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*Research Article*

# Foliar Application of Zinc Sulphate, Magnesium Sulphate and Boric Acid on Chemical Characteristics of Guava (*Psidium guajava* L.) cv. G-27

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**ABSTRACT**

*The present investigation on Guava (Psidium guajava L.) cv. G-27 was conducted during the year 2013-14 and 2014-15. Foliar spray of zinc, boron and magnesium was done as $Zn_1$ = Zinc sulphat @ 0.25%; $Zn_2$ = Zinc sulphat @ 0.50%; $Zn_3$ = Zinc sulphat @ 0.75%;$B_1$ = Boric acid @ 0.1%; $B_2$ = Boric acid @ 0.2%; $B_3$ = Boric acid @ 0.3% ;$Mg_1$= Magnesium sulphat @ 0.20%; $Mg_2$ = Magnesium sulphat @ 0.40%; $Mg_3$ = Magnesium sulphat @ 0.60%. The result showed that $Zn_3$ recorded On the basis of results obtained in present investigation. It was found that foliar spray of zinc, boron and magnesium had significantly improved the various chemical characteristics of guava. From the different concentration $Zn_3$ and $Mg_3$ recorded highest TSS of 10.4, $Zn_{3,}$ significantly lower the acidity. Ascorbic acid recorded 192.05% and 191.89% in $Zn_3$ and $Mg_{3.}$ Higher concentration of zinc, magnesium and boron significant increase the sugar and pectin content also. These results are on pooled basis of 2013-14 and 2014-15.*

***Key word:*** *Guava, Zinc, Boron, Magnesium, Foliar spray, TSS, Acidity, Sugar, Pectin.*

## 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. The total area under its cultivation in India is 262.2 thousand ha with an annual production of 3648.9 thousand MT, productivity is 13.9 MT/ha, whereas in Madhya Pradesh, the area, production and productivity of guava is 30.31thousand ha, 523.75 MT and 17.2 MT/ha, respectively[16]. 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.

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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. Guava fruits response well to zinc, boron, magnesium, potassium and molybdenum applications[21,10]. However, very little work has been done on the application of these nutrients in guava trees. The effect on chemical qualities of fruits to these nutrients may vary from region to region and pocket to pocket. The present commercial variety of guava viz. Gwalior-27 is commonly grown in different agro-climatic regions. 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 its chemical character and nutritive value with the help of modified technique of nutrient application, which may be foliar feeding.

## MATERIAL AND METHODS

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

The experiment consisted of 28 treatment combinations of 3 levels of each zinc, boron and magnesium and spray of plain tap water as control. It is basically to find the difference between control and the rest besides it, individual effect of zinc, boron and magnesium and their interactions were also studied. 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%; $Zn_3$ = Zinc sulphat @ 0.75%; $B_1$ = Boric acid @ 0.1%; $B_2$ = Boric acid @ 0.2%; $B_3$ = Boric acid @ 0.3%; $Mg_1$= Magnesium sulphat @ 0.20%; $Mg_2$ = Magnesium sulphat @ 0.40%; $Mg_3$ = Magnesium sulphat @ 0.60%.

The experiment was laid out in Randomized Block Design (RBD). Eighty four twelve-year-old bearing guava trees of cultivar Gwalior-27 of uniform vigour and size, planted at 6 x 6 m distance were selected for the present study. All the trees were maintained under uniform cultural schedule during the course of investigation and each tree formed as a unit of treatment. All the treatments were replicated thrice. 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 and one month after the first spray (in both the years) in the 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. Determination of T.S.S. in $^0$Brix estimated by hand refractometer[1]. Acidity was estimated by simple acid–alkali titration method as described in A.O.A.C.[1]. Ascorbic acid content estimated method was followed given by Ranganna[19]. Pectin is estimated according to the methods of Kertesz[11]. The difference in percentage between total sugars and reducing sugar was taken as the estimate of non-reducing sugar. Reducing sugar in fruit juice was estimated by the method as suggested by Nelson[15].

## RESULTS

The results obtained during the course of investigation have been described the mean value on pooled basis are only sown here, the detailed values presented in Table 1 and 2 for the different observations.

