatment which comprised of 2% Potassium sulphate has recorded the highest fruit length (9.9 cm), fruit girth (15.2 cm), pulp weight (115.40 g), fruit firmness (3.8 kg/cm^3), sugar content (16.30%), TSS (22.2^o Brix), reducing sugar (11.30%) and specific gravity (1.3) when compared to the control where only water spray was given. The best performed trees which have received the treatment of potassium sulphate @ 2% were taken for postharvest treatment study with five treatments (Ethephon solution @ 500 ppm, 1000 ppm, 1500 ppm, 2000 ppm and control). If was found that the combined effect of the pre-harvest treatment with 2% potassium sulphate combined with post harvest treatment of ethephon solution @ 1500 ppm +25 μ LDPE bag (O_2 @ 5% & CO_2 @ 10% at 11^{o}C) has increased the shelf life (13 days) and decreased physiological loss in weight (1%).

Keywords: Potassium sulphate; Ethephon; Pre-harvest spray, growth regulator, sapota, physical and quality characters of sapota.

INTRODUCTION

The sapota (*Manilkara achras* (Mill) Forsberg) is a well-known tropical fruit that is native to Tropical America and belongs to the family Sapotaceae. It is popularly known by several names such as chiku in India, sapodilla, zapota or sapodilla plum in different regions of the world (Desai *et al*., 2017). India is considered to be the largest producer of sapota in the world (Patel *et al*. 2017). Being climacteric in nature sapota fruits need ripening treatments after full maturity (Baidya *et al.,* 2020). Fruit undergoes a succession of colour, texture, and flavour changes as it ripen, indicating compositional alterations (Sudha *et al*., 2007). Due to a decrease in polyphenols with a simultaneous increase in sugars, ethylene production, rate of respiration, and enzymatic activities, ripe fruits have a good aroma and are great in sweetness without astringency (Sankaranarayanan *et al*., 2007).

In tropical nations, post-harvest losses are extremely high (Siddiqui *et al.,* 2014). By slowing down the metabolic activity of fruits, several chemicals and plant growth regulators have been employed to speed or delay ripening, reduce losses, and improve and maintain colour and quality (Thirupathaiah *et al.*, 2017). These substances inhibit the growth and spread of microorganisms by minimising shrivelling, resulting in a prolonged shelf life and marketability of the fruits (Patel *et al.*, 2017).

Therefore, the present investigation was carried out to evaluate the effect of pre harvest and postharvest treatments of chemicals and growth regulators on quality and shelf life of sapota fruits.

MATERIAL AND METHODS

The present investigation was carried out during the year 2016-19 at Horticultural College and Research Institute, TNAU, Coimbatore. With three replications and seven treatments, the experiment was set up in a Factorial Randomized Block Design (FRBD). The uniform sized trees of sapota cv. PKM-1 were marked and sprayed with different chemicals and plant growth regulators. The treatment schedule followed was as given in Table 1.

Table 1.

Treatments
T1-control (Water spray and Absolute).
T2-Potassium sulphate 1%
T3- Potassium sulphate 2%
T4- Potassium nitrate 1%
T5- Potassium nitrate 2%
T6-GA3 50 ppm
T7-GA3 100 ppm

The fruits were harvested when colour of the fruit turned to light brown *i.e.* potato colour and recorded physical characteristics of fruit viz., fruit length, fruit girth, pulp weight, firmness and specific gravity. Fruits were harvested and used from the best performed pre harvest treatment *viz.*, T_3-potassium sulphate @ 2% was used for postharvest treatment. The experiment was laid out in Factorial Randomized Block Design with three replications. In postharvest study three factors were used viz., post harvest chemical treatments (T_1-Control; T_2-Ethephon solution @ 500 ppm; T_3-Ethephon solution @ 1000 ppm; T_4-Ethephon solution @ 1500 ppm; T_5-Ethephon solution @ 2000 ppm), Active modified Atmosphere Packaging material (P_1- 25 μ LDPE bags with 5% O_2 and 10% CO_2 and P_2- 40 μ LDPE bags with 5% O_2 and 10% CO_2) and storage temperature (S_1-11°C and S_2-20°C). One kg fruits from each replication of each treatment were stored at room temperature in laboratory to observe the shelf life study parameters.

