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Research Article

EFFECT OF MICRONUTRIENTS ON POST HARVEST QUALITY AND SHELF LIFE OF SAPOTA *CV.* KALIPATTI

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Abstract- A field study was conducted to know the effect of micronutrients on post harvest quality and shelf life of sapota *cv.* Kalipatti. Zinc and iron sulphates are used for soil and foliar application, boron for soil application sodium tetraborate (Jai bore) and for the foliar application solubor were used. The results indicated that the foliar application T_{10} -RDF + 0.5% $ZnSO_4$ + 0.5% $FeSO_4$ + 0.3% B per tree (i.e. in two times as foliar i.e. 1st at 50 per cent flowering and another at fruits at pea size) was gave physiological loss in weight of fruits 7.05% at three days after harvest and 1.35% at six after harvest over three days after harvest without effecting quality attributes, with promoted shelf life (12 days) with maximum per cent (23.25%) of total and minimum per cent (8.57%) of non-reducing sugars was promoted shelf life.

Keywords- Micronutrients, Shelf life and Sapota.

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Introduction

Sapota is a good source of sugar which ranges between 12 and 16 per cent [3] and used for making jams, jellies, osmo-dehydrated slices and squash [13]. Products like sweet chutney, dried sapota pieces, sapota milk shake, nectar, blended sapota drinks, pickle, preserve and candy and wine can also be prepared with good sensory quality [4, 16]. Fruits are produced throughout the year but production is not consistent. One of the major problems in sapota cultivation is the occurrence of certain physiological disorders and short shelf life, apart from the problems of pests and diseases, which reduce the quality of the fruit drastically [21]. Sapota fruits are required to be managed appropriately with the help of pre harvest application of micronutrients [8] followed by storage at appropriate temperature and relative humidity.

Various experiments have been conducted earlier on foliar spray of micro-nutrients in different fruit crops and shown significant response to improve quality of fruits [10]. These micronutrients helps in absorption of major nutrients [20] their by fruit quality will increase. The weight loss can be decreased by the application of calcium may be due to its role in the maintenance of fruit firmness, retardation of respiratory rates as well as transpiration and delayed senescence [2, 6, 11, 17]. Therefore, based on the possible benefits of zinc, iron and boron the present study was planned to know the response of soil and foliar application micronutrients on the following objective. To study the response of soil and foliar application of zinc, iron and boron on post harvest quality shelf life of sapota *cv.* Kalipatti as influenced by the application of zinc, iron and boron.

Materials and Methods

Experimental details

Field experiments were conducted at Kittur Rani Chennamma College of Horticulture, Arabhavi, Belagavi District during 2015-2016. Experiments were laid out in Randomized Complete Block Design with eleven treatments *viz.,* T1: control-only recommended dose of fertilizers[RDF], T2: water foliar application+ RDF, T3: $ZnSO_4$ (50 g/plant soil application)+RDF, T4: $FeSO_4$ (40 g/plant soil application)+RDF, T5: Boron (Jai bore 25 g/plant soil application)+RDF, T6: $ZnSO_4$ (foliar application 0.5 per cent)+RDF, T7: $FeSO_4$ (foliar application 0.5 per cent)+RDF, T8: boron (Solubor for foliar application 0.3 per cent)+RDF, T9: $ZnSO_4$ (50 g) + $FeSO_4$ (40 g) + boron (25 g) for soil application+ RDF. T10: ZnSO4 (0.5%) + $FeSO_4$ (0.5%) + boron (0.3%) for foliar application+ RDF. Micronutrients (foliar application) and T11: T9 +T10+RDF. These nutrients are applied in two times as foliar i.e. 1st at 50 per cent flowering and another at fruits at pea size. For soil application micronutrients applied along with RDF.

For post harvest studies the fruits were stored at room temperature i.e. day and night temperature is (25±2 °C and 18±2 °C respectively), & RH (70±5%). In this 40 no. of fruits per treatment was taken for physiological loss in weight 3rd day and 6th day after was observations are taken and for organolepic evaluation 1 to 10 score card were used on the basis of sensory score the data was generated.

Statistical analysis of experimental data

The experimental data collected relating to different parameters were statistically analyzed as described by [19] and the results were tested at 5 per cent level of significance by Fischer method of analysis of variance.

