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Effect of multimicronutrient mixture on soil and leaf nutrient status of guava (*Psidium guajava* L.) cv. Lucknow 49

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Abstract

The research experiment carried out on 'Effect of multimicronutrient mixture on growth, yield and quality of guava (*Psidium guajava* L.) cv. Lucknow 49' was carried out during the *Kharif* season of 2023 and 2024 at Horticulture Research Farm, Anand Agricultural University, Anand (Gujarat). The study followed a Completely Randomized Design (CRD) with ten treatments and three replication. Application of different multimicronutrient mixture grade according to the treatments. Soil application was given at on set of monsoon and foliar application was given at fruit setting stage and 30 day after fruit setting stage. In the pooled analysis, T₁₀ (Foliar spray of 1% multimicronutrient mixture grade-IV & 125 g/tree soil application of multimicronutrient mixture grade-V) recorded highest soil nutrient content available iron (6.90 mg/kg) and available zinc (0.99 mg/kg) after two years of experiment. Important parameters related to leaf nutrition status, viz., Fe (150.29 mg/kg), Mn (59.09 mg/kg), Zn (41.67 mg/kg), Cu (10.79 mg/kg) and B (56.13 mg/kg) in T₁₀ (Foliar spray of 1% multimicronutrient mixture grade-IV & 125 g/tree soil application of multimicronutrient mixture grade-V) after foliar spray recorded significant maximum in pooled values. However, the Fe, Mn, Zn, Cu and B content in leaf of guava before foliar spray were found non-significant.

Keywords: Guava, multimicronutrient mixture, foliar application, soil application, grade

Introduction

Guava plant is hardy in nature, prolific bearer and highly remunerative even without much care. It has a high adaptability to wide ranges of soil and climatic conditions compared to other fruit crops. It can be grown in soil with the pH range from 4.5 to 8.2. Thus, it is possible for a marginal farmer to raise the crop even under adverse soil and water condition, but it is highly sensitive to water logging and frost. However, good management practices give a high profit return.

Soil application of micronutrient is important for recover the trees from noticed deficiency for healthy growth of tree and could achieve a good yield with excellent fruit quality. Soil application of micronutrient is also improved physico-chemical properties of soil as well as nutrient content and also improved soil fertility.

Foliar application is based on the principle that the nutrients are quickly absorbed by leaves and transported to different part of the plant to fulfill the functional requirement of nutrition. Foliar application of the nutrient is obviously an ideal way to avoiding the problem of nutrient availability. This method is highly helpful for the correction of trace element deficiencies to restore disrupted nutrient supply and to overcome stress factors limiting their availability. Foliar application is based on the principle that the nutrients are quickly absorbed by leaves and transported to different parts of the plant to fulfil the functional requirement of nutrition.

In dry land, fruit crops depend on rainfall which is uncertain in most of the cases and the plants find it difficult to absorb nutrients from the soil, which leads to nutrient deficiencies in fruit crops. Soil and the foliar application of nutrients will be a viable option to mitigate nutrient deficiencies for optimising production under such conditions.

Materials and Methods

The research work was conducted on 5 year old guava trees of Lucknow-49 variety located at

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Horticulture Research Farm of Anand Agricultural University, Anand, Gujarat. viz., T₁ - Control, T₂ - Foliar spray of 2% multimicronutrient mixture grade-I, T₃ - Foliar spray of 2% multimicronutrient mixture grade-II, T₄ - Foliar spray of 2% multimicronutrient mixture grade-III, T₅ - Foliar spray of 2% multimicronutrient mixture grade-IV, T₆ - 250 g/tree soil application of multimicronutrient mixture grade-V, T₇ - Foliar spray of 1% multimicronutrient mixture grade-I & 125 g/tree soil application of multimicronutrient mixture grade-V, T₈ - Foliar spray of 1% multimicronutrient mixture grade-II & 125 g/tree soil

application of multimicronutrient mixture grade-V, T₉ - Foliar spray of 1% multimicronutrient mixture grade-III & 125 g/tree soil application of multimicronutrient mixture grade-V, T₁₀ - Foliar spray of 1% multimicronutrient mixture grade-IV & 125 g/tree soil application of multimicronutrient mixture grade-V. There are ten treatments and three replication the data of various soil and leaf nutrient content for both the years was appropriately computed, tabulated, pooled and analyzed by applying Completely Randomized Design (CRD).

