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Effect of foliar spray of micronutrients on growth, yield and quality of Guava (*Psidium guajava* L.) CV. Dharidar

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Abstract
A field experiment was conducted on clay loam soil texture with pH of 6.9 and EC is 0.51 dSm-1 on cowpea with ten treatments in a randomized block design during the year of rabbi 2019 at Experimental Farm, Department of Horticulture, School of Agricultural Sciences, G. H. Raisoni University, Saikheda, Chhindwara, (M.P) to evaluate the impact of Effect of foliar spray of micronutrients on growth and yield of Guava. Application of zinc sulphate and magnesium sulphate significantly influenced on growth and yield parameters of guava. In the interaction effect of zinc sulphate and magnesium sulphate, the treatment Zn_3Mg_3 ($ZnSO_4$ @ 0.75% & $MgSO_4$ @ 0.75%) were found to be the best treatments on all most vegetative and yield attributing parameters of guava plant.

Keywords: Zinc sulphate, magnesium sulphate, guava

Introduction
Guava (*Psidium guajava* L.), which belongs to the family Myrtaceae is one of the most popular fruits grown in tropical, sub- tropical and some parts of arid regions of India, It is the fifth most important fruit in area after mango, banana, citrus and apple and fifth most important fruit in production after banana, mango, citrus and papaya. It is cultivated in India since early 17th century and due to its wider adaptability in diverse soils and agro-climatic regions, low cost of the cultivation, prolific bearing and being highly remunerative with fruit nutritive values it has gained more popularity among the fruit growers.

This fruit originated in tropical America and seems to have been growing from Mexico to Peru. The trees were domesticated more than 2000 years ago. It was spread rapidly through the worlds' tropics by Spanish and Portuguese soon after the discovery of the new world. Now it is cultivated in tropical and subtropical parts of several countries like India, Hawaii, Brazil, Mexico, Thailand, New Zealand, Philippines, Indonesia, China, Malaysia, Cuba, Sri Lanka, Venezuela, Australia, Burma, Myanmar, Israel, Pakistan, Bangla Desh etc. Brazil is the leading producer of guava in the world. In India, guava is a major fruit crop of tropical, subtropical and arid region of the country. The important guava growing states in the country are Uttar Pradesh, Bihar, Madhya Pradesh, Karnataka, Andhra Pradesh, Maharastra, Gujarat, Chattisgarh and Rajasthan, though it is successfully grown in all over the country. Uttar Pradesh, Bihar, Madhya Pradesh and Maharastra are the leading guava growing states. Uttar Pradesh is the largest grower, produces best quality guava and Allahabad has the distinct reputation for growing the best guava in the country as well in the world. In Madhya Pradesh major guava producing areas are Jabalpur, Gwalior, Bhopal Rewa, Neemuch, Ratlam, Khandwa and Mandsaur (Malwa region).

Nature has endowed it liberally to tolerate the drought and flood condition and adoptability to a wide range of soil and climatic conditions. Its cultural requirement is also very limited. Besides other factors of crop production, micronutrients play an important role. The present commercial variety of guava viz. Dharidar is commonly grown in different agro-climatic regions. The performance of a particular variety in one agro-climatic region may not prove suitable for other regions due to their different-different requirement of micronutrients. Hence, it deserves utmost attention of the horticulture scientist to search the suitable doses of micronutrients for a particular agro-climatic zone.

Material and methods
The present investigation, "Effect of foliar spray of micronutrients on growth, yield and quality of Guava (*Psidium guajava* L.) CV. Dharidar" was conduted at Department of

Hortculture, School of Agricultural Sciences, G. H. Raisoni University, Saikheda, Chhindwara, (M.P). The experiment was laid out in randomized block design with twenty five treatments comprising of zinc sulphate and magnesium sulphate with the different five concentration each having treatments T1-Zn0Mg0, T2-Zn0Mg1, T3-Zn0Mg2, T4-Zn0Mg3, T5-Zn0Mg4, T6-Zn1Mg0, T7-Zn1Mg1, T8-Zn1Mg2, T9-Zn1Mg3, T10-Zn1Mg4, T11-Zn2Mg0, T12-Zn2Mg1, T13-Zn2Mg2, T14-Zn2Mg3, T15-Zn2Mg4, T16-Zn3Mg0, T17-Zn3Mg1, T18-Zn3Mg2, T19-Zn3Mg3, T20-Zn3Mg4, T21-Zn4Mg0, T22-Zn4Mg1, T23-Zn4Mg2, T24-Zn4Mg3, T25-Zn4Mg4,. The field experiment was completed with three replications and crop was fertilized and irrigated as per treatment schedule. Variety Dharidar was sown at a spacing of 3 X 3 m. Periodical observations were taken up with different growth stages. The experimental data on observations were statistically analyzed by adopting the procedure of Panse and Sukhatme. The critical difference was calculated at five per cent probability level to draw statistical calculations.

