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Exploring the Interplay of Micronutrients in Enhancing Tree Mulberry Growth, Yield and Sericultural Success Across Diverse Nutrient Regimens

Devamani Mahadevaswamy*[1], Dhahira Beevi Nagoorgani[2] and Manoj T. S[3]

[1-3] Centre for Higher Studies in Botany and Sericulture (RSRS) (Periyar University), Vaikkalpattarai, Salem-17, Tamil Nadu, India

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Abstract

A research study conducted from 2021 to 2023 at the Regional Sericultural Research Station, Salem, Tamil Nadu, investigated the effects of ten nutrient levels on the growth, yield, and quality of tree mulberry in response to challenges such as water scarcity. T_2 exhibited superior growth and yield parameters, with 33.99 branches per tree, 29.99 leaves per branch, a branch length of 145.35 cm, and leaf/stem yields of 31.21 and 19.89 mt/ha/year, respectively. T_5 showed the best results in silkworm economic parameters, including larval weight (52.83 g), cocoon weight (2.18 g), shell weight (0.53 g), shell ratio (24.19%), and filament length (1328 m). Regarding nutrient content, T_5 recorded the highest percentages of N, P, K, S, Ca and Mg (3.88, 0.29, 3.62, 0.29, 3.67, 1.0%). Additionally, sulfur content was similar in T_5 and T_2 (0.29%). Micronutrients such as Zn, Fe, Mn and B were also highest in T_5 (61.24, 148.63, 140.61, and 82.64 ppm). Nutrient uptake analysis revealed that T_2 followed by T_5 had the highest uptake of macro nutrients N, P, K, S, Ca, and Mg (260.82, 18.97, 242.17, 20.05, 250.89, and 75.33 kg/ha/year for T_2 and 237.35, 17.89, 220.65, 19.42, 218.69, and 68.31 kg/ha/year for T_5). The study revealed that T_2 and T_5 exhibited superior performance in tree mulberry plants.

***Key words*:** V_1, Soil, Leaf nutrients, Nutrients uptake, Silkworm

Mulberry cultivation is commonly practiced in three distinct forms, bush, low-cut, and tree, each yielding varying quality outcomes due to rearing techniques [1]. The quality and yield of mulberry leaves have been impacted by changes in water availability and increasing water resource depletion, leading to a reduction in leaf quality. This situation has prompted sericulturists to adapt by reducing the size of mulberry gardens to accommodate water constraints. To address this issue, some farmers have transitioned to cultivating mulberry as small trees, optimizing limited irrigation water and minimizing labor requirements. A spacing of 6'x6' or 8'x8' or 10'x10' with tree heights of 4' to 5' is maintained, both under rainfed and irrigated conditions. This approach facilitates mechanized cultural practices, intercropping, and drip irrigation, effectively reducing labor costs while maintaining leaf quality. Notably, mulberry leaf quality from trees surpasses that of conventional gardens. To ensure the sustained production of high-quality mulberry leaves, adopting the step-up and step-down method of pruning is essential. This technique involves retaining a desired number of branches based on plant spacing, promoting proper shape and size, and creating an umbrella-like crown that exposes shoots to enhanced sunlight and aeration. Successful establishment of a productive tree mulberry garden necessitates planting saplings that are at least 8 months old. Deep-rooted mulberry varieties such as S13, S1635, MSG2, RC1, RC2, RFS175, V1, and Vishala is well-suited for this approach. Overall, the combination of strategic pruning methods and appropriate variety selection contributes to healthy tree mulberry growth and superior leaf quality.

Mulberry trees exhibit exceptional resilience, enduring 20 days of inundation during growth a rarity among xerophytic plants. Their robust water logging tolerance during dormancy further sets them apart. In India, recent decades have witnessed environmental shifts, including erratic monsoons and altered rainfall patterns. These changes have compelled farmers to adopt strategies like reduced planting with wider spacing and improved irrigation methods (AMITs) to maintain quality and quantity of mulberry leaf yield [2]. Mulberry (*Morus* spp.) is a swiftly growing deciduous woody perennial, typically pruned to a bush or dwarf tree form [3]. Spacing and mulberry species significantly impact growth parameters. Notably, Vishwa variety under 4'x4' spacing has shown substantial yield improvement and enhanced phytochemical traits [4-5]. For feeding the Jammu SH6 × NB4D2 hybrid silkworm, the mulberry variety TR-10 both in bush and cultivated tree forms alongside a wild tree of the same age were selected. This selection was based on suitability for the Jammu region [6]. The quality and quantity of mulberry vary based on factors like nutrient supply, soil fertility, climate, and variety. Over 70% of the nutrients needed for silk protein synthesis (Sericin and fibroin) come from mulberry leaves. Leaf nutrient quality viz., crude protein (18.66%), total sugar (3.36%), starch (14.55%), crude fiber (9.32%), CHO (17.91%), moisture content