Results and Discussion

Physiological loss in weight

The various treatments are significantly influenced thephysiological loss in weight of sapota fruits [Table-1]. The minimum physiological loss in weight was recorded in T_{10} (7.05 %) followed by T_7 (10.14%) which was no-par with T_5, T_8, T_4, T_4, T_2, T_3 and T_6 (10.21, 10.37, 10.53, 10.79, 11.17 and 11.50 per cent respectively) three days after harvest and the highest physiological loss in weight was recorded in T_{11} (19.00%) followed by T_1 (15.21%). Then the minimum physiological loss in weight was recorded in T_6 (0.89%) which was no-par with T_5, T_4, T_{10}, T_7, T_9 and T_8 (1.01,

1.05, 1.34, 2.10, 2.74 and 3.09 per cent respectively) at six days after harvest and the maximum loss was recorded in T_{11} (4.35%) which was on- par with T_1, T_2 and T_3 (4.16, 4.16 and 3.81 per cent respectively) at six days after harvest.

Table-1 *Effect of zinc, iron and boron on physiological loss in weight of sapota cv. Kalipatti.*

Treatments	Per cent weight loss three days after harvest	Per cent weight loss six days after harvest
T1-Control (RDF)	15.21	4.16
T2 -RDF + Water spray	10.95	4.16
T3 -RDF + 50 g ZnSO4 per tree (SA)	11.17	3.81
T4 -RDF + 40 g FeSO4 per tree (SA)	10.79	1.05
T5 -RDF + 25 g B per tree (SA)	10.21	1.01
T6 -RDF + 0.5% ZnSO4 per tree (FA)	11.50	0.89
T7 -RDF + 0.5% FeSO4 per tree (FA)	10.14	2.10
T8 -RDF + 0.3% B per tree (FA)	10.37	3.09
T9 -RDF + 50 g ZnSO4+40 g FeSO4+ 25 g B per tree (SA)	10.53	2.74
T10 -RDF + 0.5% ZnSO4 + 0.5% FeSO4 + 0.3% B per tree (FA)	7.05	1.34
T11 -T9 + T10	19.00	4.35
S. Em±	**0.98**	**0.75**
C.D. at 5%	**3.06**	**2.72**

RDF – Recommended dose of fertilizer; **SA** –Soil Application; **FA** – Foliar Application

Similar results have also been obtained by [14] in guava and [15] in litchi. The increase in evapo-transpiration changes with progress of storage period might be responsible for high PLW of fruits as reported by [7]. The decrease in weight loss by the application of combine iron, zinc and boron may be due to its role in the maintenance of fruit firmness, retardation of respiratory rates as well as transpiration and delayed senescence. This is may be due optimum nutrients availability will increase membrane resistance to bio-chemical changes, but in case of T_1 and T_2 the reason may be the insufficient nutrients availability where as in T_{11} all micronutrients found to toxic was found to be toxic [1, 5].

Days taken to fruit ripe and shelf life

Among the various treatments tried in this study, the days to ripe were significantly different [Table-2]. The maximum number of days (5.00 days) to ripe was noticed in T_{10} while, the minimum number of days to ripe (3.00) was noticed in T_1 and in T_2. This is may be due optimum nutrients availability will increase membrane resistance to bio-chemical changes, but in case of T_1 and T_2 the reason may be the insufficient nutrients availability [1, 5].

Table-2 *Effect of zinc, iron and boron on post-harvest shelf lifeof sapota cv. Kalipatti.*

Treatments	Post-harvest shelf life	
	Days taken to ripening	Shelf life (days)
T1-Control (RDF)	3.00	8.00
T2 -RDF + Water spray	3.00	8.33
T3 -RDF + 50 g ZnSO4 per tree (SA)	4.00	8.00
T4 -RDF + 40 g FeSO4 per tree (SA)	4.17	7.50
T5 -RDF + 25 g B per tree (SA)	4.50	8.17
T6 -RDF + 0.5% ZnSO4 per tree (FA)	4.00	9.33
T7 -RDF + 0.5% FeSO4 per tree (FA)	4.50	10.50
T8 -RDF + 0.3% B per tree (FA)	4.25	10.75
T9 -RDF + 50 g ZnSO4+40 g FeSO4+ 25 g B per tree (SA)	5.00	11.00
T10 -RDF + 0.5% ZnSO4 + 0.5% FeSO4 + 0.3% B per tree (FA)	5.00	12.00
T11 -T9 + T10	4.67	11.00
S. Em±	**0.09**	**0.21**
C.D. at 5%	**0.26**	**0.63**

RDF – Recommended dose of fertilizer **SA** –Soil Application **FA** – Foliar Application

The maximum shelf life (12 days) was noticed in the T_{10} it is due to increased amount of photosynthetic activity during its development and optimum levels of assimilates cell wall integrity and minimum shelf life (8.00 days) was noticed in T_1 (control). Similar results finding by [12]. This might be due to biochemical reaction inside the fruit tissues in terms of cell division and application micronutrients helps to synthesis of growth substance metabolism this might be reason for early ripening of fruits hence, reduces the shelf life of fruit.

