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Effect of Graded Level of Nutrients on Quality of tree Mulberry and Larval Parameters of Silkworm *Bombyx mori* L.

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ABSTRACT: The study titled "Performance of bivoltine seed crop on graded level of nutrients in tree mulberry" was conducted during 2022 at Krishi Vignana Kendra, Haradanahalli Farm, Chamarajanagara, to determine the impact of optimal nutrient combination on quality of mulberry. The findings highlighted that the plants treated with 40 tonnes FYM/ha/yr along with 125 per cent RDF and foliar spray of POSHAN exhibited superior characteristics such as higher moisture percentage (76.80 %), moisture retention capacity (93.30 %), crude protein (20.33 %), chlorophyll 'a' (1.57 mg/g) and 'b' (1.03 mg/g), and total chlorophyll content (2.57 mg/g). These results reveal the importance of nutrient management strategies, specifically emphasizing the significant role of organic and inorganic fertilizers combined with foliar applications in enhancing the nutritional and physiological aspects of mulberry plants. Such insights contribute significantly to optimizing agricultural practices for mulberry cultivation, thereby enhancing productivity and quality in sericulture systems.

Keywords: Bivoltine, Tree mulberry, Farm Yard Manure (FYM), Micronutrients, Graded level of nutrients.

INTRODUCTION

Sericulture, a vital agro-based cottage industry in India which contributes significantly to the nation's economy and employment sector. Asia dominates global silk production where India ranks as the second-largest producer of mulberry raw silk. Mulberry (*Morus* spp.) serves as the primary nutritional source for silkworms (*Bombyx mori* L.) which is crucial for their growth and development. The quality of mulberry leaves is pivotal and directly impacting on silkworm health. Mulberry is a hardy, perennial, deep-rooted plant that produces a lot of biomass and grows throughout the year in the tropics. Mulberry being cultivated for many years and if grown without any scientific management results in a steady decline in leaf quality and production (Rashmi *et al*., 2009). However, traditional cultivation practices and environmental challenges such as irregular rainfall and droughts pose threats to mulberry leaf quality and production therefore tree mulberry planting has spread to plain areas available crop on waste and degraded soils under extreme water stress conditions.

Sericulture relies heavily on nutrition therefore, it is imperative to apply the necessary fertilizer to the mulberry plant for the production of quality mulberry leaf (El-Kayat *et al*., 2013). Hence, this study aims to investigate the influence of graded level of nutrients that is combination of organic and inorganic fertilizers supplemented with foliar spray on quality of tree mulberry.

MATERIAL AND METHODS

A study was conducted during 2022 at Krishi Vignana Kendra, Haradanahalli Farm, Chamarajanagara, in a well-established tree mulberry garden of variety V-1 with spacing of 6*6 feet under irrigated condition. The experiment was conducted using RBD with factorial concept consisted of sixteen treatments with three replications. After top pruning, the combination of manures and fertilizers which are below listed were applied and the cultural practices were followed as of Dandin and Giridhar (2014). Fourty-five days after pruning, the quality parameters such as leaf moisture percentage, leaf moisture retention capacity crude protein and chlorophyll contents were calculated by using the following formulas.

Treatment details

Factor (A) organic manures	Factor(B)Macronutrients	Factor(C) Micronutrients
A_1- without FYM 20t ha^{-1}	B_1–No RDF	C_1 – without micronutrients
A_2- with FYM at 40 t ha^{-1}	B_2-75% RDF	C_2 - with foliar spray of micronutrients (POSHAN)
	B_3- 100% RDF	
	B_4- 125% RDF	

Treatment combinations

T_1	$A_1B_1C_1$	T_9	$A_2B_1C_1$
T_2	$A_1B_1C_2$	T10	$A_2B_1C_2$
T_3	$A_1B_2C_1$	T11	$A_2B_2C_1$
T_4	$A_1B_2C_2$	T12	$A_2B_2C_2$
T_5	$A_1B_3C_1$	T13	$A_2B_3C_1$
T_6	$A_1B_3C_2$	T14	$A_2B_3C_2$
T_7	$A_1B_4C_1$	T15	$A_2B_4C_1$
T_8	$A_1B_4C_2$	T16	$A_2B_4C_2$

$$\text{Leaf moisture percentage (\%)} = \frac{\text{Fresh weight of leaves - Dry weight of leaves}}{\text{Fresh weight of leaves}} \times 100$$