***Correspondence to:** Devamani Mahadevaswamy, E-mail: devikattani@gmail.com; Tel: +91 9655198107

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(76.52%), and minerals (9.35%) is higher in mulberry trees compared to low-cut and bush forms [1]. A combination of chemical and organic fertilizers, green manuring, and bio-fertilizers has been effective in maintaining consistent crop output over extended periods [7-8]. In tropical regions with abundant solar radiation, FYM decomposition is rapid, and around 80% of applied phosphorus becomes fixed in the soil.

The growth and yield parameters of mulberry, including moisture content and nutrient uptake, exhibited significant improvement when using different genotypes combined with wider spacing and the step-up method of leaf harvesting compared to closer spacing. Additionally, there was a notable increase in silkworm economic parameters, though no significant differences were observed concerning genotypes, spacing, and treatments [9-10]. In studies exploring interactions, no significant difference was found in yield and growth parameters. However, the combination of NPK 150:25:50 kg/ha/year with a spacing of 120 x 90 cm was found to be superior compared to 100:50:50 NPK with a spacing of 90 x 90 cm [11-12]. Closer spacing (60*60cm) resulted in higher leaf moisture, nitrogen uptake, and leaf and stem yield, while wider spacing yielded significantly higher values for other parameters. Notably, wider plant spacing did not favor leaf and shoot yields [13]. Hence, the current study was conducted to investigate the response of the V1 as tree mulberry to different micro-nutrient application levels with 6ˈ x 6ˈ plant spacings and influence on silkworm economic parameters.

MATERIALS AND METHODS

The study was conducted during 2021-2023 at Farmers field, Regional sericultural research station, Salem, Tamil Nadu, India, under irrigated conditions. The experiment took place in an established tree mulberry garden with 6ˈ x 6ˈ spacings. The research followed a Randomized Complete Block Design (RCBD) and included ten treatments with three replications each. Various growth parameters of mulberry trees were assessed, including the number of branches per tree, number of leaves per branch, shoot length, yield, and stem yield. Moisture content was also evaluated 52-60 days after fertilizer application, involving the harvesting of fresh and dry leaf and stem weights from the treated trees (10 trees per replication). Total leaf weight per crop was recorded and subsequently converted into yield per hectare per year. Soil chemical analysis was conducted using established methods: Walkley and Black's method [14] for soil organic carbon, Kjeldhal's method [15] for nitrogen, Olsen *et al*.'s method [16] for phosphorus, Jackson's method [17] for boron and Lindsay and Norvel's method [18] for micronutrient analysis. Each replication consisted of 300 larvae of the silkworm crossbreed (CB), and they were fed three times a day. Bioassays were conducted following the method described by Krishnaswami [19-20]. Data analysis employed the SPSS statistical software, utilizing the Two-way ANOVA method. The details of the treatments are as follows:

Treatment details:

T_1: 100 % RDF (350:140:140 kg NPK/ha/year)

T_2: 100 % RDF + 30 kg /ha/year micronutrients -soil application

T_3: 100 % RDF + 25 kg /ha/year micronutrients -soil application

T_4: 100 % RDF + 20 kg /ha/year micronutrients -soil application

T_5: 100 % RDF + 0.5% micronutrients (Zn, Fe, Mn) + 0.2% Borax- foliar application

T_6: 100 % RDF + 0.25% micronutrients (Zn, Fe, Mn) + 0.1% Borax- foliar application

T_7: 100 % RDF + 0.7% Poshan – foliar application

T_8: 100 % RDF + 3% Panchagavya- soil application

T_9: 100 % RDF + 5% Panchagavya – soil application

T_{10}: Absolute control

Micro and macro nutrients applied in mulberry garden in the form of $ZnSO_4$, $FeSO_4$, $MnSO_4$, Borax, Ammonium Sulphate (Nitrogen-N), Single super phosphate (Phosphorus-P), Murate of Potash (Potash-K) and Poshan purchased from CSR&TI, Mysore. Silkworm parameters calculated by using the formula as followed below:

