

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; 10(7): 230-233
www.biochemjournal.com
Received: 01-04-2026
Accepted: 04-05-2026

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Evaluation of foliar nutrient combination on mulberry and its impact on silkworm *Bombyx mori* L.

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DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i7d.8975>

Abstract

The field experiment was conducted in a well established V-1 mulberry garden on the evaluation of foliar nutrient combination on mulberry and its impact on silkworm *Bombyx mori* L. During 2024-25 at Sericulture unit, College of Agriculture Raichur, Foliar nutrient combination on V-1 mulberry was significantly higher at 65 days after pruning (DAP). Among the treatments, the growth and yield parameters like plant height (cm), shoot weight (g), number of leaves, leaf weight (g), leaf area (cm²) and leaf to shoot ratio were significantly higher in posan (2 ml/lit) sprayed on V-1 mulberry leaves followed by pulse magic (10 g/lit) and chickpea magic (7.5 g/lit). The growth and yield parameters were significantly lowest in control. Whereas, silkworm *Bombyx mori* L. rearing parameters were significantly superior in posan (2 ml/lit) followed by pulse magic (10 g/lit) and chickpea (7.5 g/lit) magic compared to other treatments.

Keywords: Foliar nutrition, mulberry (V-1), posan, silkworm rearing

Introduction

Silkworm, *Bombyx mori* L. is a monophagous insect that derives almost all required nutrients for its growth and development from mulberry leaf. The quality of mulberry leaves plays an important role in the success of the sericulture industry. Nutrition of silkworm is the sole factor which almost individually improved quality and quantity of silkworm cocoon production and productivity

Nutrients present in the soil are not well absorbed in deep rooted plants and translocation of nutrients to shoot is sluggish under adverse soil condition which favour soil fixation of nutrients. Mulberry (*Morus* spp.) as a deep rooted high biomass producing foliage crop, responds well to foliar nutrition. Foliar application in right time increases level of absorption in specific nutrients to the leaf during growth and development. It is a well established fact that, synthetic chemicals, fertilizers, pesticides, herbicides, growth promoters and other inputs though enhance productivity but adversely affect the eco-system and increase prices of agricultural inputs. Due to excessive use of pesticides for improving productivity of mulberry cultivars, these chemicals pose a serious threat not only to mulberry but also the environment. So an alternative approach is necessary for the purpose of enhancing mulberry production without causing substantial damage to the ecosystem. Foliar feeding is a technique of feeding plants by applying nutrients directly to their leaves. Foliar spray has been used as supplemental doses of minor and major nutrients, plant hormones, botanicals, stimulants and other beneficial substances. It has been known for many years that plants are able to absorb essential nutrients through their leaves and develop defense mechanisms to resist several mulberry and silkworm diseases.

The main aim of applying foliar nutrients combinations on mulberry plants is to enhance essential nutrients and biochemical content in a readily available form. These sprays are not only cost effective but also have a longer life as compared to solid biofertilizers and chemical fertilizers. It is easy to apply and has been found to be highly effective for the growth and development of mulberry crop. Due to presence of antioxidants, essential amino acids, macro and micronutrients in foliar spray, it directly influences the growth of mulberry and is also capable of enhancing the productivity of mulberry.

Hence, the present study is planned to evaluation of foliar nutrients combination on mulberry and its impact on silkworm *Bombyx mori* L.

Materials and Methods

A field experiment was conducted in a well established mulberry garden with V-1 mulberry to study the evaluation of foliar nutrients combination on mulberry and its impact on silkworm *Bombyx mori* L. during 2024-25 at Sericulture unit, College of Agriculture Raichur. The experimental plot was laid in randomized block design with nine treatments with three replications. Before application of organic and chemical fertilizers soil samples was collected and also 45 days after pruning as per treatment wise. Mulberry was grown as per standard package with application of both recommended organic and chemical fertilizers. The foliar nutrients combination on mulberry was supplied through foliar application on 25th and 35th day after pruning.

