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RESEARCH ARTICLE :

Effect of boran and zinc along with different sources of organic and inorganic plant nutrients on quality parameters of guava (*Psidium guajava* L.) cv. ALLAHABAD SAFEDA

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SUMMARY : An experiment was conducted to study the effect of different sources of organic and inorganic plant nutrients on fruit growth, yield and quality of guava (*Psidium guajava* L.) cv. ALLAHABAD SAFEDA was undertaken at the central field of Department of Horticulture, Allahabad school of Agriculture, SHIATS, Allahabad (U.P.) during 2012 (July) – 2013 (January). The experiment was laid out in Randomized Block Design (RBD) with 10 treatments and 3 replications. For the investigation, different sources of organic and inorganic plant nutrients *viz.,* FYM, *Neem* cake, Vermicompost, Urea, DAP, MOP and Micro nutrients (B and Zn) in different combinations were used. The result was revealed that investigation of organic manures and inorganic fertilizers along with micro nutrients was more effective in increasing the quality of guava than the inorganic fertilizers alone. Among the various combinations, treatment T_5 [50% Recommended dose of NPK (300g N: 100g P_2O_5: 200g K_2O Per tree) + 15 kg FYM + 5 kg *Neem* cake + Micro nutrients (0.3% B and 0.3% Zn)] was found the best over all the treatments in respect to quality parameters like TSS (12.80 ^{0}Brix), ascorbic acid (224.89 mg/100 ml of juice), minimum acidity (0.31%), total sugars (11.08%), reducing sugars (6.10%), non reducing sugars (4.98%), sugar/acid ratio (35.90%) and shelf-life (13.33 days).

KEY WORDS :
Organic manures, Inorganic fertilizers, Micro nutrients, Quality, Guava

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BACKGROUND AND OBJECTIVES

Guava (*Psidium guajava* L.),is an important fruit crop of the subtropical and tropical regions in the world. Guava (*Psidium guajava* L.), the apple of the tropics, is one of the most popular fruits grown in tropical, sub-tropical and some parts of arid regions of India. The fruit belongs to the family Myrtaceae, which has 140 genera and 3000 species widely distributed throughout the tropical and subtropical regions of the world. In India, it has been introduced in early seventeenth century and gradually became a crop of commercial significance all over the country. Guava fruit are climacteric with a relatively short shelf-life due to their rapid rate of ripening. It is a good source of ascorbic acid, pectin, sugars and certain minerals. Its skin and flesh colours vary from variety to variety depending on the amount and type of pigments. The fruit softens very rapidly during ripening (Brown and Wills,1983).

Guava has earned the popularity as "Poor man's apple" available in plenty to every person at very low price duringthe season. It is no inferior to apple for its nutritive value. It is pleasantly sweet and refreshingly acidic in flavor and emits sweet aroma. It is wholly edible along with the skin. The fruits outer layer is green and as it ripens turns into a pale yellow. Guava is a rich source of ascorbic acid, sugars and pectin.The ascorbic acid content ranges from 75 to 260 mg/100g pulp which varies with cultivar, season, location and stage of maturity. The total soluble solid content in fruits varies from 8.2 to 14.0^{0}Brix.The total sugars ranges between 4.9 to 10.1 per cent, out of which fructose (59%), glucose (36%) and sucrose (5%) are predominant sugar in ripe guava fruit. Fructose is the principle sugar in green ripe fruit while sucrose is the main one in fullyripe fruits. Fruits are fair source of vitamin A (about 250 IU/100g) and contain appreciable quantities of thiamine, niacin and riboflavin.

The integration of organic and inorganic fertilizers was more effective in increasing growth, yield and quality of guava trees than the inorganic fertilizers alone. It is also helpful to reduce the inorganic fertilizer requirement, restore the organic matter in soil and improve the physical, chemical and biological properties of soil. Similarly, application of zinc and boron might have cause rapid syntheses of protein and translocation of carbohydrates which ultimately led to increase quality of guava fruits. Hence, the present investigation was planned to evolve best treatment combination with a view to improve the quality of guava.

