



# Studies on the Effect of Foliar Application of Micronutrients for Growth, Yield, Economic Traits and Leaf Nutrient Content in Cashew (*Anacardium occidentale* L.) Var. VRI 3

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## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

## Article Information

DOI: 10.9734/IJPSS/2023/v35i224113

## Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/107048>

**Original Research Article**

**Received: 01/08/2023**

**Accepted: 07/10/2023**

**Published: 16/11/2023**

## ABSTRACT

The present field experiment on studies on the effect of foliar application of micronutrients for growth, yield, economic traits and leaf nutrient content of cashew var. VRI-3 was carried out at Horticultural College and Research Institute, Periyakulam and an experiment was conducted at a farmer's field at Kandamanur, Theni District during the year 2016 – 2017, 2017 – 2018 and 2018 –

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2019. The objective is to enhance the growth, flowering, nut yield, and economic traits of cashew var. VRI 3. Experiment was laid out in a Randomized Block Design (RBD) with seven treatments and replicated thrice. Foliar application of micronutrients was done three times in a year June – July, October – November and January – February with ten years old randomly selected trees. Experimental results revealed that the highest values of growth, flowering and yield traits were recorded in the treatment T<sub>4</sub> (NPK + micronutrient combination II (Recommended dose of fertilizer along with 0.75 % ZnSO<sub>4</sub> + 0.75 % CuSO<sub>4</sub> + 0.75 % FeSO<sub>4</sub> + 0.2 % MnSO<sub>4</sub> + 0.5 % Boric acid) such as plant height, number of panicle per m<sup>2</sup>, number of fruits per panicle, average apple weight, number of fruits per tree, average nut weight, 100 nut weight, yield per tree, estimated yield and B:C ratio for three years whereas the control (T<sub>1</sub>) registered the lowest values for all the traits were observed. The same trend was noticed in leaf nutrient content. T<sub>4</sub> exhibited the highest values of leaf nutrient content such as N,P,K and micronutrient contents viz., Iron, Zinc, Manganese and Copper whereas the lowest values were recorded in control (T<sub>1</sub>). In the present study it was concluded that the T<sub>4</sub> registered the highest values for growth, yield and economic traits of cashew var. VRI-3.

**Keywords:** Cashew; micronutrients; foliar application; growth; yield; economic traits.

## 1. INTRODUCTION

“Cashew (*Anacardium occidentale* L.) belongs to the family Anacardiaceae and is native to Brazil. India is the largest area holder of cashews. Cultivation of cashews in India is confined mainly to the peninsular areas. It is grown in Kerala, Karnataka, Goa and Maharashtra along the west coast and Tamil Nadu, Andhra Pradesh, Orissa and West Bengal along the east coast. India is the second largest producer of raw cashews in the world, next to Vietnam. Andhra Pradesh has the largest area and Maharashtra ranks first in production and productivity of cashew in India. In Tamil Nadu, cashews mainly cultivated in Ariyalur, Cuddalore, Theni, Perambalur, Pudukottai, Sivagangai, Villupuram, Tirunelveli, Thanjavur, Kanyakumari, Tuticorin, Trichy, Nagapattinam, Dindigul and Kanchipuram districts with an area of 1,04,659 ha. In Theni District, it is cultivated in 4840 ha mainly in Aundipatti and Periyakulam regions. Cashews also cultivated in coastal regions of India mainly for reducing the runoff. In India cashew is generally grown as rainfed crop. Even though cashew is a hardy crop, it responds well to manure” [1], [2]. “Nutrient management is the basic cognitive process of managing the timing, source, amount and method of nutrient application to maximize crop productivity while reducing nutrient losses that could bring up environmental problems. Manuring in cashews is not a regular practice in the existing orchards of India, even though adequate application of fertilizers might be required for cashew for growth and yield. In Tamil Nadu little or no manure and fertilizer application were practiced by most of the farmers. Cashew responds well in fertilizer application. Manures and fertilizers