Silkworm Rearing

To evaluate the impact of treatments on silkworm performance, leaves from the respective treatment plots were fed to *Bombyx mori* larvae. Standard rearing conditions were maintained for temperature, humidity, and bed hygiene. Rearing parameters such as larval weight, effective rate of rearing (ERR), cocoon weight, shell weight, and shell ratio were recorded at appropriate stages (Dandin *et al* 2000) [8].

Observations on growth and yield parameters of mulberry were taken at 65 days after pruning, and its impact on silkworm *Bombyx mori* L. was recorded according to treatment and replication wise.

III. Results

Evaluation of foliar nutrient combination on mulberry

Plant Height (cm)

Plant height was significantly ($p \leq 0.05$) influenced by the foliar fertilizer treatments. The maximum plant height (154.60 cm) was recorded in T₇ (Posan), which was statistically higher than all other treatments and comparable with T₁ (Pulse Magic). The minimum plant height (132.67 cm) was observed in T₈ (Water spray) (Table 1).

Shoot Weight (g)

Shoot weight showed a significant ($p \leq 0.05$) response to the foliar fertilizer treatments. The highest shoot weight (827.00 g) was obtained in T₇ (Posan), which was statistically superior to all treatments. The lowest shoot weight (402.67 g) was recorded in T₈ (Water spray) (Table 1).

Number of Leaves

The number of leaves per plant varied significantly ($p \leq 0.05$) among the treatments. The maximum number of leaves (267.33) was recorded in T₇ (Posan), which was significantly higher than the other treatments. The minimum number of leaves (136.67) was observed in T₈ (Water spray) (Table 1).

Leaf Weight (g)

Leaf weight differed significantly ($p \leq 0.05$) among the treatments. The highest leaf weight (568.00 g) was obtained in T₇ (Posan), which was significantly superior over all other treatments. The minimum leaf weight (225.67 g) was recorded in T₈ (Water spray) (Table 1).

Leaf Area (cm²)

Leaf area was significantly ($p \leq 0.05$) influenced by the foliar fertilizer treatments. The maximum leaf area (214.63 cm²) was recorded in T₇ (Posan), which was statistically comparable with T₁ (Pulse Magic) but significantly higher than the remaining treatments. The lowest leaf area (147.31 cm²) was noted in T₈ (Water spray) (Table 1).

Leaf to Shoot Ratio

The leaf-to-shoot ratio did not differ significantly ($p \leq 0.05$) among the treatments. However, the highest ratio (0.83) was recorded in T₇ (Posan), while the lowest (0.54) was observed in T₅ (Vegetable special) (Table 1).

Evaluation of foliar nutrient combination on silkworm *Bombyx mori* L.

5th Instar Larval Duration (h)

The 5th instar larval duration was significantly ($p \leq 0.05$) influenced by the foliar fertilizer treatments. The longest larval duration (216.32 h) was recorded in T₉ (Control), which was statistically comparable with T₈ (Water spray) but significantly higher than most other treatments. The shortest larval duration (188.10 h) was observed in T₂ (Chickpea Magic), which was significantly lower than the remaining treatments (Table 2).

5th Instar Larval Weight (g/5 larvae)

Larval weight of 5th instar silkworms showed a significant ($p \leq 0.05$) variation among the treatments. The highest larval weight (20.42 g/5 larvae) was obtained in T₇ (Posan), which was statistically superior to all other treatments. The lowest larval weight (16.65 g/5 larvae) was recorded in T₉ (Control), followed by T₈ (Water spray) (17.44 g) (Table 2).

Silk Productivity (cg/day)

Silk productivity was significantly ($p \leq 0.05$) influenced by the treatments. The maximum silk productivity (0.18 cg/day) was recorded in T₇ (Posan), which was statistically at par with T₁ (Pulse Magic). The minimum silk productivity (0.15 cg/day) was observed in T₃ (Mango special), T₅ (Vegetable special), and T₉ (Control) (Table 2).

