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EFFECT OF FOLIAR FEEDING ON FRUIT SETTING, YIELD AND QUALITY OF GUAVA

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ABSTRACT

A field experiment was carried out with different treatments of nutrients like urea @ 0.5 and 1.0%; potassium sulphate @ 1.5 and 2.0%; zinc sulphate@ 0.2, 0.4 and 0.6% and borax@ 0.4, 0.6 & 0.8% on seven year old guava tree cv. Chittidar under Malwa plateau conditions. The results revealed that the foliar spray of 1.0% urea significantly influenced the physical parameters i.e. fruit volume (196.77 ml), specific gravity (1.03), fruit length (7.10 cm) and diameter of fruit (7.81 cm) at harvest, pulp thickness (1.68 cm), pulp weight (193.64 g)over control. Maximum values for yield parameters i.e. number of fruits per tree (260.00), yield per tree (51.13 kg) and average fruit weight (196.67g) of guava fruits were recorded with foliar spray of 1.0% urea followed by 0.5% urea while lowest values for all the parameters were recorded under control. The maximum TSS (12.23^{0}Brix) and TSS: acid ratio (43.41) was recorded with foliar spray of 1% urea but maximum reducing sugar (3.77%), non reducing sugar (2.39%), total sugars (6.16%), pectin (0.74%) and chlorophyll (45.97 spad) were recorded with foliar spray of 0.8% borax. Foliar spray of 0.8% boron significantly increased the fruit set (78.77%) and fruit retention (76.97%) of guava plants.

***Keywords*:** Foliar feeding, fruit setting, yield, quality, guava

INTRODUCTION

Guava (*Psidium guajava* L.), is one of the most important sub-tropical fruit crop. It is also called "**The apple of tropics**". It belongs to the natural order Myrtle and the botanical family Myrtaceae. There are three distinct periods of growth and fruiting. These three distinct periods are; Ambe bahar-February to March flowering and fruit ripens in July-August, Mrig bahar-June to July flowering and fruit ripens October to December and Hasta bahar-October to November flowering and fruit ripens in February to April. Guava is an evergreen, shallow-rooted shrubs or small tree 9.0 m tall with spreading branches. The bark is smooth, mottled green or reddish brown and peels off in thin flakes to reveal the attractive "bony" aspect of its trunk. India is the leading producer of guava in the world. The total area and production of guava in India is about 0.22 million hectare and 2.462 million tonnes, respectively. The productivity of guava in India is 12 MT/ha. The total area and production of guava in Madhya Pradesh are 9.7 thousands hectare and 0.28 million tonnes, respectively. Madhya Pradesh ranks first in productivity with 25.5 MT/ha. Guava shares 4.5 % in area and 3.3% in production in India (NHB, 2011).

Nutrients are one of the important factors which limit the production. The leaf is the focal point of many plant functions and sensitive indicator of nutrient status of the plant. Investigations have shown that urea and zinc is important nutrients for growth, flowering, fruiting and quality of fruits. It has also been observed that the development of green colour is associated with an increase urea (N) content of leaves. Similarly, zinc also increases the chlorophyll content of leaves and plays an important role in enzymatic activities like catalyses, peroxides and cytochrome chlorophyll oxidase. Favourable effect of urea and zinc spray on vegetative growth and yield of fruit trees has been observed. Potassium is an activator of enzyme, responsible for energy metabolism, starch synthesis and nitrate reduction. It is essential for photosynthesis and translocation of sugar. It encourages strong root and shoot development. Boron is a constituent of cell membrane and essential for cell division, acts as regulators of potassium/calcium ratio, helps in nitrogen absorption and translocation of sugar in the plants. Boron also increases nitrogen availability to the plant. It is also important in oxidation–reduction reaction and is related to the formation of chlorophyll in some undetermined way. Keeping the above facts in view, this experiment was undertaken to evaluate the effect of foliar sprays of macro and micro nutrients on guava.