promote the growth of the plants and advance the onset of flowering in young trees. The ideal period for fertilizer application is immediately after the cessation of heavy rains and with available soil moisture which increases the nut weight and yield. Over the years, the application of micronutrients and exogenous hormones has significantly improved flowering and fruiting in cashews” [3]. Cultivation without manures and fertilizer application resulted in the expression of deficiency symptoms for both major and micronutrients especially N, K, Fe, Zn and B which reduced the yield. Foliar sprays of N as urea combined with an insecticide at the emergence of the flush and again at panicle initiation will ensure a better fruit set and control the major seasonal pests. The problem of declining nut yield has led to an investigation into the effectiveness of micronutrients as foliar applications to improve the fruit set, and fruit retention in cashews. Micronutrient disorders were observed during the early stage as well as the full-grown stage of cashews. The application of micronutrients as foliar spray was more effective in cashews than the soil application. With this background, the present experiment on “Studies on the effect of foliar application of micronutrients for growth, yield and economic traits in cashew (*Anacardium occidentale* L.) var. VRI-3” was conducted at the Department of Spices and Plantation Crops, Horticultural College and Research Institute, Periyakulam during 2016 – 2020.

## 2. MATERIALS AND METHODS

The field experiment was conducted at farmer's field of Kandamanur village, Theni District, Tamil

Nadu. A field survey was conducted in cashew growing areas of Aundipatti Taluk of Theni District and identified the micronutrient problems of cashews before imposing the trial and field was fixed at Kandamanur village. An experiment was taken up on 10-year-old grafted cashew trees cv. VRI-3 with the spacing of 7 x 7 m. The healthy and high-yielding trees were randomly selected and used for this study. The trees were applied with micronutrients as foliar spray at new flush stage (June – July), just before flowering (October - November) and nut development stages (January – February) as four to five litres spray solutions were sprayed in each tree. Trees under control were sprayed with water. The experiment was laid out with a Randomized Block Design (RBD) with seven treatments and replicated thrice [4]. Observations such as plant height (m), number of fruits per panicle, number of panicles per m<sup>2</sup> area, average apple weight (g), apple + nut weight (g), 100 nut weight (g), average nut weight (g), yield per tree (kg tree<sup>-1</sup>), estimated yield (t/ha) and B:C ratio were recorded and analysed statistically. The nitrogen (N) content in the leaf samples was analyzed by the Kjeldahl method [5]. Phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), iron (Fe), manganese (Mn), zinc (Zn) and copper (Cu) were estimated by tri-acid mixture (9:4:1 HNO<sub>3</sub>: HClO<sub>4</sub>: H<sub>2</sub>SO<sub>4</sub>) as per the standard method [6].

### 3. RESULTS AND DISCUSSION

#### 3.1 Vegetative Traits

The present investigation on studies on the effect of micronutrients in cashew of different

combinations of micronutrients on the growth and yield of cashews was conducted during the years 2016-17, 2017-18 and 2018-19. During the year 2016 – 2017, the experimental results revealed that all the vegetative, nuts and yield parameters varied significantly. T<sub>4</sub> (NPK + micronutrient combination II (RDF + 0.75 % ZnSO<sub>4</sub> + 0.75 % CuSO<sub>4</sub> + 0.75 % FeSO<sub>4</sub> + 0.2 % MnSO<sub>4</sub> + 0.5 % Boric acid) recorded the highest values in vegetative traits such as plant height (4.25 m), number of panicles per m<sup>2</sup> area (11.58) and number of fruits per panicle (18.56) followed by T<sub>3</sub> (3.8 m; 9.64; 17.89) whereas the absolute control (T<sub>1</sub> - no foliar spray and application of fertilizers) noticed the lowest values for all the vegetative traits (3.25 m; 7.12; 12.16). The same trend was found in 2017 – 18 as well as 2018-19 also. During the year 2017-18, experimental results revealed that T<sub>4</sub> exhibited the highest values for the traits such as plant height (4.43 m), number of fruits per panicle (19.26) and number of panicles per m<sup>2</sup> area (11.13) whereas the lowest values were found in control (3.47 m; 12.33; 5.67). In the year 2018-2019, experimental results revealed that T<sub>4</sub> registered the highest values of all the vegetative traits such as plant height (4.65 m), number of fruits per panicle (19.67) and number of panicles per m<sup>2</sup> area (11.67) whereas the lowest values were found in control (3.52 m; 12.75; 6.30). In the case of pooled mean, the same trend was noticed. T<sub>4</sub> registered the highest values for the all the vegetative traits whereas the control (T<sub>1</sub>) exhibited the lowest values for all the vegetative traits. Zinc influences the synthesis of carbohydrates and their translocation to storage organs as a result of which fruit set and development is improved [7]. He also stated that