1. Larval weight (g): The weight of the ten matured larvae were selected randomly for each replication on the 6^{th} day of fifth instar larvae weight will be recorded and expressed in terms of grams.
2. Larval Duration (h): It depicts the larval period from hatching to onset of spinning and it includes both feeding and moulting durations.
3. Cocoon weight (g): 5^{th} day of spinning 10 cocoons were selected randomly from each replication and record weight (g).
4. Pupal weight (g): 5^{th} day of spinning 10 cocoons were selected randomly from each replication. Slightly cut the cocoons and take out pupae then weight(g) recorded.
5. Shell weight (g): Ten cocoons were selected randomly from each replication. Slightly cut the cocoons and remove pupae then weight(g) recorded. It was calculated by using the formula: Cocoon shell weight =Total of cocoon weight-pupal weight
6. Shell ratio (%): $Shellratio = \frac{\text{Shell weight}}{\text{Cocoon weight}} \times 100$
7. Filament Length (m): Ten cocoons were randomly selected from each batch was reeled to find out the filament length of the cocoon using eprouvette and it was determined by adopting the formula:

$$L = R \times 1.125 \text{ m}$$

Where, L = total length of filament / cocoon (m)

R = number of revolutions

1.125 = circumference of eprouvette

8. Denier (d): Weight of the 9000m silk filament is expressed as denier by using the formula:

$$\text{Denier} = \frac{weight\ of\ the\ filament\ (g)}{lenght\ of\ the\ filament\ (m)} \times 9000$$

9. Renditta (kg): The Renditta is expressed as the quantity or kg of green cocoons require to get a kg of raw silk.

$$\text{Rendita} = \frac{Weight\ of\ the\ cocoons}{Weight\ of\ the\ raw\ silk\ reeled}$$

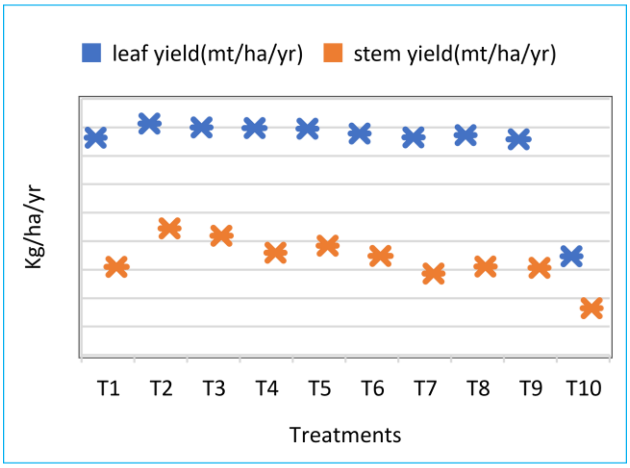
Preparation of Panchagavya

Panchagavya is an organic product that has the potential to promote plant growth and enhance immunity. To prepare Panchagavya, various ingredients are combined in specific proportions. These include fresh cow dung (7 kg), cow urine (3 liters), cow milk (2 liters), curd (2 liters), cow ghee (1 kg), sugarcane juice (3 liters), coconut water (3 liters), banana paste made from 12 fruits, and water (10 liters). The ingredients are mixed in a plastic drum placed in a shaded area and covered with a wire mesh to prevent houseflies from laying eggs. The mixture is stirred thirty times in a clockwise and counter clockwise direction, twice daily. After 18-20 days, the Panchagavya stock solution is ready for use. The prepared Panchagavya stock solution can be applied to the soil at 3% and 5% concentrations for soil application.

Poshan (0.7%): CSRTI, Mysuru has developed a foliar spray with a balanced multi-nutrient formulation for healthy mulberry growth and silkworm nutrition. A single spray is recommended 25-30 days after pruning/picking to address nutrient.

RESULTS AND DISCUSSION

Mulberry cultivating as a large/dwarf tree with the spacing of 6' x 6' or 8' x 8' or 10' x 10' are better suitable plants for conservation of water and soil with small land/area, reduction in runoff during flooding can be up to 10–20% [21]



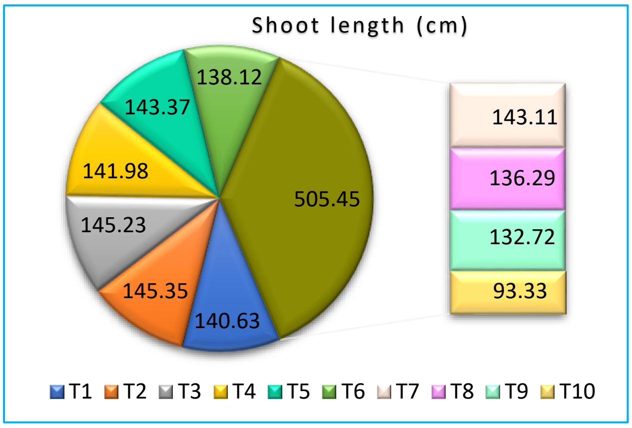
Graph 1 Micronutrients influence on tree mulberry leaf and stem yield

