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Original Research Article

Effect of Foliar Application of Micronutrients on Yield and Quality of Guava (*Psidium guajava* L.) cv. Sardar

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A B S T R A C T

The present investigation entitled "Studies on effect of foliar application of micronutrients on yield and quality of guava (*Psidium guajava* L.)" Var. Sardar was conducted in a well-established guava orchard of 9 years old Sardar guava trees planted at 5×5 m having uniform growth and productivity at the Instructional-cum-Research Farm, Department of Horticulture, College of Agriculture, Latur, during *mrig bahar* 2015-16, with the object to study the effect of foliar application of micronutrients on yield and quality of guava and to find out the effective concentration of micronutrients for yield and quality of guava fruits. The experiment was laid out in Randomized Block Design (RBD) with eleven treatments replicated thrice.The maximum number of fruits per tree (170), yield per tree (35.57 kg) and yield per hectare (14.22 t) was recorded in treatment (T_7) Zinc sulphate @ 1%. The maximum values of weight of fruit (193 g), and weight of pulp (153.60 g) were observed with the application of $CuSO_4$@ 1%+ $FeSO_4$@ 1% + $ZnSO_4$@ 1% + Borax@ 0.5% (T_{11}).The maximum TSS (11.80 ^{0}brix), reducing sugar (4.52%) and total sugar (7.40%) were observed with application of Zinc sulphate @ 1% (T_7). The minimum acidity (0.35%) was observed with application of Ferrous sulphate @ 1% (T_5).

Keywords

Guava, TSS, acidity

Introduction

The Guava is one of the most common and important fruit crop cultivated all over India. It is fourth most important fruit crop in area and production after mango, banana and citrus. It is classified under genus *Psidium* which contains 150 species, but only *Psidium guajava* exploited commercially. It was introduced in 17th century in India by Portuguese people. Guava is hardy, prolific bearer and remunerative fruit. This fruit is considered to be a poor man's apple because of its high nutritive value and comparatively low price. Guava is rich source of vitamin C, vitamin A, vitamin B2 (Riboflavin) and minerals like calcium, phosphate and iron.

The vitamin C content of Guava fruit is 212 mg/100 g and pectin content (1.15%). Guava fruit is also utilized to make products like jam, jelly, cheese, ice-cream and toffee.

Micronutrient plays an important role in production and its deficiency leads in lowering the productivity. Guava plants also show micronutrient deficiency and could be responsible for lesser yield and quality. Foliar feeding of nutrients to fruit plants has gained much importance in recent years which is quite economical and obviously an ideal way of evading the problems of nutrients availability and supplementing the fertilizers to the soil. Nutrients like nitrogen, phosphorus and potassium play a vital role in promoting the plant vigour and productivity, whereas micronutrients like zinc, boron, copper and iron perform a specific role in the growth and development of plant, quality produce and uptake of nutrients.

Micronutrient especially Copper, Boron, Iron and Zinc are responsible for metabolic activities in fruit physiology. Application of micronutrients should be at first growth phase and before flowering. Zinc takes part in chlorophyll synthesis, involved in biosynthesis of plant growth hormone and plays positive role in photosynthesis and nitrogen metabolism. Zinc is essential for auxin and protein synthesis, seed production and proper maturity. It also increases the fruit size as well as yield. Boron is a constituent of cell membrane and essential for cell division. It acts as a regulator of potassium/calcium ratio in the plant helps in nitrogen absorption and translocation of sugar in plant. It also increase nitrogen availability to the plant. Iron increases the chlorophyll content of leaves, reflecting the colour of leaves. Iron plays critical role in metabolic process such as DNA synthesis, respiration and photosynthesis. Copper is one of the micronutrients needed in very small quantities by plants. Copper activates some enzymes in plants which are involved in lignin synthesis and it is essential in several enzyme systems. It is also required in the process of photosynthesis and assist in plant metabolism of carbohydrates and proteins.