**List 1. Treatment details**

T <sub>1</sub>	Control	: No spray and not application of fertilizers
T <sub>2</sub>	NPK alone	: Recommended dose of fertilizers (RDF) (280:160:240g NPK/tree)
T <sub>3</sub>	NPK + micronutrient combination - I	: RDF + 0.5 % ZnSO <sub>4</sub> + 0.5 % CuSO <sub>4</sub> + 0.5 % FeSO <sub>4</sub> + 0.1 % MnSO <sub>4</sub> + 0.3 % Boric acid
T <sub>4</sub>	NPK + micronutrient combination –II	: RDF + 0.75 % ZnSO <sub>4</sub> + 0.75 % CuSO <sub>4</sub> + 0.75 % FeSO <sub>4</sub> + 0.2 % MnSO <sub>4</sub> + 0.5 % Boric acid
T <sub>5</sub>	NPK + micronutrient combination –III	: RDF + 0.5 % ZnSO <sub>4</sub> + 0.5 % FeSO <sub>4</sub> + 0.5 % urea
T <sub>6</sub>	NPK + micronutrient combination –IV	: RDF + 1.0 % ZnSO <sub>4</sub> + 1.0 % FeSO <sub>4</sub> + 1.0 % urea
T <sub>7</sub>	NPK + micronutrient combination -V	: RDF + 0.5 % ZnSO <sub>4</sub> + 0.5 % FeSO <sub>4</sub> + 0.25 % boric acid