Moisture retention capacity after six hours was estimated

Moisture retention capacity (%) = 100 – Moisture loss (%)

Where, fresh weight is considered to be 100 per cent

$$\text{Moisture loss (\%)} = \frac{(A - B)}{A} \times 100$$

Where,

A- Fresh weight of leaf

B-Leaf weight after six hours of harvest

Chlorophyll content in mulberry leaf was determined by the following procedure:

$$\text{Chlorophyll 'a' (mg/g)} = \frac{(12.7A663 - 2.69A645) \times X}{1000 \times n}$$

$$\text{Chlorophyll 'b' (mg/g)} = \frac{(22.9A645 - 4.68A663) \times X}{1000 \times n}$$

$$\text{Total chlorophyll (mg/g)} = \frac{(20.2A645 - 8.02A663) \times X}{100 \times n}$$

Where,

A663- Absorbance at a wavelength of 663 nm A 645- Absorbance at a wavelength of 645 nm

X –Total volume of the filtrate

n– Sample weight chemical analysis of soil

The per cent crude protein was estimated using the nitrogen content determined by the micro Kjeldahl method involving digestion, distillation and titration of the sample using the formula:

crude protein = (%) Nitrogen (%) × 6.25

RESULTS AND DISCUSSION

Moisture percentage, moisture retention capacity and crude protein. Scientific investigation of mulberry leaf parameters reveals a significant increase in quality parameters such as moisture percentage, moisture retention capacity (MRC) and crude protein content by the application of graded level of nutrients. Application of farmyard manure (FYM) at 40 t/ha/yr yielded highest moisture percentages (70.82%) compared to 20 t/ha/yr (69.61%), with nitrogen-phosphorus-potassium (NPK) application at 125% recommended dose recorded in the highest moisture content (73.58%). Foliar spray treatments exhibited enhanced moisture percentage (70.79%) compared to non-sprayed counterparts. Two-factor interactions revealed synergistic effects, with the highest moisture percentage achieved in A2 × B4 (75.68%). Similarly, FYM application at 40 t/ha/yr demonstrated superior moisture retention capacity (90.22%) compared to 20 t/ha/yr (86.70%), with the highest MRC observed with NPK at 125% RDF (91.09%). Foliar spray treatments displayed increased MRC (88.39%), while interactive effects showed peak MRC in A2 × B4 (93.24%). Crude protein content exhibited similar trends, with FYM at 40 t/ha/yr yielding the highest values (17.98%) compared to 20 t/ha/yr (17.31%), and NPK at 125% RDF recorded the highest crude protein (19.41%). Foliar spray treatments enhanced crude protein (17.96%), with interactive effects demonstrating peak crude protein in B4 × C2 (20.26%). The T16 treatment (40 T FYM/ha/yr + 125% RDF + Foliar spray of POSHAN) showcased superior performance across parameters. These findings underscore the importance of nutrient management strategies in optimizing mulberry leaf quality for sericulture (Table 1).

The results are in conformity with the findings of Mishra *et al*. (1996) found that using NPK fertilizer dose of 225:150:150 kg/ha/yr and adopting top-clipping resulted in good quality mulberry leaves in the S-54 variety with high moisture (79.69 %) and protein (25.19 %) contents. Bhaskar *et al.* (2003) found that irrigated M-5 mulberry with varying amounts of N (200-280 kg /ha/ yr), P (80-140 kg /ha/ yr) and K (80-140 kg /ha/yr) recorded that application of 280:80:80kg NPK/ha/yr recorded higher growth characteristics and leaf moisture content than in control.

Table 1 : Influence of graded level of nutrients on moisture percentage, moisture retention capacity (%) and crude protein (%) of tree mulberry.

