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RESPONSE OF DIFFERENT CONCENTRATIONS OF UREA, KNO_3 AND MICRONUTRIENT MIXTURE ON QUALITY OF SAPOTA (*MANILKARA ACHRAS* (MILL.) FOSBERG) CV. KALIPATTI

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ABSTRACT

In sapota a peak season harvesting always result in market glut and thus reduction in prices. For sustenance in non-peak season an experiment was conducted during the year 2013-14 at College Farm, College of Agriculture, Navsari Agricultural University, Bharuch Campus, Bharuch (Gujarat) to get quality yield. The experiment was laid out with ten treatments in Randomized Block Design and replicated three times. The treatment comprised of three different concentrations of Urea (T_1: 1 %, T_2: 1.5 % and T_3: 2 %), KNO_3 (T_4: 1%, T_5: 1.5 % and T_6: 2 %), Micronutrient Mixture Grade-4 (T_7: 1 %, T_8: 1.5 % and T_9: 2 %) along with control as water spray (T_{10}). All the chemicals were sprayed twice: first in the month of November at the marble stage and second in the month of January. Among the quality parameters T_9 was found superior with fruit firmness (0.56 kg cm^{-2}), TSS (21.36° Brix), acidity (0.199 %), ascorbic acid(19.17 mg $100g^{-1}$), total sugar (17.41 %), reducing sugar (9.86 %) and non-reducing sugar (7.55 %) which is found at par with T_8.

INTRODUCTION

Sapota or Chiku [*Manilkara achras* (Mill.) Fosberg] is a delicious fruit introduced from Tropical America. The plant is a native of Mexico and now widely cultivated in tropics. Sapota cultivation was taken up for the first time in Maharashtra in 1898 in a village named Gholwad (Cheema *et al.*, 1954). It is one of the excellent tropical fruit crops highly suited to humid climates of South Gujarat agro-climatic zone, which is known to produce best fruit of this species in our country. Area and production of India is 163.9 Mha and 1495.0 MT respectively out of which Gujarat alone covers 28.81 Mha and produce 309.89 MT (Anon., 2014).

In the peak season the production is high leading to market glut and thus retention of crop with better quality in non-peak season may be helpful to reduce market glut an also to fetch good market price in this season. Thus advantage of around the year flowering can be taken up in this crop. It is observed that yield response curves are strongly modulated by interactions between nutrients and other growth factors (Marschner, 2012). The application of foliar sprays can help to preserve crop yields and quality, with low environmental impact (Fageria *et al.*, 2009). The important criterion of the effectiveness of the nutrient spray is the rate at which the foliar applied nutrients are absorbed by the leaves and trans located within the plant (Alexander, 1986). Secondly, foliar sprays are normally more rapid than to soil treatment application of nutrients especially in the reproductive phase as it compensates the root decline with the onset of reproductive stage (Weinbaum, 1988). Considering this, Urea, KNO_3 and micronutrient mixture Grade-4 were taken for evaluation for their response in the non-peak season flowering.

MATERIALS AND METHODS

Plant materials and treatments

The experiment was carried out during the year 2013-14 at College Farm, Navsari Agricultural University, Bharuch Campus, Bharuch which is situated on the bank of river Narmada at 21°42'57.53" N latitude and 72° 58'38.57" E longitude at an altitude of about 20.66 m above the mean sea level. Climatically Bharuch is typical tropical characterized by fairly hot summer and moderately cold winter, moderately humid and warm monsoon with moderate rains.

The experimental material consisted of 15 years old uniform sapota trees of cultivar "Kalipatti" spaced at 8 x 8 m distance. The experiment was laid out with 3 replications and 10 treatments, where per treatment 2 trees per selected. Treatments were selected as T_1 (Urea @ 1 %); T_2 (Urea @ 1.5 %); T_3 (Urea @ 2 %); T_4 (KNO_3 @ 1 %); T_5 (KNO_3 @ 1.5 %); T_6 (KNO_3@ 2 %); T_7 (Micronutrient mixture Grade-4 @ 1 %); T_8 (Micronutrient mixture Grade-4 @ 1.5 %); T_9 (Micronutrient mixture Grade-4 @ 2 %) and T_{10} (Control – Water Spray). Foliar applications of the treatments were done twice. First spray was done during 1st fortnight of November at marble stage and 2nd spray was done 2 months after the 1st spray. The fruits were harvested in the month May when they are fully matured and parameters like fruit retention, yield, physical parameters and quality parameters were observed and statistically analyzed in SAS.Among the quality parameters, fruit firmness was measured in kg cm^{-2} by using penetrometer, while TSS was measured by using refractrometer. Acidity (%), ascorbic acid (mg/100g) were calculated by titrimetric method as described by Ranganna (1986), while total sugars (%), reducing sugars (%) and non-reducing sugars (%) were calculated by titrimetric method of Lyon and Eynon method as described by Ranganna (1986).

Statistical Analysis

The statistical analysis was performed by PROC GLM procedure of SAS 9.3 statistical software as per SAS/STAT Institute INC. (2011) for randomized block design (RBD). The treatment means were compared by means of critical differences at 5 % of probability.