RESOURCES AND METHODS

An experiment was carried out at central field of guava orchard, Department of Horticulture, SHIATS, Allahabad on 15 years old guava trees cv. ALLAHABAD SAFEDA during the year of 2012(July)- 2013(January). The trees were planted at 8×8 m distance and maintained under uniform cultural practices. The experiment was laid out in Randomized Block Design with 10 treatments and 3 replications. The soil of the experiment site was sandy loam, with a pH –6.9, organic carbon- 1.4% and nitrogen- 303 kg/ha, phosphorus- 12.6 kg/ha, potassium-122 kg/ha. The various treatments were used in this study and the details about the treatments were given below: T_0 – Control, T_1 – RDF (600N:200P_2O_5:400K_2O g), T_2 – (75% RDF+ 25 kg FYM), T_3 – (75% RDF + 25kg FYM + Micronutrients *i.e.* B (0.3%), Zn (0.3%), T_4 – (50% RDF + 15kg FYM + 3kg *Neem* cake), T_5 – (50% RDF + 15kg FYM + 3kg *Neem* cake + Micronutrients *i.e.* B (0.3%), Zn (0.3%), T_6 – (50% RDF + 15kg FYM + 6kg Vermicompost), T_7 – (50% RDF + 15kg FYM + 6kg Vermicompost + Micronutrients *i.e.* B (0.3%), Zn (0.3%), T_8 - (25% RDF + 15kg FYM + 3kg *Neem* cake + 6kg Vermicompost), T_9 (25% RDF + 15kg FYM + 3kg *Neem* cake + 6kg Vermicompost + Micronutrients *i.e.* B (0.3%), Zn (0.3%). At the time of application of fertilizers, a trench of 30 cm width and depth, 1 m away from trunk of the tree was prepared. All the fertilizers were applied in trench and covered with the soil at pre flowering stage. Here, NPK were applied through urea, DAP, MOP, respectively and the micronutrients *i.e.* zinc (0.3%) through zinc sulphate and boron (0.3%) through boric acid were sprayed with the help of foot and pedal pump sprayer at the time of fruit setting stage and 1month after fruit set. The observations were recorded Quality parameters like total soluble solids (TSS), total sugars (%), reducing sugars (%), non- reducing sugars (%), titrable acidity (%), sugar/acid ratio and ascorbic acid (mg/100 ml of juice) contents were estimated as per. The shelf-life of fruits also observed under room temperature without using chemicals.

OBSERVATIONS AND ANALYSIS

It is an evident from the data (Table 1 and 2) that quality parameters were significantly influenced by the application of B and Zn along with various sources of organic and inorganic plant nutrients.

Quality parameters:

Total soluble solids (*^{0}Brix*):

The data on soluble solids is presented in Table 1. The data on TSS content of guava fruit is influenced by different treatments, the maximum TSS content of guava fruit was found in the treatment T_5 (50% Recommended dose of NPK + 15 kg FYM + 3 kg *Neem* cake +

micronutrients(0.3% Zinc Sulphate + 0.3% Boric acid) *i.e.* (12.80 ^{0}Brix), which was followed by treatment T_9 (25% Recommended dose of NPK + 15 kg FYM + 3 kg *Neem* cake + 6 kg Vermicompost + micronutrients (0.3% Zinc Sulphate + 0.3% Boric acid) *i.e.* (12.16 ^{0}Brix and the lowest TSS was recorded in control (T_0) *i.e.* (8.23 ^{0}Brix), respectively.

The integrated use of nitrogen, zinc and organic manure which influenced the plant metabolism favourably, individually and collectively increasing the photosynthesis which ultimately improved the quality parameters of guava fruit.The increase in TSS might be due to rapid translocation of sugar from leaves to developing fruits by spraying of Boric acid. Boron facilitates sugar transport within the plant and it was also reported that borate reacted with sugar to form sugar-borate complex with more easily able to transverse membrane. The results are related with the finding of Balakrishnan (2001) and Katiyar *et al.* (2008).

Ascorbic acid (mg/100 ml of juice):

It is evident from the Table 2 showed that the ascorbic acid of guava fruit was influenced by application of B and Zn along with various sources of organic and inorganic plant nutrients were recorded maximum in treatment T_5 (50% Recommended dose of NPK + 15 kg FYM + 3 kg *Neem* cake + micronutrients (0.3% Zinc Sulphate + 0.3% Boric acid) *i.e.* (224.89 mg/100 ml of juice) which was followed by treatment T_9 (25% Recommended dose of NPK + 15 kg FYM + 3 kg *Neem* cake + 6 kg Vermicompost + micronutrients (0.3% Zinc Sulphate + 0.3% Boric acid) *i.e.* (217.65 mg/100 ml of juice) and which are significantly superior to the control T_0 (157.24 mg/100 ml of juice), respectively.

