# "Enhancement of Chemical Characteristics of Guava through Foliar Feeding of Zinc"

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**Abstract—***The present investigation on Guava (Psidium guajava L.) cv. G-27" was conducted at in the University Fruit orchard, Department of Horticulture, College of Agriculture, Gwalior (M.P.), during the year 2013-14 and 2014-15. Foliar spray of zinc was done as $Zn_1$ = Zinc sulphat @ 0.25%; $Zn_2$ = Zinc sulphat @ 0.50% and $Zn_3$= Zinc sulphat @ 0.75%. On the basis of results obtained in present investigation. It was found that foliar spray of zinc had significantly improved the various chemical parameters of guava. Individual spray of zinc sulphate i.e. $Zn_3$ ($ZnSO_4$ @ 0.75%) followed by $Zn_2$ ($ZnSO_4$ @ 0.50%) and $Zn_1$ ($ZnSO_4$ @ 0.25%)From the different concentration of zinc, $Zn_3$ was found superior then other concentrations of zinc for all the chemical parameters that was studied.*

**Keyword***: Guava, zinc, foliar spray, sugar, acidity, tss, pectin*

## 1. INTRODUCTION

Guava (*Psidium guajava* L.), also known as "apple of the tropics" and poor man's apple, is the most important, highly productive, delicious and nutritious fruit, grown commercially throughout tropical and subtropical regions of India. Its fruits are available throughout the year except during the summer season. It occupies a pride place amongst the important fruits grown in the country and claims to be the fourth most important fruit in area and production after mango, banana and citrus. Guava cultivation is drawing attention of the farmers because of the specific facts, viz., fruiting almost all the year round, simple cultivation with low cost, high yielding, high in nutritive values, resistant to adverse climatic conditions, wide adaptability, rich source of pectin, medicinal values and suitability for preservation. In India, it is grown in wide range of tropical and subtropical areas from north to south, but the most important guava producing states are Maharashtra, Madhya Pradesh, Uttar Pradesh, Bihar, West Bengal, Punjab, Gujarat & Karnataka (NHB, 2015). The total area under its cultivation in India is 268.2 thousand ha with an annual production of 3667.9 thousand MT, productivity is 13.7 MT/ha, whereas in Madhya Pradesh, the area, production and productivity of guava is 22.4 thousand ha, 841.1 MT and 37.6 MT/ha, respectively (NHB, 2015).

According to Morton (1987), food value of the guava fruit per 100 g of edible portion contains the following substances: Edible portion 100.00%, Calcium 9.1 -17mg, Moisture 77- 86 g, Phosphorus 17.8-30 mg, Protein 0.9-1.0 g, Iron 0.30-0.70mg, Fat 0.1-0.5 g, Vitamin C 350-450 mg, Fibre 2.8-5.5 g, Vitamin B 340 I.U., Carbohydrates 9.5-10 g, Vitamin A 200-400 I.U., Energy 36-50 K. CaI and Pectin 0.52-2.0%.

Micronutrients are required by plants in small quantities and thus, can be applied more safely and easily through foliar application which offers the possibility of quick absorption and supplying the tree with the specific nutrients in a particular quantity directly to the foliage and fruits at times when rapid responses are desired (Stiles, 1982). To compete in domestic as well as foreign markets, quality fruit production is becoming a major objective of the day in fruit industry. The tree crops, grown under field conditions, are subjected to numerous nutrient deficiencies which influence tree growth, tissue composition, fruit production and quality. The deficiency of different nutrients leads to several disorders in fruits and the resulting produce is not preferred by consumers as they are becoming over conscious of quality fruits. Hence, judicious use of different nutrients plays an important role to improve the quality of fruits to a great extant.

Foliar feeding of nutrients to fruit plants has gained much importance in recent years. It is quite economical and obviously an ideal way of evading the problems of nutrient availability and supplementing the fertilizers to the soil. It has been noticed that guava suffers severely from deficiency of micronutrients specially zinc and manganese which reduce the quality of fruits. Guava fruits response well to zinc, boron, potassium and molybdenum applications (Arora and Singh, 1970 and 1972; Singh and Chhonkar, 1983). However, very little work has been done on the application of these nutrients in guava trees. The response of guava plants to these nutrients may vary from region to region and pocket to pocket. The production of poor quality guava fruits in rainy season is a matter of common experience. It would worthwhile to improve the chemical quality of rainy season crop with foliar feeding of nutrients. The quality of processed products also depends on quality of raw material. Hence, the quality of raw material should be increased. We can increase the production of good quality fruits in terms of TSS, acidity, pectin content, sugars etc and nutritive value with the help of modified technique of nutrient application, which may be foliar feeding.