Treatment	Moisture percentage	Moisture retention capacity (%)	Crude protein (%)
Farmyard manure (A)			
A_1 : FYM @ 20 t ha^{-1}	69.61	86.70	17.31
A_2 : FYM @ 40 t ha^{-1}	70.82	90.22	17.98
SEm±	0.020	0.020	0.019
CD @ 5%	0.059	0.057	0.056
NPK(B)			
B_1 – No RDF	70.25	87.84	15.96
B_2 – 75 % RDF	69.69	88.29	17.30
B_3 – 100 % RDF	67.36	86.60	17.91
B_4 – 125 % RDF	73.58	91.09	19.41
SEm±	0.029	0.028	0.027
CD @ 5%	0.083	0.081	0.079
Foliar spray (C)			
C_1 : No Foliar spray	69.65	88.53	17.33
C_2 : Foliar spray	70.79	88.39	17.96
SEm±	0.020	0.020	0.019
CD @ 5%	0.059	0.057	0.056
Interaction (A×B)			
A_1×B_1	69.65	86.90	15.80
A_1×B_2	67.44	86.27	16.95
A_1×B_3	69.89	84.66	17.53
A_1×B_4	71.48	88.95	18.96
A_2×B_1	70.85	88.79	16.12
A_2×B_2	71.94	90.31	17.66
A_2×B_3	64.83	88.54	18.29
A_2×B_4	75.68	93.24	19.86
SEm±	0.041	0.040	0.039
CD @ 5%	0.118	0.114	0.112
Interaction (B×C)			
B_1× C_1	68.46	88.32	15.89
B_1× C_2	72.04	87.37	16.03
B_2× C_1	68.69	88.52	17.24
B_2× C_2	70.69	88.07	17.37
B_3× C_1	66.39	85.29	17.62
B_3× C_2	68.33	87.90	18.20
B_4× C_1	75.06	91.99	18.56
B_1× C_1	72.09	90.20	20.26
SEm±	0.041	0.040	0.039
CD @ 5%	0.118	0.114	0.112
Interaction (A×C)			
A_1×C_1	70.33	87.54	16.95
A_1×C_2	68.90	85.85	17.67
A_2×C_1	68.97	89.52	17.71
A_2×C_2	72.68	90.92	18.26
SEm±	0.029	0.028	0.027
CD @ 5%	0.083	0.081	0.079
Interaction (A×B×C)			
T_1: **$A_1B_1C_1$**	68.93	87.66	15.76
T_2: **$A_1B_1C_2$**	70.36	86.14	15.85
T_3: **$A_1B_2C_1$**	65.49	86.72	16.83
T_4: **$A_1B_2C_2$**	69.40	85.83	17.06
T_5: **$A_1B_3C_1$**	73.56	85.07	17.46
T_6: **$A_1B_3C_2$**	66.21	84.24	17.59
T_7: **$A_1B_4C_1$**	73.32	90.69	17.73
T_8: **$A_1B_4C_2$**	69.63	87.21	20.19
T_9: **$A_2B_1C_1$**	67.98	88.98	16.03
T_{10}: **$A_2B_1C_2$**	73.72	88.60	16.21
T_{11}: **$A_2B_2C_1$**	71.90	90.31	17.64
T_{12}: **$A_2B_2C_2$**	71.98	90.32	17.68
T_{13}: **$A_2B_3C_1$**	59.21	85.51	17.77
T_{14}: **$A_2B_3C_2$**	70.45	91.57	18.80
T_{15}: **$A_2B_4C_1$**	74.55	93.18	19.39
T_{16}: **$A_2B_4C_2$**	76.80	93.30	20.33
SEm±	0.058	0.056	0.055
CD @ 5%	0.167	0.162	0.158

Note: (NS– Non-Significant)

Factor(A)	Factor (B)	Factor(C)
Organic manures	Macronutrients	Micronutrients
A1– with FYM @ 20t ha-1	B1–No RDF	C1– No micronutrients
A2– with FYM @ 40t ha-1	B2– 75 % RDF	C2–with foliar spray of
	B3– 100 % RDF	micronutrients(POSHAN)
	B4– 125 % RDF	