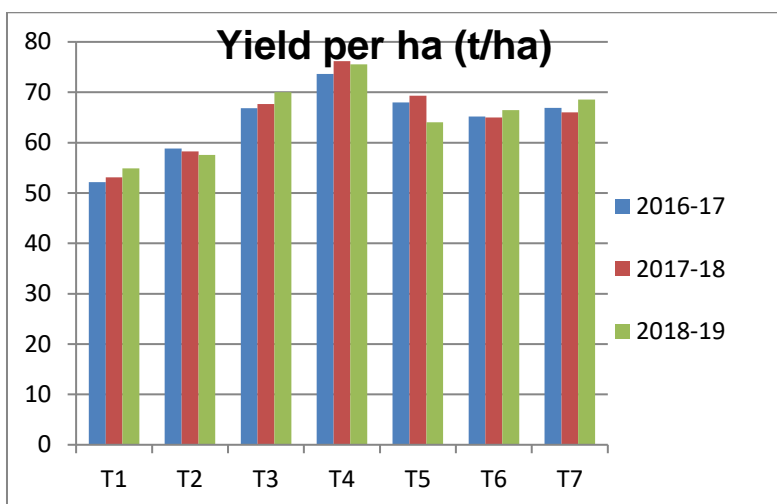


Fig. 1. Bar graph showing yield traits against different treatments

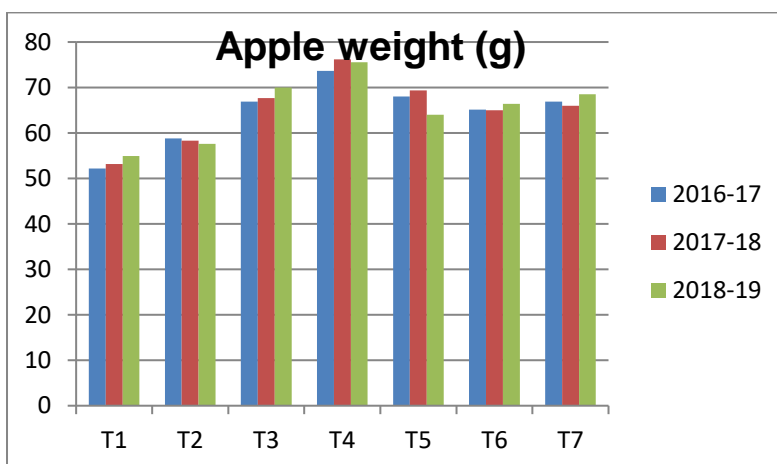


Fig. 2. Bar graph showing apple yield against different treatments

boron also very essential for flower production in cashew. A foliar spray of zinc sulphate was effective in increasing the number of fruits per plant in guava [8]. Boron is needed both at the reproductive stage for pollination and at the maturity stage, to avoid fruit drop and also for mobilization of calcium for better shelf life. Since it is highly immobile in the plant, it is continuously needed. But, reproductive parts need more B than do vegetative parts [9]. Foliar application of micronutrients which enhanced growth traits such as the number of fruits per panicle in cashew [10,11,12].

Regarding nut characters, the experimental results are presented in Table 2. The year 2016 - 17 results revealed that T<sub>4</sub> recorded the highest values for traits such as apple weight (59.66 g), apple + nut weight (67.06 g), 100 nuts weight (671.66), average nut weight (7.40 g) and

number of nuts per kg (151.33) whereas the control (T<sub>1</sub>) registered the lowest values for all the nut characters (52.16 g; 60.10 g; 628.3 g; 6.25 g; 161.83). During the year 2017 – 18, T<sub>4</sub> registered the highest values of the nut characters such as average apple weight (76.17 g), average apple + nut weight (83.62 g), average nut weight (7.45 g), 100 nut weight (674.33 g) and number of nuts per kg (151.33) while the lowest value was observed in control (T<sub>1</sub>) of the traits like apple + nut weight (59.99 g), average apple weight (53.13 g), average nut weight (6.21 g), 100 nut weight (593.67) and number of nuts per kg (162.33). In the case of 2018 -19, the same trend was noticed. T<sub>4</sub> exhibited the highest values of the traits viz., apple + nut weight (80.10 g), average apple weight (75.53 g), average nut weight (7.38 g), 100 nut weight (668.00 g) and number of nuts per kg (149.33) whereas the control (T<sub>1</sub>) found

the lowest values in the traits like apple + nut weight (62.0 g), average apple weight (54.90 g), average nut weight (6.20 g), 100 nut weight (603.0 g) and number of nuts per kg (161.33). According to the pooled mean analysis, results revealed that T<sub>4</sub> recorded the highest values for nut characters such as average apple weight (75.12 g), apple + nut weight (81.593 g), average nut weight (7.41 g), 100 nut weight (671.33) and number of nuts per kg (149.74) which was significantly superior over other treatments. 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. Foliar application of zinc sulphate (0.5 %) + borax (0.1 %) was found to be significantly higher values of nut weight and apple weight under Karnataka conditions [11]. Foliar application of micronutrients has increased nut weight over control [13]. Foliar application of borax had increased fruit weight in mango cv. Himsagar. [14]. Soil application of micronutrients such as Zn, Iron and Boron has enhanced fruit weight in cashew [15].