## 2. MATERIAL AND METHODS

The present investigation was conducted at in the University Fruit orchard, Department of Horticulture, College of Agriculture, Gwalior (M.P.), during the year 2013-14 and 2014-15.

## 3. EXPERIMENTAL MATERIALS:

Twelve-year-old bearing guava trees of cultivar Gwalior-27 of uniform vigour and size were selected for the present study. All the trees were maintained under uniform cultural schedule during the course of investigation.

The chemical was used as followed *i.e.* $Zn_1$ = Zinc sulphat @ 0.25%; $Zn_2$ = Zinc sulphat @ 0.50% and $Zn_3$ = Zinc sulphat @ 0.75%.

All the trees selected for the experiments were previously labeled as per layout of experiment and the sprays under treatment were done on rainy season crop (Ambe bahar) at full bloom stage in early morning with the help of foot sprayer @ five liters per tree to ensure the maximum absorption of nutrients through the leaves. Each tree was sprayed thoroughly in such a way as to completely drench it with the spray solution.

**Observations**: Estimation of pectin was done according to the methods of Kertesz (1951). Reducing sugar in fruit juice was estimated by the method as suggested by Nelson (1944). The reducing sugar in percentage was calculated with the help of following formula:

Reducing sugars (%) = (0.25/Burette reading) x100.

The total sugars in percentage were calculated with the help of following formula.

Total sugars (%) = (0.25/Burette reading) x100.

The difference in percentage between total sugars and reducing sugar was taken as the estimate of non-reducing sugar.

Non-reducing sugar (%) = Total sugars (%) - Reducing sugar (%)

Acidity was estimated by simple acid–alkali titration method as described in A.O.A.C. in (1970). Acidity was calculated by the formula and expressed in terms of citric acid.

Total acidity (%) = 0.128 × titer value

and determination of T.S.S. in $^0$Brix by hand refractometer.

**RESULT:** The results obtained during the course of investigation have been described in this study under appropriate headings. The observations are summarized in the form of tables (4.1 and 4.2)

**TSS**: It is evident from the table 4.1, it was clear that TSS was found to be significant due to the spray of zinc sulphate over the control. The mean maximum TSS as pooled basis (10.49 $^0$brix) was recorded under treatment $Z_3$ (Zn @ 0.75%), which was significantly superior to the other levels of $Zn_2$, and $Zn_3$, Zn (Zn @ 0.5% and Zn @ 0.25%, respectively), whereas it was minimum (6.83$^0$brix) under control ($Zn_0$).

**Acidity:** It is evident from the table 4.1, it was clear that TSS was found to be significant due to the spray of zinc sulphate over the control. The mean minimum acidity as pooled basis (0.37%) was recorded under treatment $Z_3$ (Zn @ 0.75%), which was significantly superior to the other levels of $Zn_2$, and $Zn_3$, Zn (Zn @ 0.5% and Zn @ 0.25%, respectively), whereas it was maximum (0.65%) under control ($Zn_0$).

**Pectin content:** It is evident from the table 4.1, it was clear that TSS was found to be significant due to the spray of zinc sulphate over the control. The mean maximum pectin content as pooled basis (1.04%) was recorded under treatment $Z_3$ (Zn @ 0.75%), which was significantly superior to the other levels of $Zn_2$, and $Zn_3$, Zn (Zn @ 0.5% and Zn @ 0.25%, respectively), whereas it was minimum (0.71%) under control ($Zn_0$).

**Reducing sugar:** It is evident from the table 4.2, it was clear that TSS was found to be significant due to the spray of zinc sulphate over the control. The mean maximum reducing sugar as pooled basis (3.61%) was recorded under treatment $Z_3$ (Zn @ 0.75%), which was significantly superior to the other levels of $Zn_2$, and $Zn_3$, Zn (Zn @ 0.5% and Zn @ 0.25%, respectively), whereas it was minimum (2.32%) under control ($Zn_0$).

**Non-reducing sugar:** It is evident from the table 4.2, it was clear that TSS was found to be significant due to the spray of zinc sulphate over the control. The mean maximum non-reducing sugar as pooled basis (5.40%) was recorded under treatment $Z_3$ (Zn @ 0.75%), which was significantly superior to the other levels of $Zn_2$, and $Zn_3$, Zn (Zn @ 0.5% and Zn @ 0.25%, respectively), whereas it was minimum (3.37%) under control ($Zn_0$).