Chlorophyll contents of tree mulberry leaves. The study investigates the influence of various macro and micronutrient applications on chlorophyll parameters in Mulberry plants. Application of farmyard manure (FYM) at 40 t/ha/yr resulted in the highest Chlorophyll 'a' (1.48 mg/g) compared to 20 t/ha/yr (1.14 mg/g) at 30 days after planting (DAP), similar trends observed in Chlorophyll 'b' (0.79 mg/g) and total chlorophyll (1.97 mg/g). Additionally, NPK application at 125% recommended dose of fertilizers (RDF) demonstrated the highest Chlorophyll 'a', 'b', and total chlorophyll content at 1.41, 0.57, and 2.40 mg/g, respectively. Notably, foliar spray treatments exhibited increased chlorophyll levels compared to untreated plants. Interaction analyses revealed significant effects, with the FYM-NPK interaction at A2×B4 level, NPK-Foliar spray interaction at B4×C2 level, and Foliar spray-FYM interaction at A2×C2 level showing the highest chlorophyll contents. Among treatment combinations, T16 (40 T FYM/ha/yr + 125% RDF + Foliar spray of POSHAN) exhibited the highest chlorophyll 'a', 'b', and total chlorophyll content at 1.57, 1.03, and 2.57 mg/g, respectively. Notably, foliar spray of micronutrients from POSHAN notably impacted chlorophyll content, as evident from reductions in chlorophyll content in T8 (20 T FYM/ha/yr + 125% RDF + Foliar spray of POSHAN) and T14 (40 T FYM/ha/yr + 100% RDF + Foliar spray of POSHAN) compared to T16. Control treatment (T1) exhibited the lowest chlorophyll content (0.96 mg/g for Chlorophyll 'a', 0.36 mg/g for Chlorophyll 'b', and 1.27 mg/g for total chlorophyll). The findings underscore the importance of nutrient management strategies in optimizing chlorophyll levels and subsequently, plant productivity.

Similar results were obtained by Fotedar *et al.* (1988) who found out the impact of various nitrogen levels (0, 100, 200, 300, and 400 kg ha^{-1} yr^{-1}) on mulberry quality (Table 2).

Table 2: Influence of graded level of nutrients on Chlorophyll 'a' (mg/g), chlorophyll 'b' (mg/g), total chlorophyll (mg/g) content.

Treatment	Chlorophyll 'a' (mg/g)	Chlorophyll 'b' (mg/g)	Total chlorophyll (mg/g)
A_1 : FYM @ 20 t ha^{-1}	1.14	0.42	1.82
A_2 : FYM @ 40 t ha^{-1}	1.48	0.79	1.97
SEm±	0.001	0.001	0.001
CD @ 5%	0.004	0.004	0.002
B_1 – No RDF	1.22	0.61	1.41
B_2 – 75 % RDF	1.29	0.57	1.67
B_3 – 100 % RDF	1.33	0.69	2.12
B_4 – 125 % RDF	1.410	0.57	2.40
SEm±	0.002	0.002	0.001
CD @ 5%	0.006	0.006	0.003
C_1: No Foliar spray	1.29	0.58	1.82
C_2: Foliar spray	1.33	0.63	1.97
SEm±	0.001	0.001	0.001
CD @ 5%	0.004	0.004	0.002
Interaction (A×B)			
A_1×B_1	1.01	0.38	1.34
A_1×B_2	1.13	0.44	1.55
A_1×B_3	1.16	0.36	2.05
A_1×B_4	1.26	0.50	2.35
A_2×B_1	1.43	0.84	1.47
A_2×B_2	1.46	0.69	1.78
A_2×B_3	1.49	1.01	2.19
A_2×B_4	1.56	0.63	2.45
SEm±	0.003	0.003	0.002
CD @ 5%	0.008	0.008	0.005
Interaction (B×C)			
B_1× C_1	1.18	0.59	1.36
B_1× C_2	1.25	0.63	1.46
B_2× C_1	1.28	0.55	1.61
B_2× C_2	1.31	0.58	1.72
B_3× C_1	1.32	0.70	2.06
B_3× C_2	1.33	0.68	2.18
B_4× C_1	1.38	0.49	2.26