**3.1 Effect on TSS:** $Zn_3$ (Zinc sulphate @ 0.75%) showed the maximum TSS *i.e.* 10.15 $^0$Brix, 10.72 $^0$Brix and 10.43 $^0$Brix followed by 9.46 $^0$Brix, 9.94 $^0$Brix and 9.70 $^0$Brix under $Zn_2$ (Zinc sulphate @ 0.50%) and 8.72 $^0$Brix, 9.13 $^0$Brix and 8.93 $^0$Brix under $Zn_1$ (Zinc sulphate @ 0.25%) during first year, second year and pooled data. In the present investigation, $Zn_1$, $Zn_2$ and $Zn_3$ were found significant to each other in first year, second year and in pooled data. $Mg_3$ (Molybdenum @ 0.6%) recorded the maximum TSS was found under *i.e.* 10.14 $^0$Brix, 10.71 $^0$Brix and 10.43 $^0$Brix followed by 9.29 $^0$Brix, 9.75 $^0$Brix and 9.52 $^0$Brix under $Mg_2$ (Molybdenum @ 0.4%) and 8.90 $^0$Brix, 9.33 $^0$Brix and 9.11 $^0$Brix under $Mg_1$ (Molybdenum @ 0.2%) during first year, second year and pooled data. TSS was estimated under $B_3$ (Boric acid @ 0.3%) *i.e.* 9.73 $^0$Brix, 10.27 $^0$Brix and 10 $^0$Brix followed by 9.54 $^0$Brix, 10.02 $^0$Brix and 9.78 $^0$Brix under $B_2$ (Boric acid @ 0.3%) and 9.06 $^0$Brix, 9.50 $^0$Brix and 9.28 $^0$Brix under $B_1$ (Boric acid @ 0.3%) during first year, second year and pooled data.

**3.2 Effect of acidity:** Minimum acidity was found under $Zn_3$ (Zinc sulphate @ 0.75%) *i.e.* 0.40%, 0.35% and 0.37% followed by 0.49%, 0.43% and 0.46% under $Zn_2$ (Zinc sulphate @ 0.50%) and 0.57%, 0.50% and 0.53% under $Zn_1$ (Zinc sulphate @ 0.25%) during first year, second year and pooled data. $Mg_3$ (Molybdenum @ 0.6%) recorded the minimum acidity *i.e.* 0.46%, 0.40% and 0.43% followed by 0.49%, 0.41% and 0.45% under $Mg_2$ (Molybdenum @ 0.4%) and 0.50%, 0.46% and 0.48% under $Mg_1$ (Molybdenum @ 0.2%) during first year, second year and pooled data. Minimum acidity was estimated under $B_3$ (Boric acid @ 0.3%) *i.e.* 0.46%, 0.40% and 0.43% followed by 0.50%, 0.42% and 0.46% under $B_2$ (Boric acid @ 0.3%) and 0.50%, 0.45% and 0.47% under $B_1$ (Boric acid @ 0.3%) during first year, second year and pooled data.

**3.3 Effect on ascorbic acid:** It is clear from the data presented in Table 1 that maximum ascorbic acid content was found under $Zn_3$ (Zinc sulphate @ 0.75%) *i.e.* 190.31, 193.79 and 192.05 (mg/100g pulp) followed by 184.90, 188.57 and 186.73 (mg/100g pulp) under $Zn_2$ (Zinc sulphate @ 0.50%) and 179.15, 182.40 and 180.78 (mg/100g pulp) under $Zn_1$ (Zinc sulphate @ 0.25%) during first year, second year and pooled data. $Mg_3$ (Molybdenum @ 0.6%) recorded the maximum ascorbic acid content was found under *i.e.* 190.15, 193.63 and 191.89 (mg/100g pulp) followed by 183.15, 186.69 and 184.92 (mg/100g pulp) under $Mg_2$ (Molybdenum @ 0.4%) and 181.05, 184.44 and 182.74 (mg/100g pulp) under $Mg_1$ (Molybdenum @ 0.2%) during first year, second year and pooled data. Maximum ascorbic acid content was estimated under $B_3$ (Boric acid @ 0.3%) *i.e.* 186.72, 190.41 and 188.56 (mg/100g pulp) followed by 185.55, 188.80 and 187.17 (mg/100g pulp) kg under $B_2$ (Boric acid @ 0.3%) and 182.09, 185.56 and 183.82 (mg/100g pulp) under $B_1$ (Boric acid @ 0.3%).