Leaf and stem yield

In terms of treatments, T_2 demonstrated significantly higher leaf yield (36.88 mt/ha/year) and stem yield (19.89 mt/ha/ year), followed by T_3 (36.21 and 18.61 mt/ha/ year). Conversely, leaf and stem yield were lower in T_{10} (17.37 and 10.87 mt/ha/ year) (Graph 1). These observations related to spacing echo the findings of Santhoskumar Magadum *et al.* [24], Vinodkumar *et al.* [25]. No noteworthy differences were noted among treatments regarding leaf and stem yield, in line with the results of Das *et al.* [11], Bongale [13] (Graph 1).

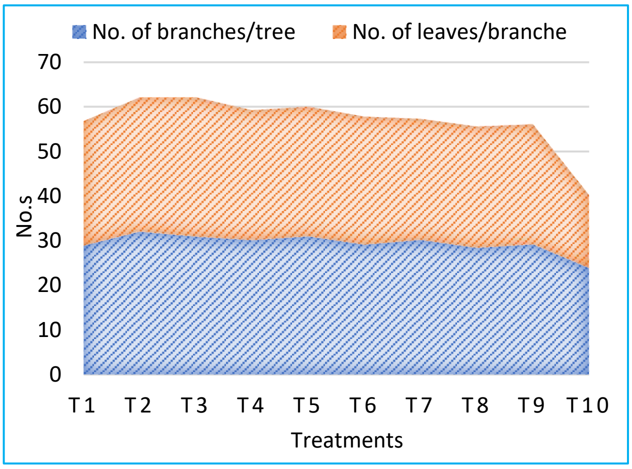
Growth parameters

Among various nutrient levels, T_2 followed by T_3 exhibited significantly higher values for the number of branches per tree (33.99, 33.15), branch length (145.35, 143.37 cm), and leaves per branch (30.10, 29.98), respectively. These results were comparable to other treatments except T_{10}, where growth parameters were comparatively lower (23.90, 119.30 cm, and 21.37). These observations align with the studies conducted by Magadum *et al.* [2], Vinodkumar *et al.* [24], emphasizing the impact of spacing on growth. Interactions among treatments did not yield significant differences in the number of branches per tree, branch length, and leaves per branch, consistent with the findings of Das *et al.* [11], Bongale [13] (Graph 2-3).



Graph 3 Micronutrients influence on tree mulberry shoot length (cm)

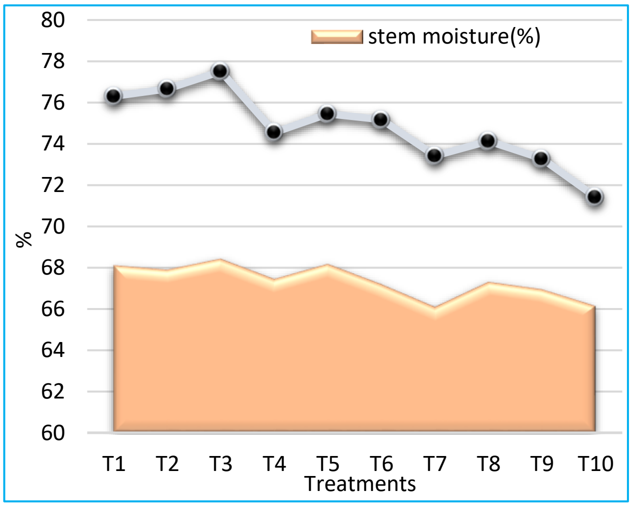
with a crown height of 5' to 6' from the ground level and stem girth of 4 to 5 inches referred to tree mulberry [12], [22]. 3' and 3.5' stump height was the most followed by the farmers as it facilitates them harvesting leaves/shoots and pruning with ease, despite, a study states that 1' to 1.5' stump height is convenient for cultural operations [23].



Graph 2 Micronutrients influence on tree mulberry number of branches per tree and leaves per branch

Leaf and stem moisture

Regarding various nutrient levels, T_3 followed by T_2 registered slightly elevated leaf and stem moisture (77.51%, 76.66% and 68.42%, 68.17%), aligning with all other treatments (Graph 4). No significant distinctions were observed among treatments regarding leaf and stem moisture percentage, in line with the findings of Murthy *et al.* [5], Das *et al.* [11], Bongale [13].