### 3.2 Yield and Economic Traits

According to the yield and economic traits, during 2016 – 17 experimental results revealed that T<sub>4</sub> recorded the highest values of yield per tree (15.66 kg/tree), estimated yield (2.44 t/ha) and B:C ratio (2.74) whereas the lowest yield traits were found in control (T<sub>1</sub>) (12.08 kg/tree; 1.88 t/ha; 1.75). In the year 2017-18, experimental results revealed that T<sub>4</sub> recorded the highest value of all the traits such as yield per tree (16.30 kg), estimated yield per ha (3.32 t/ha) and B:C ratio (2.75). The lowest value was observed in control (T<sub>1</sub>) of the traits viz., yield per tree (12.93 kg), estimated yield (2.64 t/ha) and B:C ratio (1.75). During the year 2018 – 19, the same trend was noticed. T<sub>4</sub> registered the highest values of the traits like yield per tree (5.23 kg/tree), estimated yield (1.07 t/ha) and B:C ratio (2.76) whereas control (T<sub>1</sub>) recorded the lowest values for the traits such as yield per tree (3.92 kg/tree), estimated yield (0.80 t/ha) and B:C ratio (1.74). According to the pooled mean analysis, T<sub>4</sub> exhibited the highest values in yield per tree (12.40 kg/tree), estimated yield (2.193 t/ha) and B:C ratio of 2.74. The control (T<sub>1</sub>) registered the lowest values of the traits viz., yield per tree (9.64 kg/tree), yield (1.517 t/ha) and B:C ratio (1.75). The improvement in yield due to micro-elements may be ascribed to better photosynthesis, less fruit drop, improved fruit size and fruit weight [16]. Foliar application of

zinc sulphate (0.5 %) + borax (0.1 %) found to be significantly higher values in yield traits under Karnataka conditions [11]. Foliar application of Fe (4.0 %) + Mn (3 %) + Cu (1 %) + Zn (6 %) + Mo (0.05 %) + B (2 %) is beneficial to increased nut yield in cashew var. BPP-8 under Andhra Pradesh conditions [13]. Foliar spraying of micronutrients had 30.5 % higher yield over control [17].

### 3.3 Leaf Nutrient Content

The leaf nutrient content of N, P and K is influenced by different treatments (Table 4). The leaf nutrient content either increased or remained stable during the experiment period in all the NPK along with micronutrient treatments. However, the maximum leaf nitrogen content (0.86 %) was recorded in T<sub>4</sub> (NPK + micronutrient combination II (RDF + 0.75 % ZnSO<sub>4</sub> + 0.75 % CuSO<sub>4</sub> + 0.75 % FeSO<sub>4</sub> + 0.2 % MnSO<sub>4</sub> + 0.5 % Boric acid) whereas the lowest leaf nutrient content were registered in T<sub>1</sub> (control) of 0.40 %. In the case of phosphorus content, T<sub>4</sub> exhibited the highest value of 0.29 % and the lowest phosphorus content was found in control (T<sub>1</sub>) of 0.11 %. Regarding potassium content, the same trend was noticed. T<sub>4</sub> observed the highest content of 0.19 % followed by T<sub>3</sub> (0.18 %) whereas the lowest content was obtained in control (T<sub>1</sub>) of 0.14 %. Among the treatments, the highest yield was obtained in T<sub>4</sub> and leaf nutrient content (N, P and K) were recorded comparatively high in the same treatment. This shows that utilization of applied manures to the maximum extent observed by the plant. Addition of manures add sufficient amount of organic matter to the soil and solubilise plant nutrients and improve physical conditions of the soil by accelerating porosity, aeration and water holding capacity [18].

Considerable difference was noted in the micronutrient concentration in the leaf of cashew. The highest concentration of micronutrient content in cashew leaves recorded the highest T<sub>4</sub> such as in Fe (33.483 ppm), Zn (15.953 ppm), Mn (12.203 ppm) Cu (12.657 ppm) followed by T<sub>3</sub> (32.317 ppm; 15.317 ppm; 11.653 ppm; 12.340 ppm) whereas the lowest micronutrient contents in cashew leaf were observed in control T<sub>1</sub> (25.617 ppm; 12.313 ppm; 9.297 ppm; 10.537 ppm). Variations were found in different micronutrient concentration of cashew leaf under Karnataka conditions [19].