Table 1: Composition of multimicronutrient mixture grades

Sr. No.	Content (%)					
	Grade	Iron	Manganese	Zinc	Copper	Boron
For Foliar Spray						
1	Grade-I (General)	2.0	0.5	4.0	0.3	0.5
2	Grade-II (for Zn deficiency)	2.0	0.5	8.0	0.5	0.5
3	Grade -III (for Fe deficiency)	6.0	1.0	4.0	0.3	0.5
4	Grade-IV (for Zn & Fe deficiency)	4.0	1.0	6.0	0.5	0.5
For Soil Application						
5	Grade-V (Soil Application)	2.0	0.5	5.0	0.2	0.5

Soil application was given at on set of monsoon and foliar application was given at fruit setting stage and 30 day after fruit setting stage. The different fruit yielding characters are fruit

length, fruit diameter, fruit weight, fruit volume, number of fruits per tree and fruit yield per tree.

Table 2: Method of analysis soil and leaf nutrient

Sr. No.	Content	Method of analysis
1.	Soil Fe (ppm)	Extractable DTPA (Lindsay and Norvell, 1978) ^[5]
2.	Soil Zn (ppm)	
3.	Soil Mn (ppm)	
4.	Soil Cu (ppm)	
5.	Soil B (ppm)	Hot water soluble-B, Azomethine-H method (Gupta, 1967) ^[2]
6.	Estimation of Zn, Fe, Mn and Cu from leaves	Jackson, 1973 ^[3]
7.	Estimation of boron (B) from leaves	Dry Ashing, Azomethine – H method (Gupta, 1967) ^[2]

Results and Discussion

The results obtained from the research experiment on ‘Effect of multimicronutrient mixture on growth, yield and quality of guava (*Psidium guajava* L.) cv. Lucknow 49’ are presented in Table 3, 4, 5 and 6.

Soil iron (mg/kg)

The data revealed that there were no significant differences found with application of different grades of multimicronutrients mixtures treatments in respect to iron content in soil at initial. The significantly maximum iron content in soil after harvest of guava fruit (6.90 mg/kg) was observed with treatment T₁₀ (Foliar spray of 1% multimicronutrient mixture grade-IV & 125 g/tree soil application of multimicronutrient mixture grade-V) and it was statistically superior over all the treatments. It might be due to micronutrient improved plant vigor leads to better root growth and the secretion of organic acids. These exudates can help solubilize and recycle nutrients within the rhizosphere, maintaining higher available levels in the soil. The foliar fertilization can increase soil biological parameters like microbial

biomass carbon, which supports better nutrient cycling so that increase in Fe content in soil. Similar results finding by Vikas *et al.* (2020) ^[7] in guava, Kacha *et al.* (2021) ^[4] in mango and Savdhariya *et al.* (2024) ^[6] in sapota.

Soil zinc (mg/kg)

The observed results show that there were no significant differences found with application of different grades of multimicronutrient mixtures treatments in respect to zinc content in soil at initial. The significantly highest zinc content in soil after harvest of guava fruit (0.99 mg/kg) was registered with treatment T₁₀ (Foliar spray of 1% multimicronutrient mixture grade-IV & 125 g/tree soil application of multimicronutrient mixture grade-V) and it was statistically superior over all the treatments. It might be due to micronutrients zinc are critical for the enzymes used by soil microorganisms. Increased microbial activity supports better nutrient cycling, ensuring that the zinc added to the soil remains in a stable but available state cause increase in Zn content in soil. Similar results finding by Vikas *et al.* (2020) ^[7] in guava, Kacha *et al.* (2021) ^[4] in mango and Savdhariya *et al.* (2024) ^[6] in sapota.

Table 3: Effect of multimicronutrient mixture on iron and zinc content in soil after two years of experiment in orchard of guava cv. Lucknow 49