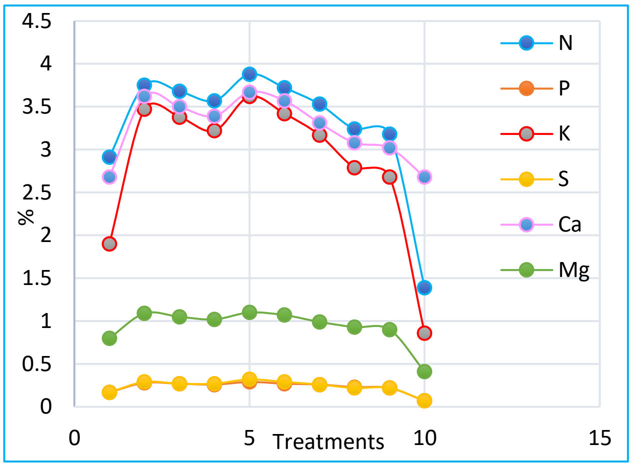
Graph 4 Micronutrients influence on tree mulberry leaf and stem moisture percentage

Leaf nutrient content (%)

Among the ten nutrient levels, T_5 exhibited significantly higher macro nutrient content percentages, including N, P, K, S, Ca, and Mg (3.88, 0.29, 3.62, 0.29, 3.67, 1.10%) followed by T_2 (3.75, 0.28, 3.47, 0.29, 3.62, 1.09%), with similar sulfur content in T_5 and T_2 (0.29%). Conversely, T_{10} recorded significantly lower nutrient content percentages (1.39, 0.07, 0.86, 0.07, 3.02 and 0.41% respectively) (Graph 5). No significant differences were observed among treatments in nutrient content percentages. In terms of micronutrients such as Zn, Fe, Mn and B, T_5 recorded the highest values (61.24, 148.63, 140.61 and 82.64 ppm) followed by T2 (58.63, 144.78, 134.04 and 75.90 ppm), while T_{10} exhibited significantly lower values (6.36, 10.96, 12.18 and 15.72 ppm respectively) (Graph-6). Significant differences were noted among treatments in micronutrient content percentages.

Nutrient uptake (kg/ha/year)

Among the ten nutrient levels, T_2 exhibited the highest macro nutrient uptake in kilograms per hectare per year for N, P, K, S, Ca, and Mg (260.82, 18.97, 242.17, 20.05, 250.89 and 75.33 kg/ha/year) followed by T_5 (237.35, 17.89, 220.65, 19.42, 218.69 and 68.31 kg/ha/year). Similarly, micronutrient uptake including Cu, Zn, Fe, Mn, and B was highest in T_2 (42.97, 484.16, 988.05, 1206.49 and 529.86 g/ha/year) followed by T_5 (40.04, 473.39, 949.61, 1169.36 and 507.19 g/ha/year). Conversely, T_{10} recorded significantly lower nutrient uptake (73.89, 3.54, 48.97, 3.85, 69.17, 20.75 kg/ha/year, and 36.45, 12.86, 61.85, 45.94, 90.30 g/ha/year respectively) (Table 1). No significant differences were observed among the treatments except for T_{10} in terms of nutrient uptake (kg/ha/year).



Graph 5 Macro and secondary nutrients composition percentage in tree mulberry leaf influenced by micronutrients
N-nitrogen, P-phosphorus, K-potash, S-sulphur, Ca-calcium, Mg-magnesium

Table 1 Nutrients uptake of tree mulberry as influenced by different nutrient levels

Treatment	N	P	K	S	Ca	Mg	B	Cu	Zn	Fe	Mn
	Kg/ha/year						g/ha/year				
T_1	149.22	8.51	99.24	8.47	137.02	41.13	209.54	27.58	85.85	161.7	98.09
T_2	260.82	18.97	242.17	20.05	250.89	75.33	529.86	42.97	484.16	988.05	1206.49
T_3	232.74	16.95	215.29	16.95	218.69	65.63	455.79	36.78	257.4	342.95	662.65
T_4	225.66	16.53	204.11	16.78	214.38	64.26	434.21	37.06	258.07	344.29	630.96
T_5	237.35	17.89	220.65	19.42	218.69	68.31	507.19	40.04	473.39	949.61	1169.36
T_6	216.65	15.87	199.05	16.79	208.36	62.5	436.24	35.11	309.2	741.68	744.11
T_7	199.01	14.61	179.42	14.82	185.05	55.47	378.32	32.26	214.79	307.74	488.46
T_8	179.24	12.99	153.35	12.32	172.33	51.7	313.69	32.54	103.19	189.7	99.94
T_9	196.44	13.57	164.83	13.29	186.82	56.11	328.19	35.46	109.44	209.98	115.95
T_{10}	73.89	3.54	48.97	3.85	69.17	20.75	90.3	25.76	12.86	61.85	45.94

Larval weight (g)