B_4× C_2	1.43	0.64	2.54
SEm±	0.003	0.003	0.002
CD @ 5%	0.008	0.008	0.005
Interaction (A×C)			
A_1×C_1	1.11	0.38	1.76
A_1×C_2	1.16	0.46	1.89
A_2×C_1	1.47	0.79	1.89
A_2×C_2	1.50	0.80	2.06
SEm±	0.002	0.002	0.001
CD @ 5%	0.006	0.006	0.003
Interaction (A×B×C)			
T_1: **$A_1B_1C_1$**	0.96	0.36	1.27
T_2: **$A_1B_1C_2$**	1.06	0.40	1.41
T_3: **$A_1B_2C_1$**	1.16	0.47	1.54
T_4: **$A_1B_2C_2$**	1.16	0.42	1.56
T_5: **$A_1B_3C_1$**	1.41	0.37	2.03
T_6: **$A_1B_3C_2$**	1.44	0.36	2.07
T_7: **$A_1B_4C_1$**	1.46	0.33	2.18
T_8: **$A_1B_4C_2$**	1.54	0.67	2.51
T_9: **$A_2B_1C_1$**	1.10	0.83	1.44
T_{10}: **$A_2B_1C_2$**	1.15	0.85	1.50
T_{11}: **$A_2B_2C_1$**	1.23	0.64	1.68
T_{12}: **$A_2B_2C_2$**	1.28	0.74	1.88
T_{13}: **$A_2B_3C_1$**	1.45	0.62	2.10
T_{14}: **$A_2B_3C_2$**	1.48	1.00	2.29
T_{15}: **$A_2B_4C_1$**	1.50	0.65	2.33
T_{16}: **$A_2B_4C_2$**	1.57	1.03	2.57
SEm±	0.004	0.004	0.002
CD @ 5%	0.011	0.012	0.007

Note: (NS– Non-Significant)

Factor(A)	**Factor (B)**	**Factor (C)**
Organic manures	Macronutrients	Micronutrients
A1– with FYM @ 20t ha^{-1}	B1–No RDF	C1– No micronutrients
A2– with FYM @ 40t ha^{-1}	B2– 75 % RDF	C2–with foliar spray of
	B3– 100 % RDF	micronutrient (POSHAN)
	B4– 125 % RDF	

Larval progression and larval weight. The research investigated larval progression (%) in FC 1 and FC 2 breeds of silkworm *Bombyx mori* L. under varying treatments. Notably, FYM application at 40 t/ha/yr resulted in higher larval progression compared to 20 t/ha/yr in both breeds (96.38% and 96.79%, respectively). Similarly, NPK application at 100% RDF recorded the highest larval progression, with values of 97.25% and 97.67% in FC 1 and FC 2 breeds, respectively. Foliar spray application demonstrated increased larval progression compared to non-application, with values of 95.88% and 96.44% in FC 1 and FC 2 breeds, respectively. Two-factor interactions revealed the highest larval progression when FYM was combined with NPK, with values of 98.00% and 98.13% in FC 1 and FC 2 breeds, respectively. FC 2 breed exhibited superior larval progression compared to FC 1 breed across treatments. Specific treatment combinations, such as T14 and T15, showed particularly high larval progression in both FC 1 (98%) and FC 2 (98.74%) breeds. Overall, these findings suggest that FC 2 breed displays greater hardiness and better larval characteristics than FC 1 breed under certain treatment conditions.

The study investigated the impact of agricultural inputs on larval weight and progression in two silkworm breeds, FC 1 and FC 2. Larval weight increased progressively with instar growth, with the final two instars contributing around 90% of body weight. Application of farmyard manure (FYM) at 40 t/ha/yr resulted in the highest larval weight (32.34 g/10 larvae) compared to 20 t/ha/yr (31.11 g/10 larvae) in FC 1 breed, while similar trends were observed in FC 2 breed with 39.08 g/10 larvae. Higher doses of NPK and foliar spray treatments also led to increased larval weight, with NPK at 125% RDF resulting in 34.95 g/10 larvae and 41.50 g/10 larvae in FC 1 and FC 2 breeds, respectively. Interaction effects between FYM, NPK, and foliar spray showed varying impacts on larval weight, with certain combinations yielding the highest weights, such as A2×B4 level (35.65 g/10 larvae and 41.93 g/10 larvae in FC 1 and FC 2 breeds, respectively). FC 2 breed demonstrated superior hardiness and recorded higher larval weights compared to FC 1, with treatment T16 (40 T FYM/ha/yr + 125% RDF + Foliar spray of POSHAN) resulting in the highest larval weight (43.67 g/10 larvae) among all treatments. Even though larval progression (%) was higher among many treatments in both races, the Larval weight was found to be highest only in the T_{16} (40 T FYM/ha/yr + 125 % RDF + Foliar spray of POSHAN). This could mean that the larval progression (%) is not directly contributing to the larval weight rather the treatments are influencing the larval weight (Table 3).