Result and Disscution

(A) Effect of zinc sulphate

Vegetative Parameters

The vegetative parameters of the guava plant were significantly influenced by the different concentration of zinc sulphate over the control. The mean maximum shoot length (14.45 cm) and number of leaf per shoot (11.22) of guava were recorded under Zn_3 ($ZnSO_4$ @ 0.75%), which was at par with the Zn_2 ($ZnSO_4$ @ 0.50%) and Zn_4 ($ZnSO_4$ @ 1.0%) whereas, minimum shoot length (12.28 cm) and number of leaf per shoot (10.06) noticed under control. increased shoot diameter (0.48 cm) was recorded under the treatment Zn_3 ($ZnSO_4$ @ 0.75%) while, minimum shoot diameter (0.35 cm) under control. The increased leaf area (72.58 cm^2) was recorded under the treatment Zn_2 ($ZnSO_4$ @ 0.50%), which was at par with the Zn_3 ($ZnSO_4$ @ 0.75%) and Zn_4 ($ZnSO_4$ @ 1.0%) while, minimum leaf area (66.58 cm^2) noticed under control. Increase in shoot length by zinc spray is due to zinc plays an important part in the fundamental process involved in the cellular mechanism and respiration (Reed, 1946). The presence of zinc in chloroplast cell was also considered the possible causes of increased growth of plants (Wood and sibley, 1950). Improvement in vegetative growth was observed earlier with Zn by several workers; (Balakrishnan, 2000) [4] in guava Sharma and Bhattacharayya (1994) and Kundu and Mitra (1999) [8] in guava.

Yield attributing Parameters

The data pertaining to various yield attributing parameters of the guava plant viz; number of fruits per plant, weight per fruit, yield per plant and yield per hectare are significantly increased by the various sprays of zinc sulphate. The maximum number of fruits per plant (168.80), weight of fruit (185.38 g), yield per plant (32.90 kg) and yield per hectare (81.89 q) were recorded under the treatment Zn_3 ($ZnSO_4$ @ 0.75%), which were significantly superior to the other levels of Zn ($ZnSO_4$ @ 0.25%, $ZnSO_4$ @ 0.50% & $ZnSO_4$ @ 1.0%) except number of fruits per plant which was at par with Zn_2 ($ZnSO_4$ @ 0.50%) whereas, minimum number of fruits per plant (148.20), weight of fruit (146.26 g), yield per plant (23.38 kg) and yield per hectare (55.42 q) were recorded under control. The increase in fruit yield due to the increased growth and yield parameters may be due to the increased auxin production. Zinc acts as catalyst in the oxidation and reduction processes and is also great importance in the sugar metabolism which might have improved the physical characters of guava fruit and thus increased the yield per tree. Heavier fruits under zinc treatment might be due to the high level of auxin in the various parts of the fruit maintained by zinc application. The role of Zn in production of auxins is well known. The increase in the fruit weight by zinc spray was due to the significant increase in the fruit width and length. The increase in the yield under the effect of zinc sprays might be due to the fact that zinc is universally claimed to be an essential micro nutrient and and it is considered indispensable for the growth of all organism (Arora & Singh 1970b) [2]. Mansour and Sied (1981) [11] reported that foliar spray of zinc at 0.5 and 1.0 per cent concentrations increased fruit set, reduced pre-harvest abscission and increased yield; at picking time fruit characters were good. Effect of zinc spray on yield have earlier been also reported by Mansour and Sied (1981) [11], Pandey *et al.* (1988) [12], Sharma *et al.* (1991) [13], Dahiya *et al.* (1993) [6], Kundu and Mitra (1999) [8] in guava.