Materials and Method

The present investigation was conducted at Instructional-cum-Research Farm, Department of Horticulture, College of Agriculture, Latur, during 2015-16. Geographically Latur is situated between $18^{0}05'$ to $18^{0}75'$ North latitude and between $76^{0}25'$ to $77^{0}25'$ East longitude has an elevation of 540 to 634 meter above the Mean Sea Level (MSL).The area falls under the semi-arid tropics. The average annual precipitation (worked on the basis of last thirty three years) of the district is 434.8 mm, mostly concentrated during the monsoon months from June to October.

The experimental site was fairly uniform with gentle slope. The soil was medium black, slightly alkaline with uniform texture, colour and having good drainage. The experiment was conducted on well-established orchard of 9 years old Sardar guava trees which are planted at 5.0 × 5.0 m spacing. The experiment was laid out in Randomized Block Design (RBD) with eleven treatments replicated thrice.The treatments comprised of Control (T_1), Copper Sulphate@ 0.5% (T_2), Copper Sulphate@ 1% (T_3), Ferrous Sulphate@ 0.5% (T_4), Ferrous Sulphate@ 1% (T_5), Zinc Sulphate@ 0.5% (T_6), Zinc Sulphate@ 1% (T_7), Borax@ 0.25% (T_8), Borax@ 0.5% (T_9), $CuSO_4$@ 0.5%+ $FeSO_4$@ 0.5% + $ZnSO_4$@ 0.5% + Borax@ 0.25% (T_{10}), $CuSO_4$@ 1%+ $FeSO_4$@ 1% + $ZnSO_4$@ 1% + Borax@ 0.5% (T_{11}). The foliar application of these treatments as per the plan was made at 35 and 70 days after flowering.

Results and Discussion

The result noted in table 1 and 2 shows that application of elemental sulphur at 60 kg/ha recorded good quality and maximum economic returns.

Effect of treatments on yield parameters of Guava

Maximum number of fruits per tree (170), highest yield per tree (35.57 kg) and highest yield per hectare (14.22 tonnes) was recorded in the treatment of $ZnSO_4$ @1% (T_7) while lowest yield per tree (24.40 kg) and yield per hectare (9.76 tonnes) was recorded in control (T_1). The maximum yield in the treatment T_7 could be attributed to the production of maximum number of fruits in this treatment resulting in more yield. The production of more number of fruits per tree in this treatment could be due to zinc which act as catalyst in the oxidation and reduction process and is also of great importance in the sugar metabolism thus increased the yield per tree. These findings are in agreement with Mansour and El-sied (1981).Increase in yield of guava fruits due to foliar application of micronutrients alone or in combination has been reported by several workers from different parts of country Sharma *et al.*, (1992), Bagali *et al.*, (1993), Meena *et al.*, (2005), Trivedi *et al.*, (2012) which supports the results obtained in present investigation. Minimum yield in control treatment is obvious and it may be due to non-availability of nutrients required for formation and development of fruits resulting in production of minimum number of fruits and less weight of fruit in turn leads to production of lowest yield in this treatment. The maximum weight of fruit (193 g) and weight of pulp (153.60 g) were recorded with foliar application of $CuSO_4$@ 1%+ $FeSO_4$@ 1% + $ZnSO_4$@ 1% + Borax@ 0.5% (T_{11}).

Table.1 Effect of foliar application of different micronutrients on yield parameters of guava