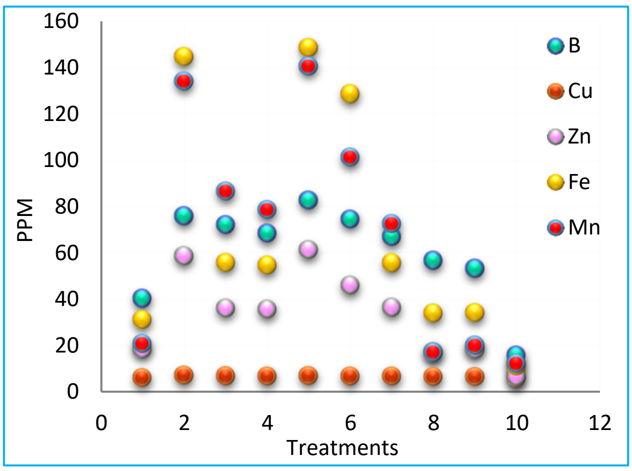
In the experiment, T_5 exhibited the highest larval weights on the 6th day of the 5th instar, with a weight of 52.83g, followed by T_2 with 52.63g. Specifically, among the crops, the fourth crop's T_5 and T_2 treatments displayed the highest larval weights, measuring 56.50g and 56.36g respectively (Table 2). Consistent findings were reported by Sridevi *et al.* [25], Choudhury *et al.* [26], Younus *et al.* [27].

Single cocoon weight (g)

Among the ten nutrient levels tested T_5 followed by T_2 showed significantly higher values in terms of cocoon weight measuring 2.18g and 2.19g respectively. Among the five crops studied, the third crop T_5 and T_2 treatments exhibited relatively higher cocoon weights, measuring 2.54g and 2.32g, respectively (Table 2) [26-31].

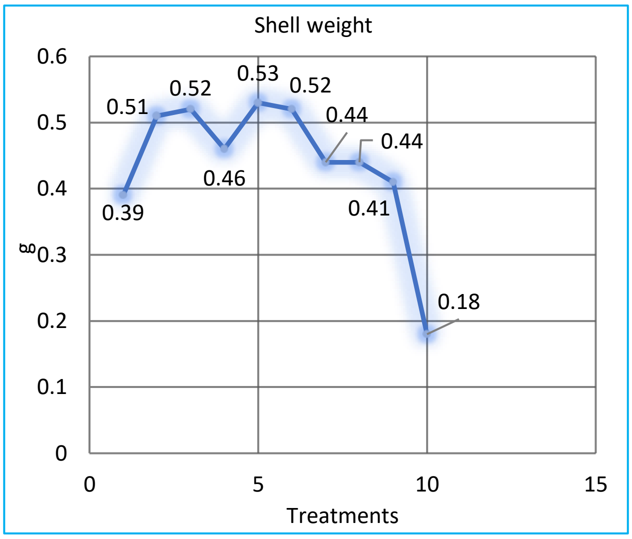
Single shell weight (g)

Among the ten nutrient levels tested (pooled data), T_5 and T_6 showed significantly higher values in terms of single shell weight, measuring 0.53g and 0.52g, respectively. Among the five crops studied, the third crop's T_5 and T_6 treatments exhibited relatively higher single shell weights, measuring 0.62g and 0.58g respectively (Graph 7) [26-31].



Cu-Copper, Zn-Zinc, Fe-Iron, Mn-Manganese, B-Boron

Graph 6 Macro and secondary nutrients composition percentage in tree mulberry leaf influenced by micronutrients



Graph 7 Influence of micronutrients on silkworm shell weight (g)

Table 2 Micronutrients and tree mulberry leaf effect on silkworm economic parameters