**Table 1. Growth, flowering and fruit characters of cashew var. VRI-3 for three consecutive years (2016 – 2019)**

Treatments	Plant height (m)				No. of fruits per panicle				No. of panicles per m <sup>2</sup>			
	2016-17	2017-18	2018-19	Pooled Mean	2016-17	2017-18	2018-19	Pooled Mean	2016-17	2017-18	2018-19	Pooled Mean
T <sub>1</sub>	3.25	3.47	3.52	3.313	12.16	12.33	12.75	12.413	7.12	5.67	6.30	6.487
T <sub>2</sub>	3.40	3.63	3.79	3.520	15.12	15.32	14.33	14.923	7.39	6.37	8.33	7.363
T <sub>3</sub>	3.80	3.98	4.22	3.987	17.89	17.98	18.67	18.180	9.64	9.00	10.33	9.657
T <sub>4</sub>	4.25	4.43	4.65	4.403	18.56	19.26	19.67	19.163	11.58	11.33	11.67	11.527
T <sub>5</sub>	3.60	3.87	4.13	3.852	16.54	15.96	15.67	16.057	10.12	9.67	8.33	9.373
T <sub>6</sub>	3.55	3.78	4.00	3.764	17.15	17.54	16.00	16.897	8.55	7.67	8.67	8.297
T <sub>7</sub>	3.50	3.77	3.90	3.705	16.19	16.92	17.33	16.813	8.15	6.67	7.57	7.463
Mean	3.621	3.847	4.030	3.792	16.230	16.473	16.346	16.349	8.936	8.054	8.743	8.595
	SED	CD(0.05%)			SED	CD(0.05%)			SED	CD(0.05%)		
Treatment	0.018	0.035			0.776	1.559			0.460	0.926		
Season	0.013	0.024			0.508	1.021			0.302	0.606		
Season x Treatment	0.032	0.069			1.344	2.701			0.797	1.604		

**Table 2. Yield traits of cashew var. VRI-3 for three consecutive years (2016 – 2019)**

Treatments	Apple weight (g)				Apple + Nut weight (g)			
	2016-17	2017-18	2018-19	Pooled Mean	2016-17	2017-18	2018-19	Pooled Mean
T <sub>1</sub>	52.16	53.13	54.90	53.397	60.10	59.99	62.00	60.697
T <sub>2</sub>	58.83	58.27	57.57	58.223	62.26	63.91	65.67	63.947
T <sub>3</sub>	66.86	67.67	70.00	68.177	69.14	74.90	73.53	72.523
T <sub>4</sub>	73.66	76.17	75.53	75.120	81.06	83.62	80.10	81.593
T <sub>5</sub>	68.00	69.33	64.03	67.120	73.96	76.47	71.50	73.977
T <sub>6</sub>	65.16	65.00	66.43	65.530	70.92	72.51	70.00	71.143
T <sub>7</sub>	66.89	66.00	68.53	67.140	69.15	71.97	68.33	69.817
Mean	64.51	65.08	65.28	64.96	69.51	71.91	70.16	70.53
	SED	CD (0.05%)			SED	CD (0.05%)		
Treatment	1.467	2.824			1.071	2.153		
Season	1.053	1.956			0.702	1.409		
Season x Treatment	2.532	5.169			1.855	3.729		

**Table 3. Nut yield of cashew under different treatments for three consecutive years (2016 to 2019)**

Treatments	Average nut weight (g)				Number of nuts per kg				100 nut weight (g)			
	2016-17	2017-18	2018-19	Pooled Mean	2016-17	2017-18	2018-19	Pooled Mean	2016-17	2017-18	2018-19	Pooled Mean
T <sub>1</sub>	6.25	6.21	6.20	6.220	161.83	162.33	161.33	161.830	628.30	593.67	603.00	608.323
T <sub>2</sub>	6.43	6.51	6.29	6.410	159.17	158.67	159.67	159.170	636.66	623.00	617.67	625.777
T <sub>3</sub>	7.28	7.23	7.19	7.233	153.83	156.00	151.67	153.835	661.66	648.67	652.33	654.220
T <sub>4</sub>	7.40	7.45	7.38	7.410	151.33	148.56	149.33	149.740	671.66	674.33	668.00	671.330
T <sub>5</sub>	6.96	7.00	6.61	6.857	155.50	153.33	157.67	155.500	645.0	647.67	646.67	646.447
T <sub>6</sub>	6.76	6.94	6.77	6.823	156.16	156.00	156.33	156.165	651.66	641.00	637.67	643.443
T <sub>7</sub>	6.62	6.64	6.87	6.710	156.67	158.67	154.67	156.670	648.33	631.67	630.15	636.717
Mean	6.81	6.85	6.76	6.81	156.36	156.22	155.81	156.13	649.04	637.14	636.50	640.89
	SED	CD(0.05%)			SED	CD(0.05%)			SED	CD(0.05%)		
Treatment	0.038	0.078				1.115	2.242			2.776	5.580	
Season	0.025	0.051				0.730	1.468			1.817	3.653	
Season x Treatment	0.067	0.135				1.932	3.884			4.808	9665	