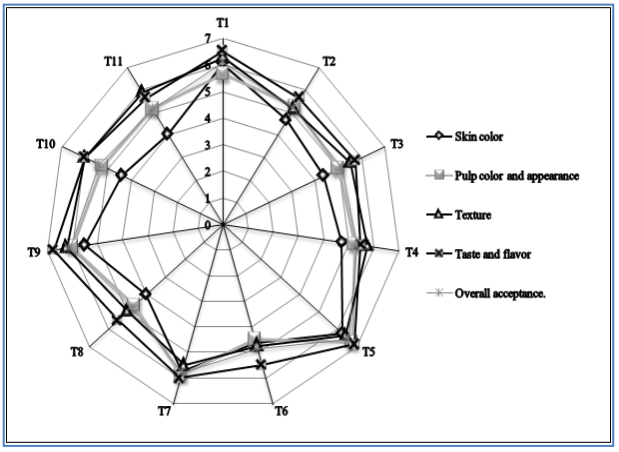
Organoleptic characters

Foliar application of micronutrients was shown difference in physical appearance of sapota [Table-3] and [Fig-1] the maximum sensory score on visual appearances like skin color, pulp color and appearance was noticed in T_5 (6.25, 6.75 and 6.38 respectively) then second highest values were noticed in T_{10} (6.00, 6.20 and 6.00), T_1 (6.00, 5.63 and 6.25) and T_9 (5.50, 6.00 and 6.25) however the lowest sensory score was noticed in T_6 (4.63, 4.50 and 5.50).

Table-3 *Effect of micronutrients on biochemical parameters of sapota*

Treatments	Sugars	
	Total sugars (%)	Reducing sugar (%)
T1-Control (RDF)	18.33	8.10
T2 -RDF + Water spray	18.40	8.04
T3 -RDF + 50 g ZnSO4 per tree (SA)	19.04	7.87
T4 -RDF + 40 g FeSO4 per tree (SA)	19.77	9.22
T5 -RDF + 25 g B per tree (SA)	21.40	8.93
T6 -RDF + 0.5% ZnSO4 per tree (FA)	16.87	5.55
T7 -RDF + 0.5% FeSO4 per tree (FA)	19.30	9.08
T8 -RDF + 0.3% B per tree (FA)	22.80	9.12
T9 -RDF + 50 g ZnSO4+40 g FeSO4+ 25 g B per tree (SA)	18.20	8.05
T10 -RDF + 0.5% ZnSO4 + 0.5% FeSO4 + 0.3% B per tree (FA)	23.25	8.57
T11 -T9 + T10	18.79	7.65
S. Em±	**0.20**	**0.34**
C.D. at 5%	**0.58**	**0.99**

RDF – Recommended dose of fertilizer **SA** –Soil Application **FA** – Foliar Application



T1-Control (RDF)
T2 -RDF + Water spray
T3 -RDF + 50 g $ZnSO_4$ per tree (SA)
T4 -RDF + 40 g $FeSO_4$ per tree (SA)
T5 -RDF + 25 g B per tree (SA)
T6 -RDF + 0.5% $ZnSO_4$ per tree (FA)
T7 -RDF + 0.5% $FeSO_4$ per tree (FA)
T8 -RDF + 0.3% B per tree (FA)
T9 -RDF + 50 g $ZnSO_4$+40 g $FeSO_4$+ 25 g B per tree (SA)
T10 -RDF + 0.5% $ZnSO_4$ + 0.5% $FeSO_4$ + 0.3% B per tree (FA)
T11 -T9 + T10

RDF – Recommended dose of fertilizer **SA** –Soil Application **FA** – Foliar Application

Fig-1 Effect of zinc, iron and boron on organoleptic characters of sapota *cv.* Kalipatti

The quality attributes like taste and flavor and overall acceptance was maximum in T_5 (6.88 and 6.56 respectively) then second highest values were noticed in T_{10} (6.00 and 5.90), T_1 (6.50 and 6.09) and T_9 (6.75 and 6.13) and the lowest quality attributes (taste and flavor and overall acceptance) were noticed in T_6 (5.50 and 4.84). The high percentage of total and non reducing [Table-4] will helps in promotion of sensory attributes. It is due to the application of combine iron, zinc and boron these nutrients will helps in the maintenance of fruit firmness, retardation of respiratory rates as well as transpiration and delayed senescence increase photosynthates mobility and it was favored by optimum nutrients availability will increase membrane resistance to bio-chemical changes [1, 5].

