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Study of micronutrient sprays on physiological parameters and leaf nutrient status of sapota cv. KALIPATTI

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ABSTRACT : India is considered to be the largest producer of sapota in the world. The major sapota producing states in India are Karnataka, Maharashtra, Gujarat, Andhra Pradesh and Tamil Nadu.An application of major and micronutrients through foliar sprays provides one of the best tool for immediate food requirement of plants. An application of micronutrients resulted in enhancement of physiological parameters and better nutrient contents in leaf of sapota. The physiological parameters like photosynthetic rate, stomatal conductance and transpiration rate were increased with higher level of micronutrients *i.e.* $FeSO_4$ 2% + $ZnSO_4$ 2% + borax 1% (T_{10}). However, leaf temperature was not influenced significantly by foliar spray of micronutrients. Regarding leaf nutrient status, iron, zinc and boron contents were found higher with same treatment ($FeSO_4$ 2% + $ZnSO_4$ 2% + borax 1%) (T_{10}) in sapota leaves as compared to other treatments.

KEY WORDS : Physiological, Micronutrients, Temperature, Photosynthetic rate, Transpiration rate, Stomatal conductance

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India is considered to be the largest producer of sapota in the world. Sapota was introduced from Mexico to Asian countries like India, Srilanka, Indonesia and Myanmar etc. it is reported that for the first time the sapota cultivation was started during 1898 in a village called Golwad in Maharashtra. In India maximum sapota producer states are Karnataka, Maharashtraand Gujarat etc. The fruit is good source of digestible sugar (12 to 18 %) and has appreciable quantities of protein, fat, fibre, minerals, P, Ca and Fe (Chundawat, 1998). Tree contains extractable quantities of tannin which has industrial potential for liquid fat and food cake.Foliar applications are often timed to coincide with specific vegetative or fruiting stages of growth, and the fertilizer formula is adjusted accordingly.

An application of major and micronutrients either in soil or foliar also provides one of the best tool for induction of flowering. In the past, attempts have been made to improve vegetative growth, flowering and fruiting. On the contrary this field seemed to be unravelled in case of sapota (Chundawat, 1998). In the areas, with intensive cultivation of sapota Zn and Fe deficiency are not uncommon. Further he suggested that these can be corrected through use of organic matter and spray of zinc sulphate and iron sulphate during the active growth period of the sapota tree. The role of boron (B) has been understood very well in large numbers of crops.

RESEARCH METHODS

The experiment was conducted on sapota tree cv. Kalipatti in orchard at the Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari during the year 2007-08.Geographically, Navsari is located on 20^0-57' N latitude, 72^0-54' E longitude with an altitude of 10 M (MSL) in Navsari

district of Gujarat. An experiment was conducted in the sapota orchard planted in 1996-97 at 10x10 m distance. All the cultural practices including nutrient application were carried out as per recommendations. FYM @ 50 kg, 1000 g N, 500 g P_2O_5 and 500 g K_2O /plant/year was applied. The experimental trees were 11 years old. Almost healthy and uniform 36 trees were selected randomly from the orchard for this study. The foliar spray of $FeSO_4$ (1% and 2%), $ZnSO_4$ (1% and 2%), borax (0.5% and 1%), $FeSO_4$ 1 %+ $ZnSO_4$ 1%, $FeSO_4$ 2 % + $ZnSO_4$ 2 %, $FeSO_4$ 1 % + $ZnSO_4$ 1 % + borax 0.5%, $FeSO_4$ 2 % + $ZnSO_4$ 2 % + borax 1 % and water spray were done in Randomized Block Design (RBD) with three replications and twelve treatments including control on ten years old sapota trees on 15th February and 15th March. Physiological parameters like leaf temperature (TI), photosynthesis rate (A), stomatal conductance (gs) and transpiration rate (E) of sapota leaves were measured by using portable photosynthesis system (L.C. pro +Portable). For leaf nutrient status, leaf sampling technique was adopted as per the method given by Bhargava and Chadha (1993). Estimation of iron (Fe), zinc (Zn) and boron (B) was done at two intervals *i.e.*on 28th February and 28th March as per the method given by AOAC (1980).

RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation are summarized below :

Physiologicalparameters:

Physiological parameters such as rate of photosynthesis, stomatal conductance, transpiration and leaf temperature of sapota were measured on 20 days before application of treatments and were found to be non significant graphically depicted in Fig. 1, 2, 3 and 4.