**Total sugar:** It is evident from the table 4.2, it was clear that TSS was found to be significant due to the spray of zinc sulphate over the control. The mean maximum total sugar as pooled basis (9.01%) was recorded under treatment $Z_3$ (Zn @ 0.75%), which was significantly superior to the other levels of

$Zn_2$, and $Zn_3$, Zn (Zn @ 0.5% and Zn @ 0.25%, respectively), whereas it was minimum (5.79%) under control ($Zn_0$).

**Discussion:** The enhanced physical growth parameters of guava fruits may be due to the fact that Zn acts as catalyst in the oxidation and reduction process and is also of great importance in sugar metabolism. The acid under the influence of zinc might have either been fastly converted into sugars and their derivatives by the reactions, involving the reversal of glycolytic pathway or be used in respiration or both. Decrease in acidity due to zinc spray is in agreement with the observations of EL-Sherrif et al. (2000). Singh and Chhonkar (1983) recorded significant increase in total soluble solids, reducing sugar and ascorbic acid content in 'Mrig-bahar' guava pulp with foliar spray of 0.4 per cent zinc sulphate solution over control. Increase in sugar by zinc might be due to the active enzymatic reaction like transformation of carbohydrates, activity of hexokinase and formation of cellulose. This present investigation finds support from Balakrishnan (2001) and Yadav *et al*. (2011) in guava.

## 4. CONCLUSIONS

On the basis of results obtained in present investigation. It is concluded that foliar spray of zinc had significantly improved the various chemical parameters of guava. Individual spray of zinc sulphate *i.e*. $Zn_3$ ($ZnSO_4$ @ 0.75%) followed by $Zn_2$ ($ZnSO_4$ @ 0.50%) and $Zn_1$ ($ZnSO_4$ @ 0.25%) were found to be the best treatments on all chemical of guava plant as compared to control.

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**Table 1: Effect of foliar spray of Zn on TSS, acidity and pectin content of guava.**

| | TSS ($^0$brix) | | | Acidity (%) | | | Pectin content (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2013-14 | 2014-15 | Pooled | 2013-14 | 2014-15 | Pooled | 2013-14 | 2014-15 | Pooled |
| Control | 6.83 | 6.93 | 6.88 | 0.68 | 0.61 | 0.65 | 0.71 | 0.71 | 0.71 |
| $Z_1$ | 8.72 | 9.13 | 8.93 | 0.49 | 0.56 | 0.53 | 0.83 | 0.88 | 0.86 |
| $Z_2$ | 9.46 | 9.93 | 9.70 | 0.43 | 0.49 | 0.46 | 0.93 | 0.99 | 0.96 |
| $Z_3$ | 10.22 | 10.75 | 10.49 | 0.35 | 0.39 | 0.37 | 1.01 | 1.07 | 1.04 |
| SEm+ | 0.178 | 0.190 | 0.119 | 0.015 | 0.012 | 0.009 | 0.019 | 0.019 | 0.012 |
| CD(0.05) | 0.503 | 0.538 | 0.333 | 0.041 | 0.034 | 0.024 | 0.054 | 0.054 | 0.035 |

**Table 2: Effect of foliar spray of Zn on different sugar content of guava.**

| | Reducing sugar (%) | | | Non-reducing sugar (%) | | | Total sugar (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2013-14 | 2014-15 | Pooled | 2013-14 | 2014-15 | Pooled | 2013-14 | 2014-15 | Pooled |
| Control | 2.30 | 2.35 | 2.32 | 3.44 | 3.30 | 3.37 | 5.79 | 5.79 | 5.79 |
| $Z_1$ | 2.76 | 2.97 | 2.87 | 4.13 | 4.45 | 4.29 | 6.89 | 7.44 | 7.16 |
| $Z_2$ | 3.14 | 3.39 | 3.27 | 4.71 | 5.07 | 4.89 | 7.86 | 8.47 | 8.17 |
| $Z_3$ | 3.48 | 3.73 | 3.61 | 5.22 | 5.58 | 5.40 | 8.71 | 9.31 | 9.01 |
| SEm+ | 0.076 | 0.076 | 0.049 | 0.113 | 0.112 | 0.073 | 0.189 | 0.191 | 0.123 |
| CD(0.05) | 0.214 | 0.216 | 0.137 | 0.321 | 0.318 | 0.204 | 0.535 | 0.541 | 0.344 |