Zn is involved in many enzymes in plant metabolism. It regulates indirectly water relations in plant. It is involved in protein synthesis and it is important constituent of protoplasm and also plays significant role in photosynthesis. Augmentation of ascorbic acid percentage of guava fruit might have been due to higher synthesis of nucleic acid, on account of maximum availability of plant metabolism. The results are in close conformity with the finding of Balakrishnan (2001) and Katiyar *et al.* (2008).

Acidity (%):

The data shows in Table 1 that the lowest percentage of acidity is recorded in treatment T_5 (50% Recommended dose of NPK + 15 kg FYM + 3 kg *Neem* cake + micronutrients(0.3% Zinc Sulphate + 0.3% Boric acid) *i.e.* (0.31%) and the highest level of acidity is recorded in control (T_0) *i.e.* (0.58%). The reduction in acid content may be based on the fact that mineral compounds reduced the acidity in fruits, since it is neutralized in plant parts during metabolic pathways or used in respiratory process as a substrate. The results are agreement with the finding of Wahid *et al.* (1993).

Total sugars (%) :

The percentage of total sugar content of guava fruit

Table 1 : Effect of boran and zinc along with different sources of organic and inorganic plant nutrients on quality parameters of guava (*Psidium guajava* L.) cv. ALLAHABAD SAFEDA

Treatments	TSS (Brix^0)	Total sugars (%)	Reducing sugars (%)	Non-reducing sugars (%)	Titrable acidity (%)
T_0	8.23	7.51	4.49	3.02	0.58
T_1	9.63	8.96	5.08	3.88	0.41
T_2	10.70	9.38	5.32	4.04	0.50
T_3	10.76	9.65	5.49	4.16	0.48
T_4	11.74	10.28	5.73	4.55	0.40
T_5	12.80	11.08	6.10	4.98	0.31
T_6	11.25	9.96	5.63	4.33	0.32
T_7	8.91	8.15	4.79	3.36	0.55
T_8	8.73	7.97	4.70	3.27	0.44
T_9	12.16	10.76	5.96	4.80	0.34
S.E.±	0.132	0.067	0.036	0.033	0.013
C. D. (P = 0.05)	0.280	0.142	0.076	0.070	0.028

was influenced by different treatments that was presented in Table 1. The maximum percentage of total sugar content was found in the treatment T_5 (50% Recommended dose of NPK + 15 kg FYM + 3 kg *Neem* cake + micronutrients (0.3% Zinc Sulphate + 0.3% Boric acid) *i.e.* (11.08 %). However, all the treatments are significantly superior from the control (T_0) *i.e.* (7.51 %), respectively.

The higher percentage of total sugars might be due to efficient translocation photosynthates to the fruits regulation of boric acid. Boron is a constituent of cell membrane and essential for cell division. The results are similar to the finding of Katiyar *et al.* (2008).

Reducing sugars (%):

The data on reducing sugars is presented in Table 1. The data showed that all the treatments had significantly superior to the control (T_0). The higher percentage of reducing sugars was recorded in treatment T_5 (50% Recommended dose of NPK + 15 kg FYM + 3 kg *Neem* cake + micronutrients (0.3% Zinc Sulphate + 0.3% Boric acid) *i.e.* (6.1%) which was on par the treatment T_9 (25% Recommended dose of NPK + 15 kg FYM + 3 kg *Neem* cake + 6 kg Vermicompost + micronutrients (0.3% Zinc Sulphate + 0.3% Boric acid) *i.e.* (5.96 %) and T_4 (50% Recommended dose of NPK + 15 kg FYM + 3 kg *Neem* cake) *i.e.* (5.73 %), respectively. The lower percentage of reducing sugars was recorded in control (T_0) *i.e.* (4.49).

Reducing sugar percentage of guava fruit might have been due to efficient translocation photosynthates to the fruits by regulation of boric acid. Acts as a regulator of potassium/calcium ratio in the plant helps in nitrogen absorption and translocation of sugars in plant.The results are in conformity with the finding of Maity *et al*. (2006).

