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Effect of Micronutrient Mixture on Yield and Quality of Guava *cv* Lucknow 49 in Sodic Soil

D. Janaki [a++*] and S. Kumar [b#]

[a] Agricultural College and Research Institute, Tamil Nadu Agricultural University, Pudukottai-622 104, Tamil Nadu, India.
[b] Department of Horticulture, AC&RI, TNAU, Madurai-625 104, Tamil Nadu, India.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Tamil Nadu occupies 4.7 lakh ha of salt affected soils, in which 3.0 lakh ha area under inland and 1.7 lakh ha under coastal. Among the 3.0 lakh inland salt affected soils, 2.0 lakh ha occupy alkalinity and 1.0 lakh ha under salinity. In Trichirappalli 18,155 ha comes under alkalinity problem. Guava is one of the commercial fruit crop comes well under salt affected soils. The main problem in yield reduction in guava is due to micronutrient deficiency. Hence the present investigation was conducted at Horticultural College and Research Institute for Women, Tiruchirappalli during 2020-2021 in clay loam texture with pH -9.23, ESP-36.52%. . The experiment was laid out in Randomized Block Design (RBD) on guava cv. Lucknow -49 planted at 3 x 2mspacing with seven treatments replicated three and ten number of plants per replication were taken. The treatments comprised of T_1 – Control, T_2 – Recommended Dose of Fertilizers alone (300:150:150 g NPK/tree), T_3 – RDF + 100% MN Mixture TN Govt. rec.@500g/tree,T_4 – RDF + 125% MN Mixture

[++] Associate Prof. (SS&AC);
[#] Professor & Head;
**Corresponding author: E-mail: janaki.d@tnau.ac.in;*

TN Govt. rec.@500g/tree ,T_5 – RDF + 100% Enriched FYM TN Govt. rec.@500g/tree,T_6 - RDF + 125% Enriched FYM TN Govt. rec.@500g/tree,T_7- RDF +1% foliar spray of 100% MN Mixture Tamil Nadu Government (II approximation) rec .The foliar application of these treatments was made at three times of new flush, 30 and 70 days after flowering. The results revealed that the application of RDF + 100% Enriched FYM TN Govt. rec.@500g/tree recorded highest 50% flowering (33.6%), fruit retention (51.5%), highest yield (42.3 t/ha) and quality parameters like TSS (12.8^{0}brix) and lowest acidity (0.42%) followed by treatment RDF + 125% MN Mixture TN Govt. rec.@500g/tree and the same treatment recorded the BC ratio of 3.64 while the control with BC ratio of 2.75.

Keywords: Salt affected soils; guava; micronutrient mixture; recommended dose of fertilizers (RDF).

1. INTRODUCTION

"The area under guava in India is 235.6 thousand ha and production is 3198.3 thousand metric tonnes with a productivity of 13.6 metric tonnes/ha. (Horticulture Statistics at a glance, 2018) Micronutrient plays an important role in production and its deficiency leads in lowering the productivity" [1].

"Guavas are extremely resilient, long-lived, and require comparatively little maintenance.. Guava is rich source of vitamin C, vitamin A, vitamin B12 (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%)" [2]. A prevalent physiological problem identified in guava is micronutrient insufficiency. Zinc deficiency causes "rosette" production, intervenal cholorosis, and small leaves and confined internodes. In regions where there is a lot of water, this happens frequently. Spraying 500g of zinc sulfate and 350g of slaked lime dissolved in 72 liters of water will cure this condition. Two of these sprayings must be administered at intervals of 15 to 30 days [3].

Guava has delightful taste and flavour. It is the fruit that has been often referred as "Apple of tropics." Bronzing in guava is a complex nutritional disorder When fruiting starts in a soil marginal in P and K, the nutrients are mobilised from older leaves to the fruits, causing bronze coloured Micronutrients like Fe, Zn, B, Cu, Mn, Mo and Cl plays a vital role in plants. Micronutrients can be applied to plants by soil and foliar application. Foliar application of micronutrients is more successful than soil application.