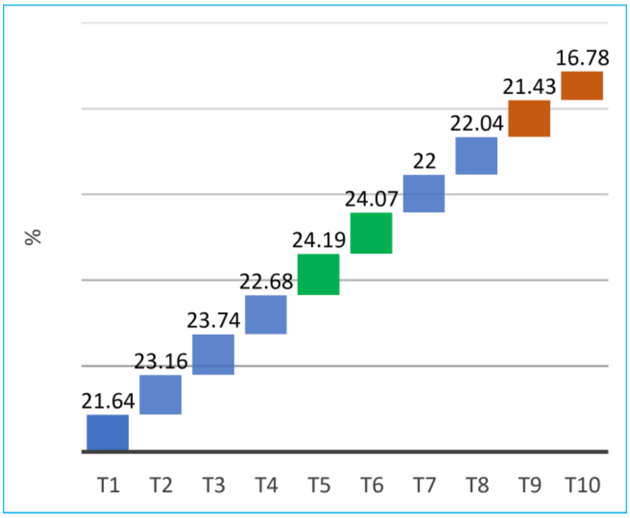
Treatment	Larval weight	Cocoon weight	Shell weight	Pupal weight	Shell ratio	Filament length	Renditta	Denier
			g		%	m	kg	d
T_1	44.81	1.81	0.39	1.42	21.64	1155	7.1	3
T_2	52.63	2.19	0.51	1.69	23.16	1310	6.28	2.5
T_3	52.14	2.19	0.52	1.67	23.74	1268	6.42	2.5
T_4	51.62	2.01	0.46	1.55	22.68	1259	6.48	2.7
T_5	52.83	2.18	0.53	1.65	24.19	1328	6	2.5
T_6	52.24	2.16	0.52	1.64	24.07	1312	6	2.5
T_7	51.3	1.99	0.44	1.55	22	1233	6.78	2.8
T_8	50.58	1.98	0.44	1.54	22.04	1236	6.7	2.9
T_9	50.15	1.93	0.41	1.52	21.43	1197	7	3
T_{10}	31.27	1.06	0.18	0.88	16.78	809	9.09	3.1

Pupal weight (g)

Among the ten nutrient levels tested, T_2 and T_3 displayed the highest pupal weights, measuring 1.69g and 1.67g, respectively. Specifically, in the third crop T_2 and T_3 again had the highest pupal weights, with values of 1.76g and 1.92g respectively (Table 2) [28-30].

Shell ratio (%)

Among the ten nutrient levels tested, T_5 followed by T_6 showed significantly higher values in terms of shell ratio, measuring 24.19% and 23.07%, respectively. Among the five crops studied, the T_5 and T_6 treatments in the third crop exhibited a relatively higher shell ratio of 24.41% and 24.55% (Graph 8) [29-30].



Graph 8 Influence of micronutrients on silkworm shell ratio (%)

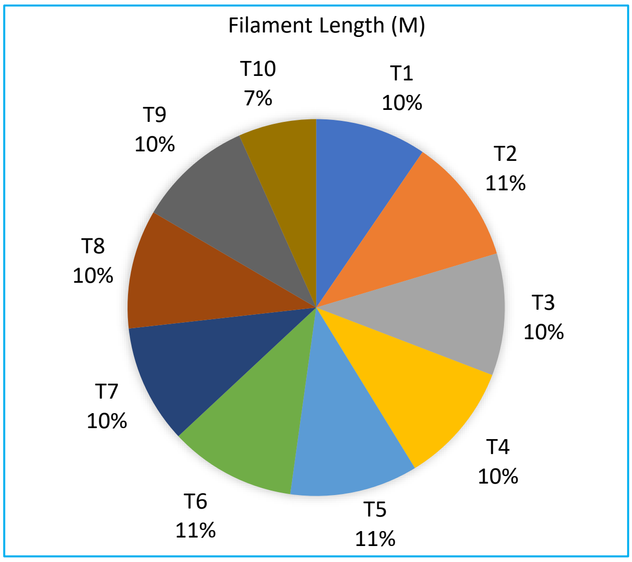
Filament length (m)

Among the ten nutrient levels tested, T_5 followed by T_6 showed significantly higher values in terms of silk filament length, measuring 1328m and 1310m, respectively. Among the five crops studied, the T_5 and T_6 treatments in the third crop exhibited a relatively higher silk filament length of 1489m and 1470m, respectively (Graph 9) [29-30].

Renditta (kg)

In the study, T_5 and T_6 exhibited significantly higher renditta values, measuring 6.28 kg, particularly in the third crop. Conversely, treatments T_2, T_3, T_5 and T_6 had relatively lower renditta values of 6 kg each (Table 2) [29-30].

Denier (%): In the study T_2, T_3, T_5 and T_6 recorded significantly favorable values in denier, measuring 2.5d in both pooled data and third crop (Table 2) [32-34].



Graph 9 Influence of micronutrients on silk filament length (m)

The soil fertility profile of an experimental tree mulberry garden

Similarly, during the before and after experiment, the soil parameters including N, P, K, S, Ca, Mg, Zn, Fe, Mn, Cu, and B were notably higher in the 6'×6' spacing with treatment T1 to T9 with the range of available N (364-433 kg/ha), P (38.83-47.37 kg/ha), K (306-356 kg/ha), S (38.61-48.96 ppm), Ca (5.33-10.53 m.eq/100g), Mg (3.03-5.03 m.eq/100g), Cu (0.99-1.01 ppm), Zn (0.41-0.74 ppm), Mn (3.31-4.86 ppm) and B (0.44-0.86 ppm). While T10 recorded lowest in macro nutrients with the range (95, 5.97, 73.10 kg/ha, 1.97 ppm, 2.19 and 0.47 m.eq/100g) and micronutrients with the range (1.02, 0.18, 1.70, 1.53 and 0.18 ppm). Elevated soil pH, EC and organic carbon (OC) levels were observed in tree mulberry with all the treatment between the range (7.6-7.7, 0.64-0.68 dSm/m and 0.62-0.86 %) (Table 3-4).