Physiological weight loss, TSS, titrable acidity, total sugar, reducing sugar, total phenol, and tannin were all measured in the fruits. The physiological weight loss in stored fruits was calculated by subtracting the final weight from the initial weight and represented as a percentage. A total soluble solid of sapota fruit was recorded by using a Hand Refractometer (0-32°Brix). The titrametric method of Lane and Eynon described by Ranganna (1979) was adopted for the estimation of acidity, total sugar and reducing sugar.

RESULTS AND DISCUSSION

The data pertaining to the physical and quality characteristics of fruit are depicted in Table 2 and 3 respectively. The analysis of variance showed significant differences for physical characteristics of fruit viz., fruit length, fruit girth, pulp weight, firmness and specific gravity and quality characteristics of fruit such as TSS, titrable acidity, total sugar, reducing sugar, total phenol and tannin. Among seven different pre harvest treatments, 2% Potassium sulphate (T_3) has showed the highest fruit length (9.9 cm), fruit girth (15.2 cm), pulp weight (115.40 g), fruit firmness (3.8 kg/cm^3), increased fruit firmness in T_3 this could be due to an increase in fruit tissue pressure potential (Lester *et al*., 2006) as well as improved phloem transport of calcium to fruits after potassium treatments. The current finding confirms John and Gene's (2011) findings in cantaloupes. The highest sugar content (16.30%) was recorded at potassium sulphate at 2%, the conversion of starch and acid into sugars, as well as the continual mobilisation of sugars from leaves to fruits, could explain the increase in percent total sugars in guava pulp caused by pre-harvest potassium sprays. The findings in guava are consistent with those of Manivannan *et al*. (2015); Jitendra *et al*. (2015).

Table 2: Effect of pre harvest sprays on physical characteristics of sapota fruits.

Treatments	Fruit length (cm)	Fruit girth (cm)	Pulp weight (g)	Firmness (kg/cm^2)	Specific gravity
T1-control	6.8	12.2	78.3	1.9	1.2
T2-Potassium sulphate 1%	7.9	12.3	90.0	3.5	1.2
T3- Potassium sulphate 2%	9.9	15.2	115.4	3.8	1.3
T4- Potassium nitrate 1%	8.2	12.5	108.6	3.5	1.2
T5- Potassium nitrate 2%	8.5	12.6	97.3	2.6	1.2
T6-GA3 50 ppm	9.2	14.0	106.6	3.5	1.1
T7-GA3 100 ppm	9.2	13.2	103.8	3.4	1.2
Mean	8.5	13.1	100.0	3.2	1.2
SEd	0.20	0.27	0.32	0.05	0.026
CD (0.05)	0.44	0.60	0.76	0.11	0.057

Table 3: Effect of pre harvest treatments on quality parameters of sapota fruits.

Treatments	Sugar content (%)	TSS (°Brix)	Reducing sugar (%)	Titrable acidity (%)	Total phenol (mg/g)	Tannin (%)
T1-control	13.2	18.4	8.2	0.3	14.0	0.2
T2-Potassium sulphate 1%	14.5	18.9	9.8	0.2	12.5	0.2
T3- Potassium sulphate 2%	16.3	22.2	11.3	0.1	11.0	0.1
T4- Potassium nitrate 1%	15.5	19.3	10.2	0.2	12.2	0.1
T5- Potassium nitrate 2%	14.2	20.7	8.4	0.2	13.3	0.2
T6-GA3 50 ppm	15.4	20.5	11.1	0.3	13.5	0.2
T7-GA3 100 ppm	13.9	19.2	8.3	0.3	13.3	0.2
Mean	14.7	19.9	9.6	0.2	12.8	0.2
SEd	0.48	0.20	0.21	0.005	0.22	0.003
CD (0.05)	1.04	0.44	0.46	0.01	0.49	0.008

The maximum TSS (22.2^{o}Brix) was found in T_3, Photo-assimilates, sugars, and other soluble solids are transported by potassium, resulting in an increase in total soluble solids in T3. The current findings in terms of total soluble solids are consistent with Mandal *et al.* (2010); Jitendra *et al*. (2015) findings in guava.

The reducing sugar was recorded maximum (11.30%) in T_3 Potassium may have aided in the increase of photophosphorylation and the dark reaction of photosynthesis, resulting in the accumulation of more carbohydrates in the fruits and improved nutritional accessibility to the developing fruits. Singh *et al.* (2002) observed similar findings in peach, and Manivannan *et al.* (2015) reported similar findings in guava. The maximum specific gravity (1.3) was found in T_3 and lowest value was recorded in control. The reduced acidity observed in T_3 it is possible that this is due to increased sugar build-up, improved sugar translocation into fruit tissues, and the conversion of organic acids to sugars. Because of the high potassium level in the tissue, neutralisation of organic acids may have resulted in a reduction in acidity (Tisdale and Nelson, 1966).