Sannappa *et al*. (2003) found that when silkworms were fed mulberry at 5 feeds per day and raised with N at 125 kg/ha/yr, they had higher fifth instar larval weight (43.83 g/10 larvae), larval survival (92.33 %), ERR (89.50 %) and cocoon yield (38.19 kg/50 DFL's) with shorter total larval duration (25.32 days) than when they were fed 4 and 3 feeds per day.

Mulberry growth and yield were significantly increased after application of NPK @ 400:180:25 kg/ha/yr, as were larval weight, larval duration, and moulting duration. The cocoons that were spun were of good quality (Sreerama, 2006). The study was carried out to ascertain the performance of silkworm (*B. mori* L.) double hybrid fed on leaf raised through splitting the recommended dose of chemical fertilizers. The weight of ten mature larvae was recorded to be higher (55.40 g) in treatment T_{14} ($N_4P_1K_2$) being statistically at par with 55.38, 55.31 and 54.90 grams found in treatments T_{13} ($N_4P_1K_1$), T_{16} ($N_4P_2K_2$) and T_{15} ($N_4P_2K_1$), respectively. Cocoon yield per 10,000 larvae by number was recorded highest 9133.33 in T_{14} ($N_4P_1K_2$) treatment which was found statistically at par with 9100.00 and 9066.67 in treatments T_{13} ($N_4P_1K_1$) and T_{16} ($N_4P_2K_2$) respectively (Nazim *et al*., 2020).

Table 3: Influence of graded level of nutrients on Larval progression (%), test weight (g/10 larvae) of FC 1 and FC 2 bivoltine silkworm breeds.

Treatment	Larval progression (%)		Larval weight (g/10 larvae)	
	FC 1	FC 2	FC 1	FC 2
Farmyard manure (A)				
A_1 : FYM @ 20 t ha^{-1}	95.75	96.47	31.11	37.52
A_2 : FYM @ 40 t ha^{-1}	96.38	96.79	32.34	39.08
SEm±	-	-	0.161	0.003
CD @ 5%	NS	NS	0.466	0.009
NPK(B)				
B_1 – No RDF	94.50	95.24	28.77	35.39
B_2 – 75 % RDF	95.50	96.21	30.81	37.45
B_3 – 100 % RDF	97.25	97.67	32.37	38.86
B_4 – 125 % RDF	97.00	97.42	34.95	41.50
SEm±	0.621	0.599	0.228	0.005
CD @ 5%	1.794	1.732	0.659	0.013
Foliar spray (C)				
C_1 : No Foliar spray	96.25	96.83	31.26	37.52
C_2 : Foliar spray	95.88	96.44	32.19	39.08
SEm±	-	-	0.161	0.003
CD @ 5%	NS	NS	0.466	0.009
Interaction (A×B)				
A_1×B_1	94.50	95.25	28.04	33.83
A_1×B_2	96.00	96.72	30.35	37.15
A_1×B_3	96.50	97.22	31.80	38.05
A_1×B_4	96.00	96.70	34.25	41.06
A_2×B_1	94.50	95.22	29.49	36.95
A_2×B_2	95.00	95.70	31.28	37.76
A_2×B_3	98.00	98.13	32.94	39.67
A_2×B_4	98.00	98.13	35.65	41.93
SEm±	-	-	-	0.006
CD @ 5%	NS	NS	NS	0.019
Interaction (B×C)				
B_1× C_1	95.00	95.73	28.38	34.10
B_1× C_2	94.00	94.74	29.15	36.68
B_2× C_1	95.00	95.75	30.61	37.34
B_2× C_2	96.00	96.67	31.02	37.57
B_3× C_1	97.00	97.10	31.97	38.76
B_3× C_2	97.50	98.24	32.77	38.96
B_4× C_1	98.00	98.74	34.09	39.88
B_1× C_1	96.00	96.10	35.81	43.11
SEm±	-	-	-	0.006
CD @ 5%	NS	NS	NS	0.019
Interaction (A×C)				
A_1×C_1	96.00	96.72	30.77	36.51
A_1×C_2	95.50	96.23	31.44	38.53
A_2×C_1	96.50	96.94	31.75	38.53
A_2×C_2	96.25	96.65	32.94	39.62
SEm±	-	-	-	0.005
CD @ 5%	NS	NS	NS	0.013
Interaction (A×B×C)				
T_1: $A_1B_1C_1$	95.00	95.73	27.61	31.36
T_2: $A_1B_1C_2$	94.00	94.78	28.48	36.30
T_3: $A_1B_2C_1$	95.00	95.73	30.19	37.14
T_4: $A_1B_2C_2$	97.00	97.71	30.50	37.17
T_5: $A_1B_3C_1$	96.00	96.69	31.72	37.98
T_6: $A_1B_3C_2$	97.00	97.75	31.88	38.12
T_7: $A_1B_4C_1$	98.00	98.74	33.57	39.58