**Table 4. Yield and economic traits of cashew var. VRI -3 under different treatments for three consecutive years (2016 to 2019)**

Treatments	Yield per tree (kg)				Yield per ha (t/ha)				B:C ratio			
	2016-17	2017-18	2018-19	Pooled Mean	2016-17	2017-18	2018-19	Pooled Mean	2016-17	2017-18	2018-19	Pooled Mean
T <sub>1</sub>	12.08	12.93	13.21	12.740	1.88	2.54	2.64	2.353	1.75	1.75	1.74	1.75
T <sub>2</sub>	13.40	13.55	13.81	13.587	2.11	2.73	2.76	2.533	2.01	2.11	2.12	2.00
T <sub>3</sub>	15.58	15.77	15.94	15.763	2.43	3.21	3.32	2.987	2.64	2.68	2.69	2.64
T <sub>4</sub>	15.66	15.89	16.38	16.113	2.44	3.30	3.34	3.027	2.74	2.75	2.76	2.74
T <sub>5</sub>	15.30	15.37	15.80	15.490	2.29	3.12	3.03	2.813	2.54	2.58	2.60	2.54
T <sub>6</sub>	14.26	14.83	14.90	14.663	2.22	2.82	2.93	2.657	2.58	2.60	2.61	2.58
T <sub>7</sub>	13.98	14.20	14.63	14.270	2.18	2.77	2.84	2.597	2.48	2.52	2.54	2.48
Mean	14.323	14.707	14.953	14.661	2.221	2.927	2.980	2.710	2.39	2.43	2.44	2.39
	SED	CD (0.05%)			SED	CD(0.05%)						
Treatment	0.168	0.338			0.0594	0.128						
Season	0.110	0.222			0.068	0.0.148						
Season x Treatment	0.292	0.586			0.107	0.215						

**Table 5. Nitrogen, phosphorus and potassium content (%) of cashew leaf for three years (2016 – 2019)**

Treatments	Nitrogen (%)				Phosphorus (%)				Potassium (%)			
	2017	2018	2019	Pooled mean	2017	2018	2019	Pooled mean	2017	2018	2019	Pooled mean
T <sub>1</sub>	1.44	1.46	1.49	1.463	0.071	0.074	0.079	0.075	0.330	0.337	0.340	0.336
T <sub>2</sub>	1.47	1.50	1.56	1.510	0.078	0.079	0.079	0.079	0.368	0.370	0.373	0.370
T <sub>3</sub>	1.52	1.57	1.62	1.570	0.091	0.092	0.093	0.092	0.382	0.385	0.401	0.389
T <sub>4</sub>	1.56	1.59	1.64	1.597	0.097	0.098	0.098	0.098	0.391	0.401	0.408	0.400
T <sub>5</sub>	1.50	1.52	1.59	1.537	0.087	0.089	0.090	0.089	0.380	0.381	0.384	0.382
T <sub>6</sub>	1.48	1.52	1.58	1.527	0.081	0.084	0.087	0.084	0.378	0.380	0.381	0.380
T <sub>7</sub>	1.50	1.53	1.57	1.533	0.084	0.086	0.089	0.086	0.374	0.376	0.379	0.376
Mean	1.496	1.527	1.579	1.534	0.084	0.086	0.088	0.086	0.372	0.376	0.381	0.376
SEd	0.038	0.017	0.018		0.078	0.183	0.184		0.018	0.014	0.015	
CD (0.05)	0.074	0.039	0.039		0.129	0.041	0.040		0.035	0.027	0.028	
	SEd	CD (0.05)			SEd	CD (0.05)			SEd	CD (0.05)		
Treatment	0.031	0.0691			0.0018	0.0027			0.0062	0.0134		
Season	0.0238	0.0520			0.0019	0.0030			0.0089	0.0193		
Treatment x Season	0.0634	0.128			0.0039	0.0059			0.0092	0.0201		



