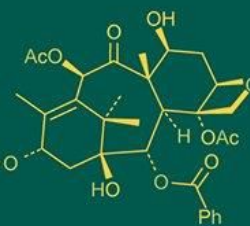


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Nanita Bora
College of Sericulture,
Assam Agricultural University,
Assam, India

Pooja Borah
College of Sericulture,
Assam Agricultural University,
Assam, India

Parishmiti Sonowal
College of Sericulture,
Assam Agricultural University,
Assam, India

Advancing sustainable sericulture through organic nutrient management: A comprehensive review

Nanita Bora, Pooja Borah and Parishmiti Sonowal

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Abstract

Sericulture, an agro based industry which helps in uplifting the socio-economic conditions of sericiculturists, especially in rural and semi-urban regions. For silkworm rearing, farmer's require quality leaves to feed the silkworms, due to which they highly rely on chemical fertilizers and pesticides for higher leaf yield as well as to control pests. As a result, consistent use of these chemical inputs cause soil quality degradation along with decreased leaf yield over time. This review article aims to explore the use of organic nutrient sources like FYM, compost, vermicompost, green manure, oil cakes, pressmud, jeevamrutha and panchagavya in sericulture which not only minimizes the harmful impact of chemical fertilizers but also helps in maintaining the soil health which leads to advancing sustainable sericulture.

Keywords: Sericulture, organic nutrient, FYM, compost, pressmud, panchagavya

Introduction

Sericulture activities encompass the host plant production to rearing of silkworm for production of quality silk. The quality of silk depends heavily on the quality of host plant leaves, which in turn closely tied to soil fertility and nutrient management. Depending on the ages of silkworm larvae, the requirement of quality leaves with different nutrient content varies. Since the nitrogen content from organic manures is desirable for the growth and development of chawki or young age silkworm rearing which influences not only on the health of late-age larvae but also on the cocoon yield (Anonymous, 1975) ^[1]. Growing concerns over soil degradation, chemical residue in leaves and environmental sustainability have induced the interest on organic farming practices among the farmers. The organic farming systems are guided by the philosophy "feed the soil to feed the plant" (Shashidhar, 2009) ^[2]. Organic matter is regarded as the soul of the soil fertility and productivity without which the soil is lifeless. The product that comes out of such soil are less nutritious and the organism depending on it will have least strength to resist disease (Shashidhar, 2009) ^[2]. According to the research findings by Shashidhar, (2009) ^[2] total 18 MT nutrients are removed from the soil annually and 10 MT are replenished i.e., 6 MT by inorganic and 4 MT by organic sources. Therefore, a gap of 8-10 MT is still yet to be replenished. To overcome this, integrated organic nutrient management with traditional organic inputs such as compost, green manure, biofertilizers, vermicompost etc. with scientific nutrient planning was introduced to ensure balanced soil health that sustained productivity and to reduce dependency on chemical fertilizers that enhanced the cultivation of nutrient rich host plant leaves, ultimately improving silkworm health and cocoon quality.

The cost of silkworm host plant leaf production is increasing every year because of the requirement of high and costly chemical inputs. Approximately 60% of the total cost of leaf production is accounted for the consumption of costly chemical fertilizers and farm yard manure. The increasing cost and scarcity of chemical inputs is a growing concern impacting both farmers and the global food security (Dandin *et al.*, 2006) ^[3]. In the context of Sericulture, silkworms are solely depends on host plant leaves. Due to repeated harvesting of leaves it results rapid nutrient mining from soil reserves, which reflects on leaf quality, silkworm growth metabolism and eventually cocoon yield. Hence, the use of various organic manures improves not only the crop productivity but also reduce the cost of cultivation, to protect environment and avoid pest and disease outbreaks (Jayaraj *et al.*, 2006) ^[4].

Corresponding Author:
Nanita Bora
College of Sericulture,
Assam Agricultural University,
Assam, India

Concept and sources of organic nutrient used in sericulture

Most of the silkworm host plants are perennial in nature, because of which, once they are planted, they are being maintained for several years with continuous agronomical practices in a timely interval. To maintain the plants, farmers prefer chemical based inputs because of short term results. Though these chemical inputs initially yield some good results, the silkworm rearers experience some negative impacts on leaf yield after few years, which ultimately reflected on poor cocoon crop production. Moreover, the repeated application of chemical inputs depletes the naturally available essential nutrients besides deleterious effect on soil quality and environment.