RESULTS AND DISCUSSION

In the present investigation, results so obtained are presented in the Table 1 for quality parameter. Fruit firmness was found highest on application of T_9 which were found at par with T_8. This was found in agreement with Kumar *et al.* (2015) in guava. This might be due to role of B in the membrane stability (Yamauchi *et al.,* 1986), thus enabling to strengthen the cell walls. Boron may be necessary for cell-to-wall adhesion and organization of the architectural integrity of the cell (Bassil *et al.*, 2004) which might result better strengthening the fruit skin.

Fruit TSS was found highest at T_9 which was statistically at par with T_8. However, T_9 showed the lowest acidity which was at par with the T_8. This was found in agreement with Saraswathy *et al.* (2005) in sapota and Nehete *et al.* (2010) in Mango. Higher TSS in Micronutrient mixture Grade-4 based fertilizer might be mainly due to the influence of boron and zinc. Boron is responsible for sugar metabolism and accumulation of carbohydrates (Sourour, 2000). Whereas, zinc plays a roles in photosynthesis and related enzymes which helps in the further accumulation of carbohydrates (Abedy, 2001).The reason for lower acidity might lies with the conversion of acid under influence of micronutrients by reactions involving reversal of glycolytic pathway (Ruffner *et al.*, 1975). The possible role of zinc might also be responsible in reducing acidity by activation of many enzymes (Abedy, 2001).

Ascorbic acid content was seen higher in T_9 which was significantly at par with T_8, T_7 and T_6. This was found in accordance with the Saraswathy *et al.* (2005) in sapota and Shekhar *et al.* (2010) in papaya. This might be due to the presence of different micronutrients in Micronutrient mixture Grade-4 which is known to increase ascorbic acid content level (Taiz and Zeiger, 2010).

Highest total sugars and reducing sugars was found in T_9 which was found at par with T_8. However, non-reducing sugars was found higher T_9, but was at par with T_3, T_8, T_2, T_7 and T_4. This was found in agreement with Saraswathy *et al.* (2005) in sapota; Nehete *et al.* (2010) in mango and Shekhar *et al.* (2010) in papaya. This might be due to the presence of Zn in Micronutrient mixture Grade-4 which plays an important role in photosynthesis and a related enzyme, which leads to increase in sugar (Abedy, 2001). Foliar spray of micronutrients increased the sweetness of fruits, which was due to more intensive transformation of starch into sugars and its translocation into fruits (Rushko, 1968) might have increased both reducing and non-recuing sugars and ultimately total sugars. Further, boron is also responsible for sugar metabolism and accumulation of carbohydrates (Sourour, 2000) which also have contributed for enrichment of sweetness. However, in case of non- reducing sugars, higher results with T_3 and T_2 might be due to the presence of nitrogen, where nitrogen fertilization in autumn seems to lead to a greater accumulation of carbohydrate reserves by indirectly affecting the photosynthetic rate (Oliveira and Pristley, 1988) making accumulation of sucrose and less conversion into invertase sugar.

From this experiment, results shows that there is rise in quality parameters on foliar application of micronutrients mixture Grade-4 in treatment T_9 and T_8 which very much been supported by the Lalithya *et al.*(2014) suggesting their better absorption via foliar application and thus fruits shows better quality.

Table 1: Effect of different chemicals on quality parameters

Treatment	Fruit Firmness (kg cm^{-2})	TSS (° Brix)	Acidity(%)	Ascorbic acid content (mg $100g^{-1}$)	Total Sugar (%)	Reducing Sugar (%)	Non-reducing Sugar (%)
T_1	0.42^{de}	20.67^{bc}	0.199^{bc}	15.42^{ef}	16.53^{def}	9.51^{cde}	7.02^{bcd}
T_2	0.46^{cd}	20.67^{bc}	0.234^{a}	15.42^{ef}	16.66^{cde}	9.36^{e}	7.30^{ab}
T_3	0.49^{bc}	20.51^{bc}	0.242^{a}	14.58^{f}	16.96^{bc}	9.48^{cde}	7.47^{a}
T_4	0.47^{c}	20.71^{b}	0.199^{bc}	16.25^{cdef}	16.77^{bcd}	9.57^{bcd}	7.20^{abc}
T_5	0.49^{bc}	20.49^{bc}	0.213^{b}	17.08^{bcde}	16.34^{ef}	9.58^{bcd}	6.76^{de}
T_6	0.49^{bc}	20.38^{bc}	0.206^{b}	17.81^{abc}	16.20^{f}	9.65^{bc}	6.55^{e}
T_7	0.48^{c}	20.82^{b}	0.199^{d}	17.50^{abcd}	16.76^{bcd}	9.54^{cd}	7.22^{abc}
T_8	0.52^{ab}	21.31^{a}	0.178^{d}	18.22^{ab}	17.10^{ab}	9.75^{ab}	7.36^{ab}
T_9	0.56^{a}	21.36^{a}	0.171^{bc}	19.17^{a}	17.41^{a}	9.86^{a}	7.55^{a}
T_{10}	0.41^{e}	20.16^{c}	0.185^{cd}	15.83^{def}	16.34^{ef}	9.45^{de}	6.89^{cde}
LSD @ 5 %	0.04	0.50	0.016	1.95	0.42	0.14	0.41
r^2	0.81	0.74	0.91	0.73	0.78	0.76	0.72
C V %	5.40	1 .43	4.74	6.81	1.49	1.06	3.43

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