**3.4 Effect on reducing sugar:** With increasing dose of zinc, there was corresponding increase in reducing sugar. Maximum reducing sugar was found under $Zn_3$ (Zinc sulphate @ 0.75%) *i.e.* 3.46%, 3.68% and 3.57% followed by 3.14%, 3.39% and 3.27% under $Zn_2$ (Zinc sulphate @ 0.50%) and 2.76%, 2.97% and 2.87% under $Zn_1$ (Zinc sulphate @ 0.25%). It is clear from the data presented in table 4.46 and fig. 4.69 that application of different levels of magnesium significantly increased the reducing sugar. $Mg_3$ (Molybdenum @ 0.6%) recorded the maximum reducing sugar was found under *i.e.* 3.46%, 3.68% and 3.57% followed by 3.05%, 3.29% and 3.17% under $Mg_2$ (Molybdenum @ 0.4%) and 2.85%, 3.07% and 2.96% under $Mg_1$ (Molybdenum @ 0.2%). A critical examination of data (table 4.46 and fig. 4.69) revealed that the effect of foliar spray of boron was found significantly on reducing sugar. Maximum reducing sugar was estimated under $B_3$ (Boric acid @ 0.3%) *i.e.* 3.24%, 3.45% and 3.34% followed by 3.19%, 3.43% and 3.31% under $B_2$ (Boric acid @ 0.3%) and 2.93%, 3.16% and 3.05% under $B_1$ (Boric acid @ 0.3%)

**3.5 Effect on non-reducing sugar:** Appraisals of data revealed that the effect of foliar spray of zinc significantly increased non-reducing sugar. Maximum non-reducing sugar was found under $Zn_3$ (Zinc sulphate @ 0.75%) *i.e.* 5.15%, 5.56% and 5.35% followed by 4.71%, 5.07% and 4.89% under $Zn_2$ (Zinc sulphate @ 0.50%) and 4.13%, 4.43% and 4.28% under $Zn_1$ (Zinc sulphate @ 0.25%) during first year, second year and pooled data. $Mg_3$ (Molybdenum @ 0.6%) recorded the maximum non-reducing sugar was found under *i.e.* 5.15%, 5.53% and 5.34% followed by 4.57%, 4.93% and 4.75% under $Mg_2$ (Molybdenum @ 0.4%) and 4.27%, 4.60% and 4.44% under $Mg_1$ (Molybdenum @ 0.2%) during first year, second year and pooled data. Maximum non-reducing sugar was estimated under $B_3$ (Boric acid @ 0.3%) *i.e.* 4.83%, 5.18% and 5.01% followed by 4.76%, 5.14% and 4.95% kg under $B_2$ (Boric acid @ 0.3%) and 4.39%, 4.74% and 4.56% under $B_1$ (Boric acid @ 0.3%) during first year, second year and pooled data.

**3.6 Effect on total sugars:** With increasing dose of zinc, there was corresponding increase in total sugar. Maximum total sugar was found under $Zn_3$ (Zinc sulphate @ 0.75%) *i.e.* 8.61%, 9.24% and 8.93% followed by 7.85%, 8.46% and 8.16% under $Zn_2$ (Zinc sulphate @ 0.50%) and 6.88%, 7.40% and 7.14% under $Zn_1$ (Zinc sulphate @ 0.25%) during first year, second year and pooled data. $Mg_3$ (Molybdenum @ 0.6%) recorded the maximum total sugar was found under *i.e.* 8.61%, 9.20% and 8.91% followed by 7.62%, 8.22% and 7.92% under $Mg_2$ (Molybdenum @ 0.4%) and 7.12%, 7.68% and 7.40% under $Mg_1$ (Molybdenum @ 0.2%). Maximum total sugar was estimated under $B_3$ (Boric acid @ 0.3%) *i.e.* 8.07%, 8.63% and 8.35% followed by 7.95%, 8.57% and 8.26% kg under $B_2$ (Boric acid @ 0.3%) and 7.33%, 7.90% and 7.61% under $B_1$ (Boric acid @ 0.3%) during first year, second year and pooled data.