The data pertaining to the combined effect of pre harvest and postharvest treatments on quality characteristics of fruit are depicted in Table 4. The analysis of variance showed significant differences for quality parameters of fruit *viz*., firmness, TSS, acidity, physiological loss in weight and shelf life. The pre-harvest treatment with 2% potassium sulphate combined with post harvest treatment of ethephon solution @ 1500 ppm +25 μ LDPE bag with O_2 @ 5% & CO_2 @ 10% at 11^{o}C ($T_4P_1S_1$) has increased the fruit firmness (3.9 kg/cm^2), TSS (21.8°Brix) and shelf life (13 days) and decreased physiological loss in weight (1%) and acidity (0.1%). LDPE acts as a moisture and gaseous barrier, preventing water loss (transpiration) and suppressing respiration by accumulating CO_2 and reducing O_2 levels. Slower senescence, respiration, and ethylene liberation rate by oxidising ethylene to ethylene glycol and polygalacturonase activity can be responsible for the delayed ripening of fruits contained in polyethylene bags. It could also be attributed to a larger degree of carbon-dioxide accumulation in the bag as a result of restricted oxygen and carbon-dioxide penetration, which reduces the rate of respiration. The polyethylene bag functions as a barrier, allowing moisture to diffuse freely into the atmosphere. In papaya, similar findings were obtained (Ramakrishna *et al*., 2001).

Table 4: Combined effect of pre harvest and post harvest treatments on fruit quality of sapota fruits.

Treatments	Firmness (kg/cm^2)	TSS (^{o}Brix)	Acidity (%)	Physiological loss in weight (%)	Shelf life (days)
$T_1P_1S_1$	2.0	17.0	0.3	2.5	8.0
$T_1P_1S_2$	1.7	16.2	0.3	2.7	9.0
$T_1P_2S_1$	1.8	19.6	0.3	2.5	10.0
$T_1P_2S_2$	2.4	18.9	0.2	1.9	9.5
$T_2P_1S_1$	1.8	19.0	0.2	2.3	8.5
$T_2P_1S_2$	1.9	20.4	0.3	2.1	9.5
$T_2P_2S_1$	1.7	19.3	0.2	1.2	10.5
$T_2P_2S_2$	1.8	19.1	0.3	1.5	11.0
$T_3P_1S_1$	2.3	21.3	0.2	2.7	12.0
$T_3P_1S_2$	1.4	19.3	0.2	2.8	10.0
$T_3P_2S_1$	2.8	21.0	0.2	2.3	9.5
$T_3P_2S_2$	2.4	21.4	0.2	2.3	9.0
$T_4P_1S_1$	3.9	21.8	0.1	1.0	13.0
$T_4P_1S_2$	3.5	21.4	0.3	1.4	11.0
$T_4P_2S_1$	3.3	19.9	0.2	2.0	10.0
$T_4P_2S_2$	2.6	19.4	0.3	2.3	9.0
$T_5P_1S_1$	2.8	19.3	0.3	2.6	10.0
$T_5P_1S_2$	2.3	19.1	0.2	2.4	10.5
$T_5P_2S_1$	2.5	18.2	0.2	3.2	11.0
$T_5P_2S_2$	3.0	17.8	0.2	2.5	11.5
Mean	2.4	19.4	0.2	2.2	10.1
SEd	0.027	0.210	0.001	0.022	0.133
CD (0.05)	0.547	0.425	0.002	0.045	0. 270

CONCLUSION

On the basis of present studies the pre-harvest treatment with 2% potassium sulphate combined with post harvest treatment of ethephon solution @ 1500 ppm +25 μ LDPE bag with O_2 @ 5% & CO_2 @ 10% at 11^{o}C ($T_4P_1S_1$) has increased the fruit firmness (3.9 kg/cm^2), TSS (21.8°Brix) and shelf life (13 days) and decreased physiological loss in weight (1%) and acidity (0.1%). Sapota is one of the important fruit crops in India. Places like Gujarat, Maharashtra, Karnataka and Tamil Nadu share the maximum part in terms of production. Therefore, proper management practices before and after the harvest of the crops should be suggested to the farmers which helps to increase in shelf life and quality of sapota fruits.