Non – reducing sugars (%):

The data on the non – reducing sugars of guava fruit is presented in Table 1. The data shown that the application of different sources of organic and inorganic plant nutrients have a significant effect on the non-reducing sugars content of guava fruit in all the treatments as compare to the control (T_0). The maximum percentage of non-reducing sugars was recorded in the treatment T_5 (50% Recommended dose of NPK + 15 kg FYM + 3 kg *Neem* cake + micronutrients(0.3% Zinc Sulphate + 0.3% Boric acid) *i.e.* (4.98%) and the minimum percentage of non-reducing sugars was recorded in T_0 *i.e.* (3.02%). Augmentation of sugar percentage may be attributable to higher synthesis of nucleic acids, on account of maximum availability of plants metabolism.The results are agreement with the finding of Katiyar *et al.* (2008).

Sugar-acid ratio :

The data on sugar-acid ratio is presented in Table 2. The data on sugar acid ratio content of guava fruit is influenced by different treatments, which was showed that maximum sugar acid ratio of guava fruit was found in the treatment T_5 (50% Recommended dose of NPK + 15 kg FYM + 3 kg *Neem* cake + micronutrients(0.3% Zinc sulphate + 0.3% Boric acid) *i.e.* (35.9) and the

Table 2: Effect of boran and zinc along with different sources of organic and inorganic plant nutrients on quality parameters of guava (*Psidium guajava* L.) cv. ALLAHABAD SAFEDA

Treat. No.	Ascorbic acid (mg/100 ml of juice)	Sugar/acid ratio	Organoleptic test	Shelf-life (No. of days)
T_0	157.24	18.50	5.88	7.67
T_1	189.84	15.44	6.00	11.00
T_2	172.65	18.76	6.44	8.67
T_3	194.52	20.27	6.66	10.00
T_4	202.89	25.93	6.72	11.33
T_5	224.89	35.90	7.77	13.33
T_6	210.75	30.83	6.94	13.00
T_7	184.31	14.82	6.44	9.67
T_8	175.51	18.11	7.11	8.33
T_9	217.65	31.35	7.72	12.67
S.E.±	2.723	0.890	0.329	0.715
C. D. (P = 0.05)	5.773	1.886	0.697	1.516

minimum sugar-acid ratio was recorded in control (T_0) *i.e*. (18.50), respectively. The results are related with the finding of Maity *et al*. (2006).

Organoleptic test :

The data on organoleptic test is presented in Table 2. In this test the marks are given by depending on the hedonic scale in respect to colour and appearance, body and texture, flavour and taste, overall acceptability. so, in which the maximum marks (7.77) were recorded in treatment T_5 (50% Recommended dose of NPK + 15 kg FYM + 3 kg *Neem* cake + micronutrients (0.3% Zinc Sulphate + 0.3% Boric acid) followed by treatment T_9 (25% Recommended dose of NPK + 15 kg FYM + 3 kg *Neem* cake + 6 kg Vermicompost + micronutrients (0.3% Zinc sulphate + 0.3% Boric acid) with (7.72). the minimum marks (5.88) were recorded in T_0 (control).

Shelf-life of fruits (under room temperature) :

The data on shelf-life of guava fruits under room temperature is presented in Table 2. Maximum shelf-life of fruits was observed in treatment T_5 (50% Recommended dose of NPK + 15 kg FYM + 3 kg *Neem* cake + micronutrients (0.3% Zinc Sulphate + 0.3% Boric acid) *i.e*. (13.33 days) followed by treatment T_6 (50% Recommended dose of NPK + 15 kg FYM + 6 kg Vermicompost) with (13 days) and the minimum days (7.67 days) of shelf-life of fruits were recorded in T_0 (control). The results are agreement with the finding of Chaitanya *et al*. (1997).

Conclusion:

From the present investigation it is concluded that among the different treatment combinations the treatment T_5 (50% recommended dose of NPK + 15 kg FYM + 3 kg *Neem* cake + Micro nutrients *i.e*. Zn (0.3%) and B (0.3%)) was superior in respect to all the quality parameters and also recorded best in shelf life of guava fruits cv. ALLAHABAD SAFEDA.

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