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MATERIALS AND METHODS

A field experiment was conducted during rainy and winter season of 2013-14 at College of Horticulture, Mandsaur (M.P.) on seven year old trees of guava cv. Chittidar. The experiment was laid out in randomized block design with three replications. The eleven treatments T_0 control, T_1 (urea @0.5%), T_2 (urea @ 1.0%) T_3 (K_2SO_4 @ 1.5 %), T_4 (K_2SO_4 2.0%), T_5 ($ZnSO_4$ @ 0.2%), T_6 ($ZnSO_4$ @ 0.4%), T_7 ($ZnSO_4$ @ 0.6%), T_8 (borax @ 0.4%), T_9 (borax @ 0.6%) and T_{10} (borax @0.8%) were applied.Fruit length and diameter were noted using the vernier callipers, volume of fruit was recorded by water displacement method and weight of fruit was recorded using electronic weigh balance. While reproductive parameters were calculated by using following formulas:

Fruit setting (%) = (Number of set fruits/Number of flowers) x100
Fruit retention (%) = Number of fruits at harvest/Initial number of fruit set x100

For determination of chemical parameters of fruit *viz.* acidity, total soluble solids (TSS), sugars (total, reducing and non-reducing sugars), ascorbic acid and pectin content, four healthy fruits were selected randomly from each tree at full maturity stage. Hand refractometer was used for determination of Total Soluble Solids in ^{0}Brix. Acidity was estimated by simple acid–alkali titration method (A.O.A.C., 1970). Sugars in fruit juice were estimated by the method as suggested by Nelson (1944). Assay method of ascorbic acid was followed (Ranganna, 1977). Estimation of pectin was done according to the methods of Kertesz (1951). The statistical analysis was done according to the methods suggested by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

The physical characteristics of fruit are an expression of a plant's vegetative activity which was also significantly influenced by foliar spray of various nutrients. The results revealed that maximum fruit volume (196.77 ml), specific gravity (1.03), fruit length (7.10 cm) and diameter of fruit (7.81 cm) at harvest, pulp thickness (1.68 cm), pulp weight (193.64 g) were recorded with foliar spray of 1.0% urea. Maximum volume, length and diameter of fruit at harvest was recorded due to accelerated rate of cell division and cell enlargement and more intercellular space with the application of higher concentration of different nutrients in guava (Pal *et al.,* 2008). Increased vegetative growth due to residual effects of higher concentration of urea on plant which resulted in high leaf to fruit ratio ultimately resulted in higher amount of photosynthesis finally increasing pulp weight, pulp thickness and seed: pulp ratio. The results are in accordance with the findings reported in guava by Dhomane *et al.,* (2011) and Kundu *et al.,* (2007).

Table 1: Effect of foliar feeding of nutrients on floral and physical parameters of guava

Treatment	Fruit setting (%)	Fruit retention (%)	Fruit volume (ml)	Specific gravity	Fruit length at harvest (cm)	Fruit diameter at harvest (cm)	Pulp thickness (cm)	Pulp weight (g)
T_0 Control	71.60	67.67	125.03	0.99	5.32	5.82	1.37	120.83
T_1 0.5% urea	72.43	72.57	183.13	1.01	7.08	7.16	1.63	182.00
T_2 1.0% urea	74.70	73.50	196.77	1.03	7.10	7.81	1.68	193.64
T_3 1.5% K_2SO_4	74.77	71.40	128.27	0.98	5.86	6.14	1.40	122.60
T_4 2.0% K_2SO_4	75.37	72.90	135.83	0.96	5.88	6.32	1.47	128.57
T_5 0.2% $ZnSO_4$	75.63	72.57	160.37	1.00	6.60	6.90	1.60	164.50
T_6 0.4%$ZnSO_4$	75.70	73.33	165.40	1.01	7.06	7.06	1.62	170.47
T_7 0.6% $ZnSO_4$	76.77	74.96	172.17	1.01	7.07	7.11	1.63	172.78
T_8 0.4% borax	76.73	73.43	148.40	1.02	6.25	6.39	1.50	148.54
T_9 0.6% borax	76.87	74.03	155.50	1.01	6.38	6.42	1.53	154.06
T_{10} 0.8 borax	78.77	76.97	160.17	1.00	6.40	6.84	1.57	160.80
S Em ±	1.10	1.48	0.92	0.01	0.38	0.34	0.05	0.73
CD (P=0.05)	3.27	4.37	2.71	NS	1.14	1.02	0.16	2.19