**3.7 Effect on pectin content:** The data further indicated that with increasing dose of zinc, there was corresponding increase in pectin content. Maximum pectin content was found under $Zn_3$ (Zinc sulphate @ 0.75%) *i.e.* 0.77%, 0.82% and 0.80% followed by 0.68%, 0.74% and 0.71% under $Zn_2$ (Zinc sulphate @ 0.50%) and 0.58%, 0.63% and 0.61% under $Zn_1$ (Zinc sulphate @ 0.25%) during first year, second year and pooled data. $Mg_3$ (Molybdenum @ 0.6%) recorded the maximum pectin content was found under *i.e.* 0.77%, 0.82% and 0.80% followed by 0.65%, 0.71% and 0.68% under $Mg_2$ (Molybdenum @ 0.4%) and 0.60%, 0.66% and 0.63% under $Mg_1$ (Molybdenum @ 0.2%) during first year, second year and pooled data. Maximum non- pectin content was estimated under $B_3$ (Boric acid @ 0.3%) *i.e.* 0.72%, 0.76% and 0.74% followed by 0.69%, 0.75% and 0.72% under $B_2$ (Boric acid @ 0.3%) and 0.62%, 0.68% and 0.65% under $B_1$ (Boric acid @ 0.3%) during first year, second year and pooled data.

## DISCUSSION

The salient findings of these experiments are presented before is being discussed in detail hereunder. An attempt has been made to establish the relationship amongst the chemical manifestations as affected by the different treatments under study.

**4.1 Effect of zinc**

Analysis of data are preceding chapter clearly indicate that quality parameters of guava influenced by spray of chemicals in terms of TSS, acidity, ascorbic acid, reducing sugar, non-reducing sugar, total sugars and pectin content of fruits. Foliar spray of zinc sulphate significantly lowers the acidity. Minimum significant values was noted in $Z_3$ ($ZnSO_4$ @ 0.75%) followed by $Z_2$ ($ZnSO_4$ @ 0.5%) and $Z_1$ ($ZnSO_4$ @ 0.25%) for all the parameters. The results are in agreement with the findings of previous workers who found that foliar application of zinc sulphate reduced the acid contents of the fruits viz., Lal and Sen[14], Chaitanya *et al.*[6], Sharma *et al.*), Arora and Singh *et al*.[2] in guava and Dhillon and Bindra[8] in grape. 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 Goswami *et al*.[9].

On the other hand TSS, ascorbic acid, reducing sugar, non-reducing sugar, total sugars and pectin content of fruits significantly increased by $Z_3$ ($ZnSO_4$ @ 0.6%) followed by $Z_2$ ($ZnSO_4$ @ 0.4%) and $Z_1$ ($ZnSO_4$ @ 0.2%). The effectiveness of the application depends on the ability of the micronutrients to penetrate through the leaf cuticle into the mesophyll cells and thus eliciting a particular response. It 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 plants to developing fruits. Kumar *et al*.[13] suggested that foliar application of ZnSO4 increased the TSS contents by increasing photosynthetic activity of the plants resulting into the production of more sugars. Same trend has also been observed by Gurjar *et al.*[10], Chandra and Singh[7], Pal *et al.*[17] and Bakshi *et al.*[3]. Zinc application also increased the ascorbic acid which seems to be due to increased growth and availability of more metabolites for ascorbic acid synthesis. The results are in accordance with the findings reported by Singh *et al.*.

**4.2 Effect of magnesium**

The chemical parameters of the guava plant were significantly influenced by the different concentration of magnesium over the control. In the present investigation, TSS, acidity, ascorbic acid, reducing sugar, non-reducing sugar, total sugars and pectin were studied.

The beneficial effect of Mg in increasing total soluble solids, reducing sugar, total sugar, T.S.S./acid ratio and ascorbic acid content in guava fruit were also reported by Lal and Sen[14]. Decrease in acidity content by Mg spray has previously been shown by Ghosh and Lal and Sen[14]. The increase in T.S.S. and different fractions of sugar under the influence of micronutrients might be due to hydrolysis of complex polysaccharides into simple sugars, synthesis of metabolites and rapid translocation of photosynthetic products and minerals from other parts of plant to developing fruits. Several workers observed similar results as, Ghosh, Balakrishnan[4] and Balakrishnan[5] in guava.