The results obtained after the foliar spray of micronutrients were significantly affected on physiological parameters *viz.*, photosynthesis, transpiration, stomatal conductance and leaf temperature graphically depicted in Fig. 1, 2, 3 and 4. The sapota plants sprayed with combined treatment of micronutrients at higher level ($FeSO_4$ 2% + $ZnSO_4$ 2% + Borax 1% - T_{10}) significantly increased in photosynthates, stomatal conductance and transpiration.

This might be due to enzymatic activity, synthesis of chlorophyll, transfer of energy etc. governed by iron in plants. Similarly, boron found to be responsible for translocation of sugars. Likewise, zinc is essential for functions like saccharides metabolism, photosynthesis and protein synthesis in plants. On the other hand, leaf temperature was not affected by any single or combine treatment.

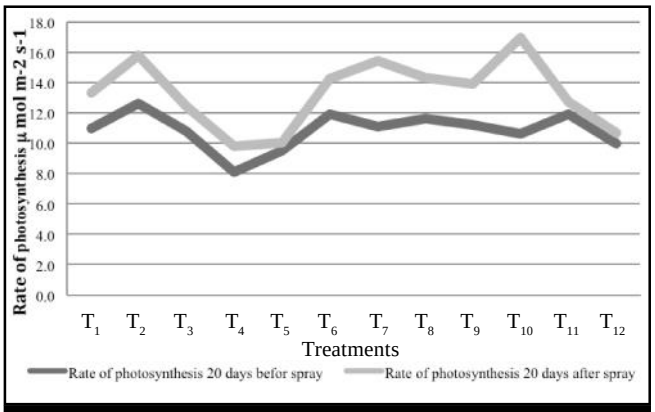

Fig. 1 : Effect of micronutrients on rate of photosynthesis of leaf in sapota cv. KALIPATTI

Table 1 : Effect of micronutrients onnutrient contents in leaf of sapota cv. Kalipatti on 28th of Februaryand 28th of March 2008

Treatments	28thFebruary				28thMarch			
	Fe (ppm)	Zn (ppm)	B (ppm)	S (%)	Fe (ppm)	Zn (ppm)	B (ppm)	S (%)
T_1 – $FeSO_4$ – 1%	154.20	93.0	92.1	0.537	159.33	104.33	94.13	0.567
T_2 – $FeSO_4$ – 2%	156.67	96.7	98.4	0.613	160.33	106.23	100.25	0.667
T_3 – $ZnSO_4$ – 1%	124.33	122.7	93.2	0.667	125.70	128.33	96.63	0.703
T_4 – $ZnSO_4$ – 2%	130.87	125.0	98.4	0.677	137.97	132.67	99.62	0.793
T_5 – Borax – 0.5%	122.50	87.1	150.3	0.433	127.70	89.74	159.55	0.447
T_6 – Borax – 1%	127.03	86.7	154.8	0.440	130.33	90.10	161.87	0.457
T_7 – $FeSO_4$ 1% + $ZnSO_4$ 1%	159.33	123.3	92.5	0.597	167.80	130.33	93.62	0.647
T_8 – $FeSO_4$ 2% + $ZnSO_4$ 2%	162.67	125.0	98.2	0.670	178.13	135.77	102.95	0.710
T_9 –$FeSO_4$ 1% + $ZnSO_4$ 1% + Borax 0.5%	166.83	122.9	157.7	0.687	187.42	138.00	163.57	0.727
T_{10} –$FeSO_4$ 2% + $ZnSO_4$ 2% + Borax 1%	173.17	133.7	165.2	0.703	199.67	149.13	173.61	0.820
T_{11} – Water spray	108.67	52.8	78.4	0.407	108.69	53.37	78.57	0.410
T_{12} – Control	107.83	52.6	77.5	0.400	107.84	52.97	77.46	0.407
S. E. +	7.26	6.36	8.48	0.04	9.554	7.207	7.60	0.04
C.D. (P=0.05)	21.28	18.65	24.88	0.12	28.02	21.14	22.28	0.13
C.V.	7.401	9.02	10.83	10.66	7.88	8.37	9.39	10.37