Treatment details	Number of fruits/tree	Yield/tree (kg)	Yield/ha (tonnes)	Weight of fruit(g)	Weight of pulp(g)
T_1- Control	97	24.40	9.76	92.00	67.66
T_2- Copper Sulphate @ 0.5%	110	26.94	11.57	123.00	96.40
T_3- Copper Sulphate @ 1%	124	32.42	12.96	152.00	120.30
T_4- Ferrous Sulphate @0.5%	104	25.96	10.38	101.00	73.40
T_5- Ferrous Sulphate @ 1%	121	29.45	11.78	114.00	81.60
T_6- Zinc Sulphate @ 0.5%	138	33.45	13.38	139.00	111.20
T_7- Zinc Sulphate @ 1%	170	35.57	14.22	173.00	144.40
T_8- Borax @ 0.25%	129	32.91	13.16	135.00	106.20
T_9- Borax @ 0.5%	147	34.31	13.72	167.00	151.40
T_{10}- $CuSO_4$ @ 0.5% + $FeSO_4$ @ 0.5% + $ZnSO_4$ @ 0.5% + Borax @ 0.25%	135	34.01	13.60	154.00	146.30
T_{11}- $CuSO_4$ @ 1% + $FeSO_4$ @ 1% + $ZnSO_4$ @ 1% + Borax @ 0.5%	142	34.97	13.98	193.00	153.60
S.E.±	1.02	0.24	0.19	1.02	0.82
C.D at 5%	3.02	0.71	0.57	3.02	2.42

Table.2 Effect of foliar application of different micronutrients on quality parameters of guava

Treatment details	TSS(^{0}Brix)	Reducing sugars (%)	Total sugars (%)	Acidity (%)
T_1- Control	9.86	2.32	4.97	0.58
T_2- Copper Sulphate @ 0.5%	10.67	2.53	5.47	0.47
T_3- Copper Sulphate @ 1%	10.87	2.51	5.60	0.45
T_4- Ferrous Sulphate@0.5%	10.75	2.72	5.70	0.37
T_5- Ferrous Sulphate @ 1%	11.05	3.50	6.37	0.35
T_6- Zinc Sulphate @ 0.5%	11.47	3.20	6.20	0.41
T_7- Zinc Sulphate @ 1%	11.80	4.52	7.40	0.38
T_8- Borax @ 0.25%	11.23	2.90	5.80	0.42
T_9- Borax @ 0.5%	11.35	4.10	6.90	0.40
T_{10}- $CuSO_4$ @ 0.5% + $FeSO_4$ @ 0.5% + $ZnSO_4$ @ 0.5% + Borax @ 0.25%	10.73	2.49	5.30	0.43
T_{11}- $CuSO_4$ @ 1% + $FeSO_4$ @ 1% + $ZnSO_4$ @ 1% + Borax @ 0.5%	11.30	3.71	6.63	0.42
S.E.±	0.23	0.04	0.12	0.02
C.D at 5%	0.68	0.11	0.36	0.05

Effect of treatments on quality parameters of guava

The maximum T.S.S. (11.80 ^{0}Brix) was recorded in the treatment $ZnSO_4$ @1% (T_7) while the minimum T.S.S. (9.86 ^{0}Brix) was recorded in control treatment. The increase in T.S.S due to treatment of zinc is an established fact that zinc is credited with definite role in the hydrolysis of complex polysaccharides into simple sugars, synthesis of metabolites and rapid translocation of photosynthetic products and minerals from other parts of the plant to developing fruits. Kumar and Bhushan (1980) reported that foliar application of $ZnSO_4$ increased the T.S.S content by increasing photosynthetic activity of plants resulting into production of more sugars.

All the treatments showed a general decline of fruit acidity with the concentration of increased micronutrients. The lowest acidity of fruit (0.35%) was recorded with spray of 1% zinc sulphate. Lal and Sen (2001) reported that foliar application of zinc sulphate reduced the acid content in guava fruits. The maximum reducing sugar (4.52%) and total sugars (7.40%) was recorded in the treatment of zinc sulphate@1% (T_7), while minimum values of these parameters were noticed in the control T_1 i.e. (2.32%) and (4.97%) respectively. The increased in non-reducing sugar and total sugar with zinc sulphate alone or in combination with other nutrients may be due to increased rate of photosynthesis and perceptible increase in sugar contents through the foliar feeding of zinc sulphate might be due to the active synthesis of tryptophan in the presence of zinc, the precursor of auxin which in turn causes an increase in rate of chlorophyll synthesis which ultimately accelerates the photosynthetic activity which accumulated more sugars in fruits (Skoog 1940). These findings are in agreement with Rawat *et al.,* (2010).

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