T_8: $A_1B_4C_2$	94.00	94.67	34.93	42.55
T_9: $A_2B_1C_1$	95.00	95.73	29.15	36.85
T_{10}: $A_2B_1C_2$	94.00	94.71	29.83	37.06
T_{11}: $A_2B_2C_1$	95.00	95.77	31.02	37.54
T_{12}: $A_2B_2C_2$	95.00	95.63	31.54	37.98
T_{13}: $A_2B_3C_1$	98.00	97.52	32.21	39.55
T_{14}: $A_2B_3C_2$	98.00	98.74	33.67	39.79
T_{15}: $A_2B_4C_1$	98.00	98.74	34.61	40.19
T_{16}: $A_2B_4C_2$	98.00	97.52	36.70	43.67
SEm±	-	-	-	0.009
CD @ 5%	NS	NS	NS	0.026

Note: (NS – Non-Significant)

Factor (A)	Factor (B)	Factor (C)
Organic manures	Macronutrients	Micronutrients
A_1 – with FYM @ 20 t ha^{-1}	B_1 – No RDF	C_1 – No micronutrients
A_2 – with FYM @ 40 t ha^{-1}	B_2 – 75 % RDF	C_2 – with foliar spray of
	B_3 – 100 % RDF	micronutrients (POSHAN)
	B_4 – 125 % RDF	

CONCLUSIONS

A comprehensive scientific investigation into mulberry leaf parameters reveals significant influences on moisture percentage, moisture retention capacity (MRC), crude protein content, and chlorophyll content by the combined application of fertilizers and these are the crucial factors for optimizing mulberry plant productivity in sericulture. Application of farmyard manure (FYM) at 40 t/ha/yr demonstrates superior performance across parameters, notably yielding highest moisture percentages, MRC, crude protein content, and chlorophyll levels, with synergistic effects observed particularly in combined treatments with NPK at 125% recommended dose of fertilizer (RDF) and foliar spray of micronutrients (POSHAN), highlighting the pivotal role of nutrient management strategies in enhancing mulberry leaf quality and photosynthetic efficiency.

The larval progression (%) of FC1 breed peaked at 98% in treatments T8, T13, T14, T15, and T16, while FC2 breed showed its highest progression in treatments T8 (A1B4C2 – 20 T FYM/ha/yr + 125% RDF + Foliar spray of POSHAN), T14 (A2B3C2 – 40 T FYM/ha/yr + 100% RDF + Foliar spray of POSHAN), and T15 (A2B4C1 – 40 T FYM/ha/yr + 125% RDF) at 98.74%. Non-significant differences were observed between these treatments for both breeds. Regarding larval weight, significant differences were noted in FC2 breed, whereas FC1 breed showed non-significant differences.

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Conflict of Interest. None.

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