"Spraying of 0.3% boric acid 10-15 days before flowering correct the deficiency. In general, foliar applications of 0.5 per cent zinc sulphate and 0.4 per cent boric acid 10 to 14 days before flowering effectively eliminate the zinc and boron deficiencies" [2]. Hence present investigation was carried out to evaluate the micronutrient mixture in guava on growth, yield andquality.

2. MATERIALS AND METHODS

The field trial was conducted at Horticultural College and Research Institute for Women, Tiruchirappalli,Tamil Nadu during 2020-2021 in clay loam texture with pH -9.23, ESP-36.52%. with GPS of 10.75567 ^{0}N and 78.60093 ^{0}E. The experiment was laid out in Randomized Block Design (RBD) with seven treatments replicated three and ten number of guava per replications plants planted at 3.0 x 2.0m spacing were taken.. The treatments comprised of T_1 – Control, T_2 – RDF alone (300:150:150 g NPK/tree),T_3 – RDF + 100% MN Mixture TN Govt. recommendation @ 500 g/tree ($FeSO_4$-80g,$MnSO_4$ and $ZnSO_4$ each -50 g,$CuSO_4$-10g,Borax-125g,Sodium molybdate-2g /tree) ,T_4 – RDF + 125% MN Mixture TN Govt. rec.@500g/tree ,T_5 – RDF + 100% Enriched FYM (Mixing FYM and MN mixture at 10:1 and incubated for 30 days) TN Govt. MN mixture rec.@500g/tree,T_6 - RDF + 125% Enriched FYM TN Govt. rec.@500g/tree,T_7- RDF +1% foliar spray of 100% MN Mixture Tamil Nadu Govt (II approximation.) recommendation . The foliar application of these treatments was made at three times of new flush, 30 and 70 days after flowering. The initial soil sample was collected and analysed for its physico-chemical properties. The growth parameters like 50% flowering, fruit retention was recorded, the yield and quality parameters like reducing, non-reducing sugar were analyzed and based on the performance cost economics was worked out.

3. RESULTS AND DISCUSSION

1. Initial Soil Characteristics of the experimental field

The soil texture was clay loam with Alathur soil series. The initial soil with pH of 9.23 and

Electrical Conductivity of 0.17 dS m^{-1} with Exchangeable Sodium Percentage of 36.5%. The available N was low (184 Kg ha^{-1}), medium in available P (21.0 kg ha^{-1}) (Table 1). The available K was medium (232 kg ha^{-1}). The available micronutrients Fe was 3.52 ppm, deficit in Zn (0.71ppm), the available Cu and Mn was 0.42ppm and 0.39 ppm respectively.

2. Floral Characters

The results indicated significant differences in Micronutrient mixture on flower characters as represented in Table 2. As regards to the number of flowering %, the treatment T_5 - RDF + 100% Enriched FYM TN Govt. rec.@500g/tree application recorded the maximum flowering % of 33.6% over the control which recorded 26.4%. The data on fruit retention% revealed that the treatment T_5 - RDF + 100% Enriched FYM TN Govt. rec.@500g/tree registered highest fruit retention% of 51.5 % followed by the treatment T_4 (RDF + 125% MN Mixture TN Govt. rec.@500g/tree) with a value of 48.3%. The treatment control recorded the lowest value of 36.3%. The production of more number of flowers per tree, fruit retention in this treatment could be due to zinc and iron 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. Darshan et al*.* Increase in yield of guava fruits due to foliar application of micronutrients alone along with soil has been reported by several workers from different parts of country viz., Meena et al*.,* [4], Trivedi et al*.,* [5] which supports the results obtained in present investigation.