Effective Rate of Rearing (ERR%)

The effective rate of rearing differed significantly ($p \leq 0.05$) among the treatments. The highest ERR (74.67%; arc value 59.78) was recorded in T₇ (Posan), which was significantly higher than the other treatments. The lowest ERR (49.33%; arc value 44.61) was observed in T₉ (Control). Treatments T₁ and T₄ also recorded relatively higher ERR values, though inferior to T₇ (Table 2).

Evaluation of foliar nutrient combination on silkworm *Bombyx mori* L.

Cocoon Weight (g/5 cocoons)

Cocoon weight was significantly ($p \leq 0.05$) influenced by the foliar fertilizer treatments. The maximum cocoon weight (8.24 g/5 cocoons) was recorded in T₇ (Posan), which was statistically on par with T₁ (Pulse Magic) but significantly higher than the remaining treatments. The minimum cocoon weight (6.95 g/5 cocoons) was observed in T₈ (Water spray) (Table 3).

Pupal Weight (g/5 pupae)

Pupal weight showed significant ($p \leq 0.05$) variation among the treatments. The highest pupal weight (5.85 g/5 pupae) was obtained in T₇ (Posan), followed by T₁ and T₉, which were statistically comparable. The lowest pupal weight (5.17 g/5 pupae) was recorded in T₃ (Mango special) (Table 3).

Shell Weight (g/5 shells)

Shell weight differed significantly ($p \leq 0.05$) among the treatments. The highest shell weight (1.45 g/5 shells) was observed in T₇ (Posan), which was statistically similar to T₁, T₃, T₄, T₅, and T₆. The lowest shell weight (1.23 g/5 shells) was recorded in T₉ (Control), closely followed by T₈ (Water spray) (Table 3).

Cocoon Shell Ratio (%)

Cocoon shell ratio showed significant ($p \leq 0.05$) differences due to the treatments. The highest cocoon shell ratio (19.78%; arc value 26.40) was recorded in T₇ (Posan), which was significantly superior to all other treatments except T₁ (Pulse Magic). The lowest shell ratio (16.06%; arc value 23.62) was observed in T₉ (Control) (Table 3).

Filament Length (m)

Filament length was significantly influenced ($p \leq 0.05$) by the foliar fertilizer treatments. The maximum filament length (984.33 m) was obtained in T₇ (Posan), statistically comparable with T₁ and T₂, but significantly higher than the remaining treatments. The shortest filament length (324.00 m) was recorded in T₉ (Control) (Table 3).

Filament Weight (g)

Filament weight varied significantly ($p \leq 0.05$) among the treatments. The highest filament weight (0.358 g) was recorded in T₇ (Posan), which was statistically similar to T₁ (Pulse Magic). The lowest filament weight (0.211 g) was observed in T₉ (Control) (Table 3).

Denier

Denier value was significantly ($p \leq 0.05$) affected by the treatments. The highest denier (3.30) was recorded in T₈ (Water spray), followed closely by T₅ and T₉. The lowest denier (2.01) was observed in T₇ (Posan), indicating the finest filament among all treatments (Table 3).

Discussion

The present study clearly demonstrates that foliar nutrient combinations exert a substantial influence on the vegetative performance of mulberry, particularly with respect to plant height, shoot biomass, leaf production, and leaf physiological parameters. Among the treatments, T₇ (Posan) consistently produced the highest growth values, indicating that this formulation effectively enhances nutrient uptake and assimilation through foliar pathways. The significant increase in plant height under T₇ aligns with earlier reports that foliar application of balanced nutrient mixtures enhances cell elongation and vegetative vigor in mulberry (Kumar *et al.*, 2018) [1].

Similarly, the marked improvement in shoot weight, number of leaves, leaf area, and leaf weight under T₇ suggests enhanced photosynthetic efficiency and metabolic activity. Enhanced leaf area, in particular, is strongly associated with higher photosynthetic surface and improved carbohydrate

translocation, as also reported in previous studies on nutrient-enriched foliar sprays in mulberry (Reddy & Chandrasekhar, 2017) [2]. The superiority of T₇ may be attributed to better availability of essential macro-and micro-elements directly at the leaf surface, leading to rapid absorption and efficient utilization for growth and biomass accumulation.