Treat. No.	Treatments details	Iron (mg/kg)		Zinc (mg/kg)	
		Initial	After harvest	Initial	After harvest
T ₁	Control	5.90	5.50	0.80	0.70
T ₂	Foliar spray of 2% multimicronutrient mixture Grade-I	5.70	5.70	0.80	0.72
T ₃	Foliar spray of 2% multimicronutrient mixture Grade-II	5.70	5.80	0.81	0.96
T ₄	Foliar spray of 2% multimicronutrient mixture Grade-III	5.80	6.70	0.82	0.78
T ₅	Foliar spray of 2% multimicronutrient mixture Grade-IV	5.70	6.10	0.74	0.79
T ₆	250 g/tree Soil application of multimicronutrient mixture Grade-V	5.90	5.90	0.82	0.75
T ₇	Foliar spray of 1% multimicronutrient mixture Grade-I & 125 g/tree Soil application of multimicronutrient mixture Grade-V	6.00	5.90	0.82	0.74
T ₈	Foliar spray of 1% multimicronutrient mixture Grade-II & 125 g/tree Soil application of multimicronutrient mixture Grade-V	5.90	6.30	0.81	0.89
T ₉	Foliar spray of 1% multimicronutrient mixture Grade-III & 125 g/tree Soil application of multimicronutrient mixture Grade-V	6.00	6.60	0.82	0.78
T ₁₀	Foliar spray of 1% multimicronutrient mixture Grade-IV & 125 g/tree Soil application of multimicronutrient mixture Grade-V	5.80	6.90	0.84	0.99
S.Em ±		0.17	0.19	0.03	0.03
C. D. (P=0.05)		NS	0.55	NS	0.08
C.V.%		5.12	5.23	5.86	5.82

Table 4: Effect of multimicronutrient mixture on iron and manganese content in leaf of guava cv. Lucknow 49

Treat. No.		Iron (mg/kg)						Manganese (mg/kg)					
		Before foliar application			After foliar application			Before foliar application			After foliar application		
		2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled
T ₁		116.46	116.09	116.27	118.93	118.60	118.76	35.77	35.54	35.66	40.50	39.74	40.12
T ₂		117.88	117.74	117.81	120.07	119.22	119.65	36.31	36.14	36.23	41.66	40.59	41.12
T ₃		117.61	117.77	117.69	121.93	122.14	122.04	36.40	36.10	36.25	42.55	42.15	42.35
T ₄		118.54	118.64	118.59	146.62	147.18	146.90	36.91	36.44	36.68	56.22	56.52	56.37
T ₅		120.66	120.50	120.58	123.86	124.76	124.31	39.09	38.83	38.96	43.59	42.60	43.10
T ₆		120.07	120.37	120.22	131.94	131.08	131.51	38.88	38.88	38.88	45.68	44.27	44.97
T ₇		119.05	119.11	119.08	134.09	133.83	133.96	37.89	36.89	37.39	46.29	45.43	45.86
T ₈		119.11	119.47	119.29	135.00	134.68	134.84	39.26	38.93	39.10	50.53	49.24	49.89
T ₉		120.10	120.15	120.13	136.25	137.96	137.11	39.34	38.09	38.72	53.19	52.52	52.86
T ₁₀		122.67	122.93	122.80	150.22	150.37	150.29	39.42	39.04	39.23	59.72	58.45	59.09
T	S.Em ±	3.83	3.74	2.68	4.17	4.02	2.90	1.48	1.42	1.03	1.43	1.54	1.05
	C. D. (P=0.05)	NS	NS	NS	12.31	11.87	8.28	NS	NS	NS	4.22	4.54	3.00
Y	S.Em ±	-	-	1.20	-	-	1.30	-	-	0.46	-	-	0.47
	C. D. (P=0.05)	-	-	NS	-	-	NS	-	-	NS	-	-	NS
YXT	S.Em ±	-	-	4.64	-	-	5.02	-	-	1.78	-	-	1.82
	C. D. (P=0.05)	-	-	NS	-	-	NS	-	-	NS	-	-	NS
C.V.%		5.57	5.43	5.50	5.48	5.28	5.38	6.76	6.57	6.67	5.16	5.65	5.41

Table 5: Effect of multimicronutrient mixture on zinc and copper content in leaf of guava cv. Lucknow 49