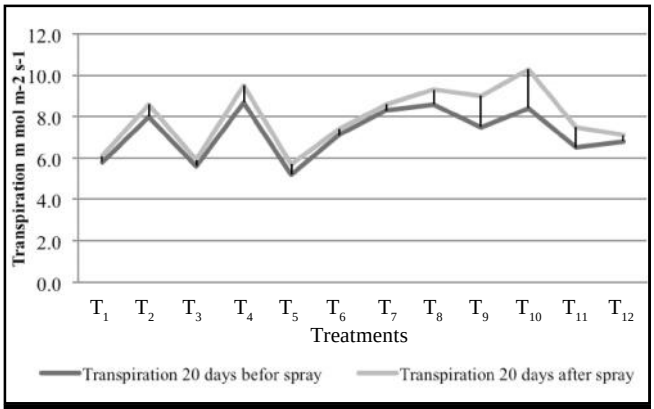

Fig. 2 : Effect of micronutrients on transiration of leaf in sapota cv. KALIPATTI

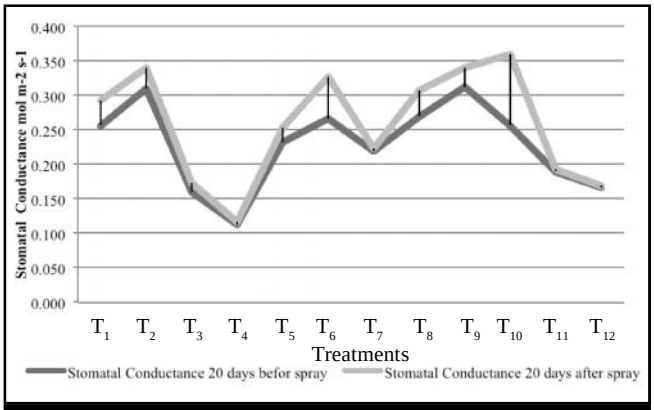

Fig. 3 : Effect of micronutrients on stomatal conductance of leaf in sapota cv. KALIPATTI

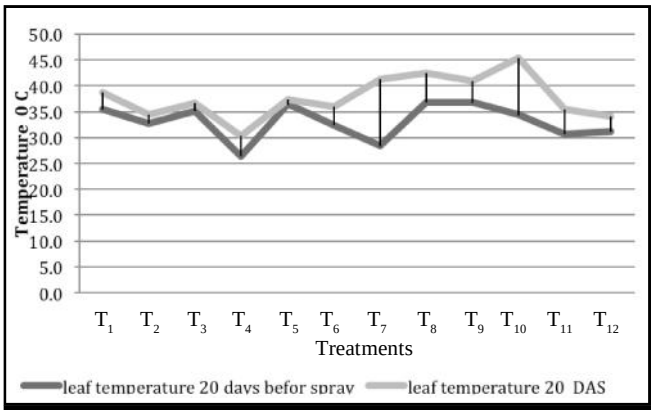

Fig. 4 : Effect of micronutrients on leaf temperature in sapota cv. KALIPATTI

In general, stomatal movement is important for plants to exchange gas and water with environment. According to Sharkey and Ogawa (1987) it has very close relation with photosynthesis, respiration and transpiration. In the present investigation increased rate of photosynthesis was associated with increased stomatal conductance as well as maximum transpiration rate with lower leaf temperature. The dependence of transpiration rate on stomatal conductance to diffusion of water vapor is well known (Cowan, 1977).

Nutritional status of sapota leaf:

The micronutrient spray and the leaf analysis were done twice at one month interval. The leaf sampling was carried out on 28th February and 28th march given in Tables 1. Tissue nutrient tests are much more reliable than past history, plant symptoms, or soil tests for establishing whether nutrient deficiencies exist.

An analysis of sapota leaves exhibited increase in Fe, Zn and B in the sapota plant. However, increase in nutrients in leaf was significantly influenced after the micronutrient sprays (Table 1). The maximum content of iron (173.17ppm), zinc (133.7ppm) and boron (165.2 ppm)in sapota leaf was recorded in micronutrient combination spray $FeSO_4$ 2% + $ZnSO_4$ 2% + borax 1%. It may be attributed to the fact that the micronutrients might have enhanced the physiological processes of the leaves which in turn have led to rapid absorption and utilization of nutrients for primary metabolic processes. Dutta and Dhua (2002) in mango, Jeyabaksaran and Pandey (2008) in banana and Lal *et al.* (2000) in guava, are in agreement with the present study.

Conclusion:

The morphophysiological parameters like photosynthetic rate, transpiration rate and stomatal conductance were increased by higher level of micronutrients *i.e.* $FeSO_4$ 2% + $ZnSO_4$ 2% + Borax 1% treatment. The same treatment increase the nutrient status in sapota leaves of Kalipatti variety. Leaf temperature was not significantly influenced by foliar spray of micronutrients.

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