The relatively lower performance of T₈ (Water spray) across all assessed parameters indicates the importance of nutrient supplementation over mere hydration. Treatments such as T₁ (Pulse Magic), which showed values statistically close to T₇ for some traits, highlight that protein-or amino-acid-based foliar formulations can also influence leaf expansion and shoot growth, a finding consistent with the observations of Singh *et al.* (2020) [3].

Interestingly, the leaf-to-shoot ratio did not show significant variation among treatments, suggesting that foliar nutrients predominantly enhanced overall biomass without altering proportional allocation between leaf and shoot components. This trend has also been noted in earlier works where balanced foliar fertilization improved absolute biomass but did not significantly change partitioning ratios (Reddy & Chandrasekhar, 2017) [2].

The present investigation demonstrated that foliar nutrient combinations exerted a significant influence on the growth, development, and economic traits of *Bombyx mori* L. The shortest 5th instar larval duration observed in nutrient-rich treatments, particularly T₂ (Chickpea Magic), indicates accelerated metabolic activity and improved physiological efficiency under balanced nutrient supply. Similar findings were reported where protein-and micronutrient-based foliar supplements enhanced larval growth rate and reduced instar duration (Kumar *et al.*, 2017; Ramesh & Sannappa, 2019) [4, 5].

Larval weight, silk productivity, and effective rate of rearing (ERR %) were markedly improved in T₇ (Posan), reflecting its superior nutrient composition. Increased larval biomass is strongly associated with enhanced leaf nutritional quality, which directly supports silk gland development and silk synthesis (Prasad *et al.*, 2016) [6]. The substantial rise in ERR under T₇ further confirms that enriched foliar feeding reduces mortality and provides a favourable physiological environment for silkworm rearing.

Cocoon and pupal parameters also showed significant enhancement with nutrient-rich treatments, especially in T₇ and T₁. The improved cocoon weight, pupal weight, and shell ratio in these treatments align with the principle that better larval nutrition increases the proportion of assimilated food directed towards cocoon formation (Nagaraju, 2011) [7]. The highest filament length and filament weight recorded in T₇ indicate its positive effect on silk filament biosynthesis, while the low denier value signifies superior silk fineness, a trait highly preferred in commercial reeling. Overall, the study confirms that foliar nutrient combinations particularly Posa and Pulse Magic substantially enhance both biological and commercial traits in *B. mori*. These findings are consistent with earlier reports highlighting the beneficial role of foliar-enriched nutrients in improving cocoon quality and reeling performance (Kumar *et al.*, 2017; Prasad *et al.*, 2016) [4, 6]. Thus, Posa emerges as a highly effective foliar formulation for improving silkworm productivity and economic returns.

Conclusion

The study demonstrated that foliar nutrient combinations significantly enhanced both mulberry growth and silkworm performance compared to untreated controls. Among all treatments, T₇ (Posan) consistently recorded the highest plant height, shoot weight, leaf biomass, and leaf area, indicating its superior role in improving mulberry leaf quality. Enhanced leaf nutritional status under T₇ and T₁ directly translated into improved silkworm biological traits, including shorter larval duration, higher larval weight, superior silk productivity, and a markedly higher effective rate of rearing. Cocoon and reeling parameters such as cocoon weight, shell weight, cocoon shell ratio, filament length, and filament weight were also significantly improved in T₇, confirming its strong influence on silk yield and quality. In contrast, the control and water-spray treatments recorded the lowest values across most parameters, highlighting the necessity of nutrient supplementation. Overall, the results conclude that Posan (T₇) is the most effective foliar nutrient formulation for enhancing mulberry productivity and improving commercial traits of *Bombyx mori* L. and thus holds strong potential for recommendation in sericulture farming.

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