**Table 6. Different micronutrients concentrations of cashew leaf for three years (2016 – 2019)**

Treatments	Fe content (ppm)				Zn content (ppm)				Mn content (ppm)				Cu content (ppm)			
	2017	2018	2019	Pooled mean	2017	2018	2019	Pooled mean	2017	2018	2019	Pooled mean	2017	2018	2019	Pooled mean
T <sub>1</sub>	25.34	25.61	25.90	25.617	12.11	12.36	12.48	12.313	9.07	9.28	9.54	9.297	10.25	10.64	10.72	10.537
T <sub>2</sub>	26.54	27.10	27.80	27.147	12.79	13.54	13.9	13.410	9.58	9.65	10.15	9.793	10.80	10.95	11.10	10.950
T <sub>3</sub>	32.10	32.40	32.45	32.317	15.17	15.31	15.47	15.317	11.57	11.61	11.78	11.653	12.10	12.40	12.52	12.340
T <sub>4</sub>	33.14	33.58	33.73	33.483	15.42	15.86	16.58	15.953	12.08	12.18	12.35	12.203	12.35	12.64	12.98	12.657
T <sub>5</sub>	31.25	31.41	31.58	31.413	14.52	14.84	15.27	14.877	10.85	10.97	11.21	11.010	11.87	11.96	12.10	11.977
T <sub>6</sub>	27.40	29.41	31.25	29.353	14.13	14.22	14.82	14.390	10.11	10.23	10.54	10.293	11.40	11.54	11.67	11.537
T <sub>7</sub>	28.22	28.10	28.31	28.203	13.9	14.25	14.74	14.297	9.87	10.14	10.25	10.087	11.02	11.25	11.38	11.217
Mean	29.141	29.659	30.146	29.648	14.006	14.340	14.751	14.365	10.447	10.580	10.831	10.619	11.399	11.626	11.781	11.602
SEd	0.018	0.025	0.052		0.013	0.021	0.032		0.02	0.019	0.016		0.013	0.015	0.021	
CD (0.05)	0.040	0.056	0.113		0.028	0.038	0.070		0.44	0.40	0.034		0.029	0.031	0.045	
	SEd	CD(0.05)		SEd	CD(0.05)		SEd	CD(0.05)	SEd	CD(0.05)		SEd	CD(0.05)			
Treatment	0.027	0.054		0.704	1.408		0.0042	0.0084				0.647	1.220			
Season	0.013	0.025		0.490	0.968		0.0021	0.0041				0.412	0.818			
Treatment x Season	0.045	0.089		1.321	2.548		0.0072	0.0140				1.265	2.420			

#### 4. CONCLUSION

The present experiment it was concluded that T<sub>4</sub> foliar application of micronutrients along with recommended dose of fertilizers (RDF + 0.75 % ZnSO<sub>4</sub> + 0.75 % CuSO<sub>4</sub> + 0.75 % FeSO<sub>4</sub> + 0.2 % MnSO<sub>4</sub> + 0.5 % Boric acid) recorded the highest values of growth, yield and economic traits of cashew for three years. Foliar application of micronutrients along with recommended dose of fertilizers will increased yield of 33 per cent over control. Hence this treatment will be recommended to farmers' field adoption during the ensuing year to reduce the micronutrient disorders and enhance the yield.

#### ACKNOWLEDGEMENT

The authors express their profound gratitude to the Tamil Nadu Agricultural University, Coimbatore for necessary funding and facilities for this research.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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