CONCLUSION

Among the ten treatments T_2, T_3, and T_5 emerged as standout performers with enhanced yield and growth parameters, excluding moisture percentage. Throughout the experiment, both before and after treatment, soil parameters such as N, P, K, S, Ca, Mg, Zn, Fe, Mn, Cu, and B exhibited elevated levels in the 6'×6' spacing with treatments T_1 to T_9. No significant differences were noted among the treatments in terms of mulberry growth and yield parameters except for T_{10}. Based on these findings, it can be concluded that the optimal approach for tree mulberry cultivation involves the application of 25 kg of micronutrients along with the recommended dose of macro fertilizers. The study's results pertaining to silkworm economic parameters revealed positive outcomes for T_5 and T_2 in terms of cocoon weight and for T_5 and T_6 in shell weight, shell ratio, filament length, renditta, and denier in both the third crop and pooled data. Notably, no significant differences were observed between the treatments except for T_{10} (control).

Table 3 Soil fertility status of tree mulberry garden as influenced by different nutrient levels (Before experiment)

pH	EC	OC	N	P_2O_5	K_2O	Ca	Mg	S (ppm)	B (ppm)	Cu (ppm)	Zn (ppm)	Fe (ppm)	Mn (ppm)
	dSm^{-1}	%	Kg/ha/year			m.eq/100g		ppm					
7.70	0.67	0.64	260.00	11.23	124.24	4.28	1.22	5.00	0.22	1.11	0.32	2.56	1.85
7.50	0.67	0.66	270.45	11.14	124.00	4.33	1.26	5.75	0.22	1.20	0.32	2.69	1.77
7.70	0.62	0.66	240.56	11.00	120.24	4.45	1.33	5.12	0.22	1.12	0.28	2.56	1.77

pH= negative logarithm of hydrogen; EC= electric conductivity; OC= organic carbon; N, P, K = available nitrogen, phosphorus, potash; S= Sulphur; Ca= exchangeable calcium; Mg= exchangeable magnesium; Cu-copper; Zn-Zinc; Fe-iron and Mn-Manganese

Table 4 Soil fertility status of tree mulberry garden as influenced by different nutrient levels (After experiment)

Treatment	pH	EC	OC	N	P_2O_5	K_2O	S	Ca	Mg	B	Cu	Zn	Fe	Mn
		dSm^{-1}	%	Kg/ha/year			ppm	m.eq/100g		ppm				
T_1	7.6	0.6	0.7	408.8	40.0	356.1	34.7	5.9	3.3	0.5	1.0	0.4	4.6	3.4
T_2	7.6	0.6	0.7	421.3	43.7	203.4	49.0	10.5	5.0	0.9	1.0	0.7	8.8	4.9
T_3	7.6	0.7	0.7	289.6	47.4	262.5	48.9	10.3	3.9	0.9	1.0	0.7	6.9	4.7
T_4	7.6	0.6	0.7	433.9	29.5	253.5	48.4	10.0	3.7	0.7	1.0	0.6	6.7	4.6
T_5	7.7	0.7	0.8	415.0	38.3	306.9	34.7	7.4	3.4	0.5	1.0	0.4	4.8	3.5
T_6	7.6	0.7	0.8	302.1	36.6	260.4	34.8	7.9	3.4	0.5	1.0	0.4	5.0	3.7
T_7	7.6	0.7	0.8	408.8	28.9	295.7	33.1	5.3	3.0	0.4	1.0	0.4	4.5	3.3
T_8	7.7	0.7	0.9	421.3	40.6	328.4	38.6	9.3	3.6	0.5	1.0	0.5	6.1	4.3
T_9	7.7	0.7	0.8	364.9	43.4	284.5	37.6	7.9	3.5	0.5	1.0	0.5	5.6	4.1
T_{10}	7.7	0.6	0.6	95.0	6.0	73.1	2.0	2.2	0.5	0.2	1.0	0.2	1.7	1.5
F-value	.49	2.62	48.91	496.03	392.60	627.71	828.01	604.91	317.57	1428.34	.28	695.22	216.93	163.17
Sig.	0.86	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00	0.00

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Author's contribution

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