FUTURE SCOPE

This study paves way for the researchers to carry out further experiments and field researches in making various treatment combinations for improving the shelf life of fruits and also to standardise techniques to increase the shelf life of sapota fruits.

Conflict of Interest. None.

REFERENCES

Baidya, B. J., Mahato, A., Pattnaik, R. K. and Sethy, P. (2020). A review of physiological and biochemical changes related to ripening along with post harvest handling and treatments of sapota. *Journal of Pharmacognosy and Phytochemistry, 9*(4): 2030-2035.

Desai, V. N., Satodiya, B. N. and Khatana, K. J. (2017). Influence of pre harvest spraying treatments of chemicals and plant growth regulators on physical parameters, post harvest losses and shelf life of sapota [Manilkara achras (Mill) Forsberg] fruits cv. Kalipatti. *Journal of Pharmacognosy and Phytochemistry, 6*(5): 576-578.

Jitendra, K., Rajesh, K., Ratna, R. and Mishra, D. S. (2015). Response of Pant Prabhat Guava tree to foliar sprays of zinc, boron, calcium and potassium at different Plant growth stages. *The Bioscan, 10*(2): 495-498.

John, L. J. and Gene, E. L. (2011). Effect of foliar potassium fertilization and source on cantaloupe yield and quality. *Better Crops, 95*(1): 13-15 6.

Lester, G. E., Jifon, J. L. and Makus, D. J. (2006). Supplemental foliar potassium applications with and without surfactant can enhance netted muskmelon quality. *Hortscience, 41*(3): 741-744.

Mandal, G., Dhaliwal, H. S. and Mahajan, B. V. C. (2010). Effect of pre harvest application of NAA and potassium nitrate on storage quality of winter guava (*Psidium guajava* L.). *Indian Journal of Agricultural Science, 82*(11): 9851 9889.

Manivannan, M. I., Irulandi, S. and Shoba, K. (2015). Studies on the effect of pre- harvest application of plant growth regulators and chemicals on yield and quality of guava. *International Journal of Agricultural Sciences, 11*(1): 138-140.

Patel, H. A., Patel, M. J., Vasara, R., Patel, N. G. and Sutariya, N. K. (2017). Effect of pre harvest spray of calcium on bio-chemical parameters of sapota [Manilkara achras (Mill) Forsberg] fruits cv. Kalipatti. *Journal of Pharmacognosy and Phytochemistry, 6*(5): 712-715.

Ramakrishna, M., Haribabu, K. and Purushotham, K. (2001). Effect of Preharvest application of calcium on physicochemical changes during ripening and storage of papaya. *Indian Journal of Horticulture, 58*: 228-231.

Ranganna, S. (1979). Manual of analysis of fruit and vegetable products. Tata McGraw Hill Publishing Company Ltd., New Delhi.

Sankaranarayanan, R., Geetharani, P. and Manivannan, M. (2007). Ripening behaviour of sapota. *South Indian Horticulture, 55*: 276-282.

Siddiqui, M. W., Longkumer, M., Ahmad, M. S., Barman, K., Thakur, P. K. and Kabir, J. (2014). Post harvest biology and technology of sapota: a concise review. *Acta Physiologiae Plantarum, 36*(12): 3115-3122.

Singh, C., Sharma, V. P., Usha, K. and Sagar, V. R. (2002). Effect of macro and micro nutrients on physico-chemical characters of grapes cv. Perlette. *Indian Journal of Horticulture, 59*(3): 258-260.

Sudha, R., Amutha, R., Muthulakshmi, S., Rani, W. B., Indira, K. and Mareeswari, P. (2007). Influence of pre and post harvest chemical treatments on physical characteristics of sapota (*Achras sapota* L.) var. PKM-1. *Research Journal of Agriculture and Biological Sciences, 3*(5): 450-452.

Thirupathaiah, G., Shirol, A. M., Nagesh, N., Venugopal, U. and Sampath, P. M. (2017). Effect of micronutrients on post harvest quality and shelf life of sapota cv. Kalipatti. *International Journal of Agricultural Sciences, 9*(5): 4084-4086.

Tisdale, S. L. and Nelson, W. L. (1966). Soil fertility and fertilizers. Macmillan Company. London. 81.

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