Table 1. Initial soil characteristics of experimental field

S. No.	Initial Soil Properties	Values	Rating
1	Soil texture	Clay loam –Alathur soil series	
2	ESP (%)	36.52	High
3	Organic carbon(g/kg)	3.9	Low
4	Available Nitrogen (kg ha^{-1})	184	Low
5	Available Phosphorus (kgha^{-1})	21.0	Medium
6	Available Potassium (kgha^{-1})	232	Medium
7	Free $CaCO_{3(}$%)	19.2	Calacareous
8	pH	9.23	Alkali
9	EC(dSm^{-1})	0.17	Low
10	Fe(ppm)	3.52	Low
11	Zn(ppm)	0.71	Low
12	Cu(ppm)	0.42	Low
13	Mn(ppm)	0.39	Low

Table 2. Effect of MN mixture on flower characters in Guava cv Lucknow 49

Treatment	Particulars	Flowering %	Fruit retention %
T_1	Control	26.4	36.3
T_2	RDF alone (300:150:150 g NPK/tree)	27.5	44.1
T_3	RDF + 100% MN Mixture TN Govt. rec.@500g/tree	30.6	47.0
T_4	RDF + 125% MN Mixture TN Govt. rec.@500g/tree	30.9	48.3
T_5	RDF + 100% Enriched FYM TN Govt. rec.@500g/tree	33.6	51.5
T_6	RDF + 125% Enriched FYM TN Govt. rec.@500g/tree	32.3	35.5
T_7	RDF +1% foliar spray of 100%MN Mixture TN Govt (II approxmn.) rec	29.2	45.9
	SED	0.32	0.20
	CD (5%)	0.98	0.43

3. Yield and quality parameters

The yield and quality parameters were recorded as shown in Table 3. As regards to the fruit weight, T_5 - RDF + 100% Enriched FYM TN Govt. rec.@500g/tree application recorded the maximum weight of 174.3g followed by the treatment T_4 (RDF + 125% MN Mixture TN Govt. rec.@500g/tree) with a value of 170.2 g while the control T_1 recorded the value of 145.2 g.

The fruit yield in terms of tones/ha also revealed that the application of T_5 - RDF + 100% Enriched FYM TN Govt. rec.@500g/tree recorded the maximum yield of (42.3 t/ha) followed by T_4 (RDF + 125% MN Mixture TN Govt. rec.@500g/tree) of 41.8 t/ha while the control recorded the lowest value of 30.7 t/ha (Table 3). Increase in yield of guava fruits due to foliar application of micronutrients alone along with soil has been reported by several workers from different parts of country viz., Janaki et al*.,* [2], Trivedi et al*., [*5] which supports the results obtained in present investigation.

Application of RDF along with Micronutrient mixture increased the nutrients availability and increase sucrose content of fruits. Application of RDF + 100% Enriched FYM TN Govt. rec.@500g/tree application recorded highest TSS^0 Brix value of 12.8^0 while the lowest was recorded in the control of 10.9^0 brix while the other treatments recorded the intermediate values. The acidity% was also influenced by different nutrient management practices. The treatments receiving RDF + 100% Enriched FYM TN Govt. rec.@500g/tree recorded the lowest acidity value of 0.42% followed by the next value of RDF + 125% MN Mixture TN Govt. rec.@500g/tree) of 0.48% while the lowest was recorded in control of 0.82%. These findings are in agreement with Rawat et al*.,* [3]. Zagade, [6] reported that foliar application of zinc sulphate reduced the acid content in guava fruits.

4. Fruit Nutrient Analysis

The maximum Fe and Zn content in fruit was recorded in the treatment T_5 (RDF + 100% Enriched FYM TN Govt. rec.@500g/tree) with values of 252 ppm and 17.2 ppm respectively while minimum values of these parameters were noticed in the control T_1 (Farmers practice) with Fe (172 ppm) and Zn (7.50 ppm) while the other treatments shows the intermittent values (Table 4). The maximum Cu and Mn content in fruit was recorded in the treatment T_5 (RDF + 100% Enriched FYM TN Govt. rec.@500g/tree) with values of 6.54ppm and 3.70 ppm respectively while minimum values of these parameters were noticed in the control T_1 (Farmers practice) with Cu(1.80ppm) and Mn(1.40 ppm) while the other treatments shows the intermittent values. The increased in non reducing sugar and total sugar with zinc sulphate alone or in combination with other micronutrients 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,