Table 4 *Effect of zinc, iron and boron on organoleptic characters of sapota cv. Kalipatti*

Treatments	Skin color	Pulp color and appearance	Texture	Taste and flavor	Overall acceptance.
T1-Control (RDF)	6.00	5.63	6.25	6.50	6.09
T2 -RDF + Water spray	4.63	5.25	5.13	5.63	5.16
T3 -RDF + 50 g ZnSO4 per tree (SA)	4.38	5.00	5.50	5.75	5.16
T4 -RDF + 40 g FeSO4 per tree (SA)	4.75	5.25	5.75	5.50	5.31
T5 -RDF + 25 g B per tree (SA)	6.25	6.75	6.38	6.88	6.56
T6 -RDF + 0.5% ZnSO4 per tree (FA)	4.63	4.50	4.75	5.50	4.84
T7 -RDF + 0.5% FeSO4 per tree (FA)	5.75	5.88	5.50	6.00	5.78
T8 -RDF + 0.3% B per tree (FA)	4.00	4.63	5.00	5.50	5.00
T9 -RDF + 50 g ZnSO4+40 g FeSO4+ 25 g B per tree (SA)	5.50	6.00	6.25	6.75	6.13
T10 -RDF + 0.5% ZnSO4 + 0.5% FeSO4 + 0.3% B per tree (FA)	6.00	6.01	6.20	6.00	5.94
T11 -T9 + T10	4.00	5.13	5.88	5.63	5.16
S. Em±	1.21	1.37	0.99	1.22	0.95
C.D. at 5%	NS	NS	NS	NS	NS

RDF – Recommended dose of fertilizer SA –Soil Application FA – Foliar Application NS- Non Significant

Conclusion

From this study it can be concluded that T_{10}-RDF + 0.5% $ZnSO_4$ + 0.5% $FeSO_4$ + 0.3% B per tree foliar application can be recommended for getting good quality and long shelf life fruit without any adverse effect on environment and also it will promotes increased productivity by timely availability of required nutrients.

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Conflict of Interest: None declared

References

[1] Arvind B., Mishra N. K., Mishra D. S. and Singh C. P., (2012) *Hort. Flora Res. Spectrum*., 1(4), 300-305.
[2] Bangirth P., Dilley D.R. and Dewey D.H. (1972) *J. Amer. Soc. Hort. Sci.,* 97, 679-682.
[3] Bose T. K. and Mitra S. K. (1990) In: Fruits: Tropical and subtropical, Naya Prakash, Calcutta. Pp. 565- 91.
[4] Gautam S.K. and Chundawat B.S. (1998) *Indian Food Pac*., 52,17-21.
[5] Gaya (2008) M.Sc. *Thesis, G.B. Pant Univ. of Agric. & Tech.,* Pantnagar.
[6] Jones R., Wyn G. and Lunt O.R. (1970) *Bot. Re view*, 36, 407-423.
[7] Khader S. E. S. A., Singh B.P. and Khan S.A. (1988) *Scientia Hort.,* 36, 261-266.
[8] Khopade R.Y., Patel A. N., HirayS.A. and GhadageN. J. (2015) *New Agriculturist*, 26(2), 277–280.
[9] Kulkarni P. A., Policegoudra R.S. and Aradhya S.M. (2007). *J. Food Biochem.,* 31, 399-414.
[10] Kumar S. and Verma D. K. (2004) Effect of micro-nutrients and NAA on yield and quality of litchi cv. Dehradun. Proceedings of International Sem. on *Recent Trend in Hi-tech Horticulture and Post Harvest Tech*., pp.193.
[11] Mika A. (1983) *Acta Hort.,* 138, 15-21.
[12] Pathak P. K. and Mitra S. K. (2008) *Indian J. Hort.,* 65(2), 137-140.
[13] Reddy M. G. (1959) Physico- chemical investigations on sapota and its products. M.Sc. *Thesis CFTRI Research Institute*, Mysore.
[14] Roychaudhary R., Kabier J., Dutta P. and Dhua R.S. (1992) *Indian J. Hort.,* 49(1), 27-30.
[15] Saha D.P., Sharma R.K. and Maurya K.R. (1998) *J.Applied Biol.,* 8 (1), 62-66.
[16] Sawant V. S. (1989)M.Sc. (Agri.) *Thesis Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth*, Ratnagiri MH, India.
[17] Singh B.P., Gupta O.P. and Chauhan K.S. (1982) *Indian J. Agri. Sci*., 52(4), 235-239.
[18] Sudhavani V. and Ravishanker C. (2002) *South Indian Hort.,* 50 (1-3), 173-177.
[19] Sundar R. N., Nagaraj S., Venkataramu M. N. and Jagannath M. K. (1972) *Univ. Agric. Sci.,* pp. 106-110.
[20] Thirupathaiah G., Shirol A. M. and Baskar Rao B. (2017). *Int. J. Agri. Sci. Res.,* 7(1), 121-126.
[21] Ugalat J., Haradari C. and Singh, H. (2013) *J. Crop Weed*, 9,193-97.