**4.3 Effect of boron**

The data presented in the chapter results denoted that different boron levels significantly influenced various chemical parameters. Values were found to be maximum under $B_3$ *i.e.* (B @ 0.3 %) followed by $B_2$ (B @ 0.2 %) for TSS, acidity, ascorbic acid, reducing sugar, non-reducing sugar, total sugars and pectin content and minimum values for these parameters were found under $B_1$ (B @ 0.1%). Increase in sugar, TSS, ascorbic acid, and sugars and reduced the acidity content in guava by Boron might be due to the active enzymatic reaction like transformation of carbohydrates, activity of hexokinase and formation of cellulose. The acid under the influence of chemicals might have either been rapidly converted into sugars and their derivatives by the reactions involving reversal of glycolytic pathway[20] or might be used in respiration or both. Being a major substrate of respiration, the decline in the malic acid during fruit ripening might be the results of an increase in membrane permeability which allows acids to be stored in the respiring cells[12]. The downwards trend in the levels of organic acids was also possibly due to dilution effect with the increase in volume of fruits in these treatments. The findings of the present investigation find support from Rafeii and Pakkish[18] in guava. Minimum acidity was noted under $B_3$ *i.e.* (B @ 0.3 %) followed by $B_2$ (B @ 0.2 %) and (B @ 0.1%). Different boron levels significantly reduced the acidity. Decrease in acidity due Boron spray is in agreement with the observations of Suman *et al*.[21].

**Table 1: Comparison of control vs. treatment as well as influence of zinc, magnesium and boron on TSS, acidity, ascorbic acid and reducing sugar during first year, second year and pooled data**

| | TSS $^{0}$Brix | | | Acidity (%) | | | Ascorbic acid mg/100 g pulp | | | Reducing sugar (%) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **2013** | **2014** | **Pooled** | **2013** | **2014** | **Pooled** | **2013** | **2014** | **Pooled** | **2013** | **2014** | **Pooled** |
| **Control** | 6.83 | 6.75 | 6.79 | 6.83 | 6.75 | 6.79 | 6.83 | 6.75 | 6.79 | 2.35 | 2.35 | 2.35 |
| **Treatment** | 9.44 | 9.93 | 9.69 | 9.44 | 9.93 | 9.69 | 9.44 | 9.93 | 9.69 | 3.12 | 3.35 | 3.23 |
| **F Test** | SIG | SIG | SIG | SIG | SIG | SIG | SIG | SIG | SIG | SIG | SIG | SIG |
| | **Zinc levels** | | | | | | | | | | | |
| **$Z_1$** | 8.72 | 9.13 | 8.93 | 8.72 | 9.13 | 8.93 | 8.72 | 9.13 | 8.93 | 2.76 | 2.97 | 2.87 |
| **$Z_2$** | 9.46 | 9.94 | 9.70 | 9.46 | 9.94 | 9.70 | 9.46 | 9.94 | 9.70 | 3.14 | 3.39 | 3.27 |
| **$Z_3$** | 10.15 | 10.72 | 10.43 | 10.15 | 10.72 | 10.43 | 10.15 | 10.72 | 10.43 | 3.46 | 3.68 | 3.57 |
| | **Magnesium levels** | | | | | | | | | | | |
| **$M_1$** | 8.90 | 9.33 | 9.11 | 8.90 | 9.33 | 9.11 | 8.90 | 9.33 | 9.11 | 2.85 | 3.07 | 2.96 |
| **$M_2$** | 9.29 | 9.75 | 9.52 | 9.29 | 9.75 | 9.52 | 9.29 | 9.75 | 9.52 | 3.05 | 3.29 | 3.17 |
| **$M_3$** | 10.14 | 10.71 | 10.43 | 10.14 | 10.71 | 10.43 | 10.14 | 10.71 | 10.43 | 3.46 | 3.68 | 3.57 |
| | **Boron levels** | | | | | | | | | | | |
| **$B_1$** | 9.06 | 9.50 | 9.28 | 9.06 | 9.50 | 9.28 | 9.06 | 9.50 | 9.28 | 2.93 | 3.16 | 3.05 |
| **$B_2$** | 9.54 | 10.02 | 9.78 | 9.54 | 10.02 | 9.78 | 9.54 | 10.02 | 9.78 | 3.19 | 3.43 | 3.31 |
| **$B_3$** | 9.73 | 10.27 | 10.00 | 9.73 | 10.27 | 10.00 | 9.73 | 10.27 | 10.00 | 3.24 | 3.45 | 3.34 |
| **SEm+** | **0.16** | **0.20** | **0.16** | **0.01** | **0.01** | **0.01** | **1.35** | **1.37** | **1.22** | **0.08** | **0.09** | **0.08** |
| **CD(0.05)** | **0.45** | **0.56** | **0.31** | **0.04** | **0.03** | **0.03** | **3.82** | **3.89** | **2.39** | **0.22** | **0.25** | **0.15** |