The maximum fruit weight (196.67 g), number of fruits (260) and yield (51.13 kg) per tree were recorded with the foliar spray of 1.0% urea solution followed by 0.5% urea. Increase in fruit weight may be attributed to the strengthening of middle lamella and consequently cell wall, which later may have increase the free passage of solutes to the fruits. Pal *et al.,* (2008) recorded maximum fruit weight, number of fruits and yield per tree with spray of Urea. The results further revealed that the nutrients produced an additive effect on the yield. Maximum TSS (12.23^0 Brix) and TSS/acid ratio (43.41) were recorded with foliar spray of 1.0% urea. Maximum reducing sugar (3.77%), non-reducing sugar (2.39%) and total sugars (6.16%) were recorded with foliar spray of T_{10} (borax 0.8%) which was statistically at par with treatments T_9 (borax 0.6%) and T_8 (borax 0.4%). This has been reported to divert more solids towards developing fruits and might also enhance the conversion of complex polysaccharide into simple sugars and spray of urea also helps in sugar transport ultimate accumulation of more sugars and organic acids in fruits. The higher percentage of total sugar, reducing and non-reducing sugar might have been due to efficient translocation of photosynthates to the fruits by regulation of boric acid. These results are in conformity with the results reported by Awasthi and Lal (2009) and Yadav *et al.,* (2011).

Table 2: Effect of foliar feeding of nutrients on yield and quality parameters of guava

Treatment	No. of fruits/ tree	Average fruit weight (g)	Yield/ tree (kg)	TSS (^{0}Brix)	TSS: Acid ratio	Reducing sugar (%)	Non reducing sugar (%)	Total sugar (%)	Pectin (%)	Chlorophyll Content (Spad Value)
T_0 Control	225	125	28.12	9.43	20.50	3.54	2.14	5.68	0.48	37.53
T_1 0.5% urea	250	185	46.25	12.17	43.41	3.56	2.15	5.71	0.57	45.17
T_2 1.0% urea	260	196.67	51.13	12.23	42.12	3.58	2.20	5.78	0.61	45.97
T_3 1.5% K_2SO_4	236	125.67	29.65	12.00	37.53	3.64	2.24	5.88	0.65	43.03
T_4 2.0% K_2SO_4	242	131.67	31.86	12.03	37.59	3.66	2.20	5.86	0.65	44.07
T_5 2.0% $ZnSO_4$	244	167.67	40.91	11.73	35.56.	3.62	2.23	5.85	0.67	44.77
T_6 0.4% $ZnSO_4$	245	173.67	42.54	11.80	34.72	3.70	2.27	5.97	0.70	44.80
T_7 0.6% $ZnSO_4$	249	176.01	43.82	11.87	33.93	3.72	2.29	6.01	0.71	45.10
T_8 0.4% borax	232	150.67	34.95	10.33	27.92	3.73	2.30	6.03	0.70	38.43
T_9 0.6% borax	235	156.33	36.73	11.50	30.23	3.74	2.33	6.07	0.73	38.47
T_{10} 0.8% borax	244	163.33	39.85	12.10	31.28	3.77	2.39	6.16	0.74	42.13
S Em ±	0.27	1.56	0.64	0.27	0.42	0.03	0.04	0.02	0.03	1.66
CD (P=0.05)	0.81	4.61	1.90	0.81	1.26	0.09	0.12	0.06	0.09	4.98

Foliar spray of 0.8% borax increased the maximum pectin content (0.73%) during the study. This might be due to higher concentration of nutrients which are responsible for solubilizing the pectin substances from middle lamella with rise in pectin. The maximum chlorophyll content (45.97 spad value) was recorded under the treatment 1.0% urea whereas minimum (37.53 spad value) chlorophyll content was observed under the control. The absorbed urea increased the nitrogen content, which ultimately caused a dark green foliage and thus higher status of chlorophyll. Similar findings were also reported by Chauhan *et al.,* (2014) in mango. Maximum fruit set and fruit retention percent were recorded with the application of foliar spray of T_{10} (borax 0.8%) whereas minimum fruit set (71.60%) and fruit retention (67.67%) in control. By the foliar application of boron the fruit drop is reduced because boron plays an important role in translocation of carbohydrates and auxin synthesis to sink increased pollen viability and fertilization. These results are in accordance with the findings of Yadav *et al.,* (2011).

On the basis of results obtained in present investigation it may be concluded that foliar spray of 0.8% borax was found best for maximum increase in fruit set, fruit retention and various quality parameters *i.e.* total sugars, reducing sugar, non reducing sugar, pectin and reduced the fruit drop, seed weight and seed pulp ratio Foliar spray of 1.0% urea was found best for maximum increase in volume of fruit, fruit length, diameter of fruit, pulp thickness, pulp weight, TSS, chlorophyll content, number of fruit, average fruit weight, fruit yield per tree.

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