(B) Effect of magnesium sulphate

Vegetative Parameters

The vegetative parameters of the guava plant were significantly improved by the sprays of magnesium sulphate over the control. The maximum shoot length (195 cm) was recorded under Mg_3 ($MgSO_4$ @ 0.75%), which was at par with the Mg_2 ($MgSO_4$ @ 0.50%) and Mg_4 ($MgSO_4$ @ 1.0%) and minimum shoot length (0.35 cm) noticed under control. The maximum number of leaf per shoot (11.48) was recorded under the treatment Mg_3 ($MgSO_4$ @ 0.75%), which was at par with the Mg_1 ($MgSO_4$ @ 0.25%), Mg_2 ($MgSO_4$ @ 0.50%) and Mg_3 ($MgSO_4$ @ 0.75%) whereas minimum number of leaf per shoot (10.34) noticed under control. The increased shoot diameter and leaf area was recorded under Mg_3 ($MgSO_4$ @ 0.75%), which was at par with Mg_2 ($MgSO_4$ @ 0.50%) & Mg_4 ($MgSO_4$ @ 1.0%) while, minimum shoot diameter (0.35 cm) and leaf area (68.41 cm2) was recorded with the control. It is quit clear from the findings of the present study that mg brought betterment in both growth and yield attributes may be due to stimulatory effect of mg on plant metabolism (Devlin, 1966). Also, the growth might have been augmented due to higher synthesis of nucleic acids; Mg also participates in enzymatic activities involved in protein synthesis and cell multiplication. Magnesium is the metallic constituent of chlorophyll Willstates, R. (1960). The present investigation findings confirmation with the findings of Kuznetsov and Koridze (1977) [9] in Satsuma, Mann *et al.* (1985) [10] in sweet oranges.

Yield attributing Parameters

The data pertaining to various yield attributing parameters of the guava plant viz; number of fruits per plant, weight per fruit, yield per plant and yield per hactare were significantly improved by the spray of magnesium sulphate. The maximum number of fruits per plant (165.60), weight per fruit (180.25 g), yield per plant (31.53 kg) and yield per hectare (78.03q) were recorded under the treatment Mg_3 ($MgSO_4$ @ 0.75%), which were significantly superior to other levels of Mg ($MgSO_4$ @ 0.25%, $MgSO_4$ @ 0.50% & $MgSO_4$ @ 1.0%) while, minimum number of fruits per plant (154.40), weight per fruit (154.31 g), yield per plant (25.55 kg) and yield per hectare (q) noticed under control. It is quit clear from the findings of the present study that Mg brought betterment in both growth and yield attributes may be due to stimulatory

effect of mg on plant metabolism (Devlin, 1966). The increase in the yield parameters and yield in Mg treated plants may be on account of maximum availability of plant metabolism. Similar yield improvements with mg application were observed by Kuznetsov and Koridze (1977) [9] in Satsuma, Mann *et al.* (1985) [10] in sweet oranges.

(C) Interaction effect of zinc sulphate and magnesium sulphate

Vegetative Parameters

The interaction effect of zinc sulphate and magnesium sulphate were significantly improved the vegetative parameters of guava plant except number of leaf per shoot. The maximum shoot length (14.85 cm) and leaf area (72.79 cm2) were recorded under Zn_2 Mg_4 ($ZnSO_4$ @ 0.50% & $MgSO_4$ @ 1.0%) whereas minimum shoot length (10.07 cm) and leaf area (61.17 cm2) were recorded under control. The maximum shoot diameter (0.53 cm) was recorded under Zn_3Mg_3 ($ZnSO_4$ @ 0.75% & $MgSO_4$ @ 0.75%) and Zn_3Mg_4 ($ZnSO_4$ @ 0.75% & $MgSO_4$ @ 1.0%) while, minimum shoot diameter (0.53 cm) noticed under control. The foliar sprays of micronutrients viz., Mg and Zn, might have induced the synthesis of chlorophyll and thus lead to increase in cholorophyll content which in turn resulted in higher vegetative growth Sharma and Bhattacharya (1994). The increase in number of leaves per shoot with Zn and Mg spray, this may be because Zn has an obvious affect on photosynthesis (Fujiwara and Tsutsumi, 1962) and Mg is indispensable for photosynthesis. Improvement in vegetative growth of this present findings also are in conformity with several workers, Mansour and Sied (1981) [11], Ghosh (1986) [7], Sharma *et al*. (1991) [13], Dahiya *et al*. (1993) [6] in guava.