Treat. No.		Zinc (mg/kg)						Copper (mg/kg)					
		Before foliar application			After foliar application			Before foliar application			After foliar application		
		2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled
T ₁		28.86	28.98	28.92	31.54	31.67	31.60	7.05	7.13	7.09	7.71	7.66	7.68
T ₂		29.12	29.19	29.16	32.26	32.24	32.25	7.36	7.40	7.38	7.93	7.87	7.90
T ₃		30.01	30.12	30.07	41.34	41.42	41.38	7.38	7.81	7.60	9.31	9.34	9.33
T ₄		30.13	30.29	30.21	34.61	34.46	34.54	7.46	7.05	7.26	8.78	8.76	8.77
T ₅		30.56	30.77	30.67	34.45	34.48	34.47	7.23	7.08	7.16	8.04	8.11	8.08
T ₆		30.76	30.95	30.86	36.61	36.78	36.70	7.34	7.27	7.30	8.25	8.29	8.27
T ₇		31.00	31.21	31.11	37.17	37.09	37.13	7.46	7.33	7.39	8.48	8.53	8.50
T ₈		31.81	31.78	31.79	41.47	41.54	41.51	7.49	8.04	7.76	8.86	8.83	8.84
T ₉		31.28	31.02	31.15	38.10	37.36	37.73	7.38	7.57	7.48	8.64	8.66	8.65
T ₁₀		32.09	31.95	32.02	41.64	41.69	41.67	7.80	8.12	7.96	10.77	10.81	10.79
T	S.Em ±	1.07	1.01	0.74	1.12	1.33	0.87	0.26	0.28	0.19	0.34	0.35	0.24
	C. D. (P=0.05)	NS	NS	NS	3.30	3.92	2.49	NS	NS	NS	1.01	1.02	0.70
Y	S.Em ±	-	-	0.33	-	-	0.39	-	-	0.08	-	-	0.11
	C. D. (P=0.05)	-	-	NS	-	-	NS	-	-	NS	-	-	NS
YXT	S.Em ±	-	-	1.27	-	-	1.51	-	-	0.33	-	-	0.42
	C. D. (P=0.05)	-	-	NS	-	-	NS	-	-	NS	-	-	NS
C.V.%		6.06	5.73	5.89	5.26	6.25	5.77	6.09	6.37	6.24	6.84	6.88	6.86

Table 6: Effect of multimicronutrient mixture on boron content in leaf of guava cv. Lucknow 49

Treat. No.	Treatments details	Boron (mg/kg)					
		Before foliar application			After foliar application		
		2023	2024	Pooled	2023	2024	Pooled
T ₁	Control	45.39	43.73	44.56	45.37	44.76	45.07
T ₂	Foliar spray of 2% multimicronutrient mixture Grade-I	46.26	45.13	45.70	46.20	46.00	46.10
T ₃	Foliar spray of 2% multimicronutrient mixture Grade-II	46.94	46.81	46.88	47.03	46.78	46.90
T ₄	Foliar spray of 2% multimicronutrient mixture Grade-III	46.12	47.56	46.84	47.51	48.15	47.83
T ₅	Foliar spray of 2% multimicronutrient mixture Grade-IV	46.96	46.72	46.84	48.10	50.51	49.30
T ₆	250 g/tree Soil application of multimicronutrient mixture Grade-V	47.23	47.06	47.14	49.32	51.29	50.30
T ₇	Foliar spray of 1% multimicronutrient mixture Grade-I & 125 g/tree Soil application of multimicronutrient mixture Grade-V	46.33	46.66	46.50	47.39	48.80	48.10
T ₈	Foliar spray of 1% multimicronutrient mixture Grade-II & 125 g/tree Soil application of multimicronutrient mixture Grade-V	46.85	47.20	47.02	46.65	47.37	47.01
T ₉	Foliar spray of 1% multimicronutrient mixture Grade-III & 125 g/tree Soil application of multimicronutrient mixture Grade-V	50.10	48.43	49.26	47.90	48.87	48.39
T ₁₀	Foliar spray of 1% multimicronutrient mixture Grade-IV & 125 g/tree Soil application of multimicronutrient mixture Grade-V	48.34	48.15	48.25	55.01	57.24	56.13
T	S.Em ±	1.38	1.56	1.04	1.55	1.62	1.12
	C. D. (P =0.05)	NS	NS	NS	4.57	4.79	3.21
Y	S.Em ±	-	-	0.47	-	-	0.50
	C. D. (P =0.05)	-	-	NS	-	-	NS
YXT	S.Em ±	-	-	1.80	-	-	1.94
	C. D. (P =0.05)	-	-	NS	-	-	NS
C.V.%		5.09	5.78	5.44	5.59	5.74	5.66

Leaf iron (mg/kg)

The result revealed that there was non-significant effect of application of different grades of multimicronutrient mixtures on iron content in guava leaf before spray during both the years of trial as well as in pooled analysis. The result indicated that significantly maximum iron content in guava leaf after spray (150.22 mg/kg, 150.37 mg/kg and 150.29 mg/kg) was recorded in T₁₀ (Foliar spray of 1% multimicronutrient mixture grade-IV & 125 g/tree soil application of multimicronutrient mixture grade-V) during the years 2023, 2024 and in pooled. These results partially agree with those obtained by Vikas *et al.* (2020) ^[7] in guava. They found that ferrous concentration increased more when fertilizer was applied as foliar application than soil application. Similar results found by Abd-Ella and EL-Sisy (2006) ^[1] in fig and reported that micronutrients concentration was increased in all spraying treatments.