**Table 2: Comparison of control vs. treatment as well as influence of zinc, magnesium and boron on non-reducing sugar, total sugar and pectin content during first year, second year and pooled data**

| | Non- reducing sugar (%) | | | Total sugar (%) | | | Pectin content | | |
|---|---|---|---|---|---|---|---|---|---|
| | **2013** | **2014** | **Pooled** | **2013** | **2014** | **Pooled** | **2013** | **2014** | **Pooled** |
| **Control** | 3.44 | 3.30 | 3.37 | 5.79 | 5.65 | 5.72 | 0.71 | 0.74 | 0.73 |
| **Treatment** | 4.66 | 5.02 | 4.84 | 7.78 | 8.37 | 8.08 | 0.93 | 0.98 | 0.95 |
| | SIG | SIG | SIG | SIG | SIG | SIG | SIG | SIG | SIG |
| | **Zinc levels** | | | | | | | | |
| **$Z_1$** | 4.13 | 4.43 | 4.28 | 6.88 | 7.40 | 7.14 | 0.58 | 0.63 | 0.61 |
| **$Z_2$** | 4.71 | 5.07 | 4.89 | 7.85 | 8.46 | 8.16 | 0.68 | 0.74 | 0.71 |
| **$Z_3$** | 5.15 | 5.56 | 5.35 | 8.61 | 9.24 | 8.93 | 0.77 | 0.82 | 0.80 |
| | **Magnesium levels** | | | | | | | | |
| **$M_1$** | 4.27 | 4.60 | 4.44 | 7.12 | 7.68 | 7.40 | 0.60 | 0.66 | 0.63 |
| **$M_2$** | 4.57 | 4.93 | 4.75 | 7.62 | 8.22 | 7.92 | 0.65 | 0.71 | 0.68 |
| **$M_3$** | 5.15 | 5.53 | 5.34 | 8.61 | 9.20 | 8.91 | 0.77 | 0.82 | 0.80 |
| | **Boron levels** | | | | | | | | |
| **$B_1$** | 4.39 | 4.74 | 4.56 | 7.33 | 7.90 | 7.61 | 0.62 | 0.68 | 0.65 |
| **$B_2$** | 4.76 | 5.14 | 4.95 | 7.95 | 8.57 | 8.26 | 0.69 | 0.75 | 0.72 |
| **$B_3$** | 4.83 | 5.18 | 5.01 | 8.07 | 8.63 | 8.35 | 0.72 | 0.76 | 0.74 |
| **SEm+** | **0.12** | **0.13** | **0.11** | **0.19** | **0.21** | **0.18** | **0.021** | **0.021** | **0.019** |
| **CD(0.05)** | **0.34** | **0.38** | **0.22** | **0.55** | **0.59** | **0.36** | **0.061** | **0.058** | **0.037** |

## CONCLUSION

On the basis of two years experimentation, it could be concluded that foliar spray of zinc, boron and magnesium had significantly improved the various quality attributing characters of guava. From the different concentration $Zn_3$, $B_3$ and $Mg_3$ were found superior to other concentrations of zinc, boron and magnesium for all the parameters that was studied as compared to control. So it may be recommended at farmer's level for increasing the chemical qualities of guava with the help of zinc, boron and magnesium along with the recommended dose of NPK.

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