Yield attributing Parameters

The combined sprays of zinc sulphate and magnesium sulphate showed great improvement in yield attributing characters of guava except Zn_2Mg_4 ($ZnSO_4$ @ 0.50% & $MgSO_4$ @ 1.0%). The maximum number of fruit (174.00) was obtained under Zn_2Mg_4 ($ZnSO_4$ @ 0.50% & $MgSO_4$ @ 1.0%) and minimum number of fruit (143.00) obtained with control. The higher weight per fruit (195.46g), yield per plant (35.14kg) and yield per hectare (88.13q) was noted under Zn_3Mg_4 ($ZnSO_4$ @ 0.75% & $MgSO_4$ @ 1.0%) whereas, minimum weight per fruit (136.31g), yield per plant (21.96kg) and yield per hectare (49.27q) noticed under control. The fruit weight increase by the combined application of Zn and Mg was due to the significant increase in the fruit length and width, Bagali *et al.* (1993) [3] in guava and Balakrishnan (2000) [4] in guava.

Table 1: Effect of Zinc and Magnesium on Growth and Yield parameters of Guava

Treatments	Shoot Length	No of Leaf Per Shoot	Shoot Diameter	Leaf Area	No of Fruits per Plant	Weight of fruit	Yield per plant	Yield per ha
Factor A : Zn- Zinc								
Zn_0	12.28	10.06	0.35	66.58	148.20	146.26	23.38	55.42
Zn_1	13.41	10.53	0.39	70.25	159.20	166.74	28.22	68.91
Zn_2	14.34	11.09	0.46	72.58	168.20	181.52	32.16	79.84
Zn_3	14.45	11.22	0.48	72.65	168.80	185.52	32.90	81.89
Zn_4	13.25	10.92	0.40	71.2	161.20	170.09	28.98	71.15
SE+	0.019	0.033	0.012	0.55	0.27	0.45	0.58	0.30
CD at 5%	0.056	0.096	0.034	1.62	0.79	1.31	1.70	0.89
Factor B : Mg –Magnesium								
Mg_0	12.66	10.3	0.35	68.41	154.40	154.31	25.55	61.46
Mg_1	13.30	10.69	0.40	723	158.80	165.58	28.00	68.9
Mg_2	13.91	10.69	0.44	71.22	163.80	175.19	30.32	74.92
Mg_3	13.95	10.96	0.46	71.81	165.60	180.25	31.53	78.92
Mg_4	13.89	10.98	0.43	71.82	163.00	174.67	30.24	74.52
SE+	0.019	0.033	0.012	0.55	0.27	0.45	0.58	0.30
CD at 5%	0.05	0.096	0.034	1.62	0.79	1.31	1.70	0.89
Interaction effect A X B								
SE+	0.042	0.073	0.026	1.24	0.60	1.00	1.30	0.68
CD at 5%	0.125	-	0.076	3.63	1.76	2.93	3.81	1.99

Conclusions

On the basis of results obtained in present investigation entitled "Effect of foliar spray of micronutrients on growth, yield and quality of Guava (*Psidium guajava* L.) cv. Dharidar" It is concluded that foliar spray of zinc sulphate, magnesium sulphateand their interaction had significantly improved the vegetative growth and yield attributing parameters of guava plant. Individual spray of zinc sulphate i.e. Zn_3 ($ZnSO_4$ @ 0.75%) followed by Zn_2 ($ZnSO_4$ @ 0.50%) and individual spray of magnesium sulphate i.e. Mg_3 ($MgSO_4$ @ 0.75%) followed by Mg_2 ($MgSO_4$ @ 0.50%) were found to be the best treatments on all most vegetative and yield attributing parameters of guavaplant.

In the interaction effect of zinc sulphate and magnesium sulphate, the treatment Zn_3Mg_3 ($ZnSO_4$ @ 0.75% & $MgSO_4$ @ 0.75%) followed by Zn_3Mg_4 ($ZnSO_4$ @ 0.75% and $MgSO_4$ @ 1.0%) were found to be the best treatments on all most vegetative and yield attributing parameters of guava plant. It is recommended that above mentioned treatments should be used by the orcharding for higher production of guava.

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