Leaf manganese (mg/kg)

The result indicated that the effect of different grades of micronutrients mixtures were found non-significant during both the individual years as well as in pooled analysis. The data revealed that significantly maximum manganese content in guava leaf after spray (59.72 mg/kg, 58.45 mg/kg and 59.09 mg/kg) was registered with treatment T₁₀ (Foliar spray of 1% multimicronutrient mixture grade-IV & 125 g/tree soil application of multimicronutrient mixture grade-V) in both the year of experiments (2023 and 2024) and in pooled analysis. This might be due to manganese was involved in photosynthesis, metabolism of nitrogen and its assimilation. It also activates decarboxylase, dehydrogenase and oxidase enzymes thus, with the increasing dose of nitrogen, manganese content also increased in the leaf. Results are also in accordance with the findings by Vikas *et al.* (2020) ^[7] in guava.

Leaf zinc (mg/kg)

The data shows that the effect of different grades of micronutrients mixtures were found non-significant during both the individual years as well as in pooled analysis. The data shows that significantly maximum zinc content in guava leaf after spray

(41.64 mg/kg, 41.69 mg/kg and 41.67 mg/kg) was recorded significantly maximum in T₁₀ (Foliar spray of 1% multimicronutrient mixture grade-IV & 125 g/tree soil application of multimicronutrient mixture grade-V) during the years 2023, 2024 and in pooled. It might be due to optimal levels of zinc increase uptake of phosphorus. Zinc is a component of dehydrogenases, proteinase and peptidase enzyme. It promotes growth hormones and starch formation and promotes seed maturation. Also, external application of micronutrients which had significantly reflected the increased nutritional status of zinc in guava leaf. Results are also in accordance with the findings by Vikas *et al.* (2020) ^[7] in guava. The present study is partially supported with the findings by Kacha *et al.* (2021) ^[4] in mango and Savdhariya *et al.* (2024) ^[6] in sapota.

Leaf copper (mg/kg)

The data suggested that the effect of different grades of micronutrients mixtures were found non-significant during both the individual years as well as in pooled analysis. Among all the treatments, T₁₀ (Foliar spray of 1% multimicronutrient mixture grade-IV & 125 g/tree soil application of multimicronutrient mixture grade-V) was most effective treatment and which was recorded significantly maximum copper content in guava leaf after spray (10.77 mg/kg, 10.81 mg/kg and 10.79 mg/kg) during the years 2023, 2024 and in pooled. It might be due to foliar spray of micronutrient grades containing copper which absorb by the leaf tissue which is essential for various physiological processes including photosynthesis, enzyme activation and cell wall formation. Results are also in accordance with the findings by Vikas *et al.* (2020) ^[7] in guava. The present study is partially supported with the findings by Kacha *et al.* (2021) ^[4] in mango and Savdhariya *et al.* (2024) ^[6] in sapota.

Leaf boron (mg/kg)

The findings indicate that there was non-significant effect of application of different grades of multimicronutrients mixtures on boron content in guava leaf before spray during both the years of trial as well as in pooled analysis. The evidence reveals that significantly maximum boron content in guava leaf after spray

(55.01 mg/kg, 57.24 mg/kg and 56.13 mg/kg) was recorded significantly maximum in T₁₀ (Foliar spray of 1% multimicronutrient mixture grade-IV & 125 g/tree soil application of multimicronutrient mixture grade-V) during the years 2023, 2024 and in pooled. This might be due to presence of boron binding compounds in the cell which might have increased the mechanism of boron uptake, which is thought to be a non-metabolic process determined in plant by the formation of non-exchangeable boron complexes within the cytoplasm and cell wall. Similar findings were also reported by Vikas *et al.* (2020)^[7] in guava. The present study is partially supported with the findings by Kacha *et al.* (2021)^[4] in mango and Savdhariya *et al.* (2024)^[6] in sapota.

Conclusion

The result obtained from two year research experiment it can be concluded that soil application of 125 g/tree multimicronutrient mixture grade-V at on set of monsoon and foliar spray of 1% multimicronutrient mixture grade-IV at fruit setting stage and 30 day after fruit setting stage was recorded maximum multimicronutrient content viz., iron and zinc in soil as well as iron, manganese, zinc, copper and boron in leaf of guava cv. Lucknow 49.

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