Table 3. Effect of MN mixture on fruit weight, yield and quality characters in Guava under high density planting cv Lucknow 49

Treatment	Particulars	Yield t/ha	Fruit weight (g)	Acidity (%)	TSS^{0}brix
T_1	Control	30.7	145.2	0.82	10.9
T_2	RDF alone (300:150:150 g NPK/tree)	36.6	155.1	0.76	11.3
T_3	RDF + 100% MN Mixture TN Govt. rec.@500g/tree	41.2	165.2	0.72	12.2
T_4	RDF + 125% MN Mixture TN Govt. rec.@500g/tree	41.8	170.2	0.48	12.4
T_5	RDF + 100% Enriched FYM TN Govt. rec.@500g/tree	42.3	174.3	0.42	12.8
T_6	RDF + 125% Enriched FYM TN Govt. rec.@500g/tree	40.1	160.3	0.58	12.3
T_7	RDF +1% foliar spray of 100% MN Mixture TN Govt(II approxmn.) rec	39.5	158.2	0.60	12.0
	SEd	0.84	0.32	0.10	0.08
	CD(5%)	1.72	0.70	0.23	0.12

Table 4. Effect of MN mixture on Fe, Zn, Cu and Mn content in Guava fruit

T. No.	Treatment Details	Fe (ppm)	Zn (ppm)	Cu(ppm)	Mn(ppm)
T_1	Control	172.00	7.50	1.80	1.40
T_2	RDF alone (300:150:150 g NPK/tree)	194.00	9.80	2.40	1.50
T_3	RDF + 100% MN Mixture TN Govt. rec.@500g/tree	258.00	15.60	4.20	2.85
T_4	RDF + 125% MN Mixture TN Govt. rec.@500g/tree	245.00	16.10	5.80	3.10
T_5	RDF + 100% Enriched FYM TN Govt. rec.@500g/tree	252.00	17.20	6.54	3.70
T_6	RDF + 125% Enriched FYM TN Govt. rec.@500g/tree	235.80	14.82	4.40	2.90
T_7	RDF +1% foliar spray of 100% MN Mixture TN Govt(II approxmn.) rec	203.00	11.50	2.27	2.10
	Mean	235.80	14.82	4.40	2.90
	SEd	2.01	0.16	0.08	0.03
	CD(5%)	4.39	0.22	0.11	0.05

Table 5. Cost Economics of MN mixture in Guava

Treatment	Particulars	Yield (t/ha)	B: C ratio
T_1	Control	30.7	2.75
T_2	RDF alone (300:150:150 g NPK/tree)	36.6	2.96
T_3	RDF + 100% MN Mixture TN Govt. rec.@500g/tree	41.2	3.45
T_4	RDF + 125% MN Mixture TN Govt. rec.@500g/tree	41.8	3.51
T_5	RDF + 100% Enriched FYM TN Govt. rec.@500g/tree	42.3	3.64
T_6	RDF + 125% Enriched FYM TN Govt. rec.@500g/tree	40.1	3.21
T_7	RDF +1% foliar spray of 100% MN Mixture TN Govt(II approxmn.) rec	39.5	3.01

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. These findings are in agreement with Rawat et.al. [3] and Suman et al. [7].

5. Cost Economics

Based on the yield obtained, cost economics was worked out best treatment. Based on the cost economics worked out, it is found that the Treatment T_5 (RDF + 100% Enriched FYM TN Govt. rec.@500g/tree) recorded the highest BC ratio of 3.64 while the control with BC ratio of 2.75 [8,9].

4. CONCLUSION

Application of Recommended dose of fertilizers (RDF- 300:150:150 g NPK/tree) + 100% Enriched FYM TN Govt. recommendation.@500g/tree recorded highest 50% flowering (33.6%), fruit retention (51.5%), highest yield (42.3 t/ha) and quality parameters like TSS (12.8^0brix) and lowest acidity (0.42%) and the same treatment recorded the BC ratio of 3.64 which was followed by treatment RDF + 125% MN Mixture TN Govt. recommendation @500g/tree.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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