Organic nutrient management is a holistic approach to soil fertility that combines various organic inputs to meet crop nutrient needs in a sustainable and environment friendly manner. The core idea behind organic nutrient management is to maintain a balance between nutrient supply and plant demand while minimizing external input costs and environmental degradation. In sericulture, the concept of organic nutrient management is particularly important, as the silkworms are highly dependent on the host plant leaves. Organic nutrient management helps in achieving good quality silk production by ensuring a steady and slow release of nutrients, avoiding leaf toxicity or nutrient imbalance that are common in chemical-intensive system. The growth and development of mulberry plant are highly depending on the organic nutrients as they help to resisting environmental stress along with pest and disease infestation (Venu *et al.*, 2019) [5]. The major sources of organic nutrients for sericulture are-

Organic inputs applied to the soil

Farmyard manure (FYM): Farmyard manure (FYM) is a decomposed mixture of farm animal's dung along with the urine, litter and left over material from roughages or fodder fed to the cattle which contains about 0.5 percent of N, 0.2 percent of P₂O₅ and 0.5 percent of K₂O (TNAU, 2016) [6]. Studies have been reported that, the application of FYM in mulberry plant exhibited better growth and development since it contains higher amount of organic nutrients and also makes the plant resistant to fungal diseases (Ranadive *et al.*, 2011) [7]. FYM has a great impact on leaf yield contributing characters and it can significantly reduce the infestation of foliar diseases like leaf spot, powdery mildew and tukra of mulberry plant (Ahmed *et al.*, 2022) [8]. Integrated effect of FYM, mixed with oil cake of Neem, groundnut, castor, sesame along with turmeric powder and *Pongamia* extracts reflected on higher survivability and growth attribute characters of mulberry saplings and establishment of chawki garden (Ram and Maji, 2020) [9].

Compost and Vermicompost: The mulberry cultivation can be made sustainable and economical by recycling all the organic residues of sericulture origin as compost and vermicompost (Venugopal *et al.*, 2010) [10]. By utilizing the waste generated during sericulture activities can be utilized to prepare compost as well as vermicompost, the soil quality and leaf productivity can be increase (Chantora *et al.*, 2022) [11]. Compost is formed due to biodegradation of organic materials or wastes from the different sources like poultry waste, urban waste and also waste generated from the agro-based industry like sericulture, while vermicomposting is a

bio-oxidation process of organic wastes involving a joint action of earthworms and micro-organisms (Sakthivel *et al.*, 2014) [12]. In the process of vermicomposting earthworms act as versatile bioreactors that converts organic matter into vermicast. Application of vermicompost @ 10 MT/ha/year, alone can reduce recommended dose of chemical fertilizer *i.e* NPK upto 50% and if applied with 20 MT of FYM/ha/year it can reduce the full recommended dose of NPK (Sakthivel *et al.*, 2014) [12]. Use of compost and vermicompost in sericulture aligns with the principle of sustainability, which reduce the dependency on chemical fertilizers and also contributes in organic silk production. Integrated application of FYM with vermicompost recorded higher return in mulberry sericulture than the FYM alone (Chowdhury *et al.*, 2013) [13].

Green manures: Green manures are the best alternative to FYM, which can improve the soil physical structure as well as the fertility of the soil by fixing the nitrogen with the help of its root nodule bacteria (Sakthivel *et al.*, 2014) [12]. Green manure crops that are advocated for tasar host plant plantation are dhaincha (*Sesbania aculeata*) and sunhemp (*Crotalaria juncea*), seeds are broadcasted @ 50 kg/ha. In case of mulberry plant dhaincha and sunhemp @ 15 kg seeds/acre is recommended for alkaline and neutral soil condition respectively (Sakthivel *et al.*, 2014) [12]. These crops can improve the water holding and water retention capacity along with the microbial biomass and organic carbon content in soil which are essential for soil health and growth development of plants (Rathore *et al.* 2024) [14]. About 15-17 tonnes of green biomass per hectare per year can be incorporated to soil by green manuring with different green manuring crops to improve soil structure and fertility in silkworm host plant gardens (Sakthivel *et al.*, 2014) [12]. Green leaf mulching of mulberry garden with neem and *Pongamia* leaves afforded protection against root knot nematodes in mulberry and gave higher leaf yield (Govindaiah *et al.*, 1989) [15].

Table 1: Classification of green manures

Legumes		Non-Legumes	
Green manure	Green leaf manure	Green manure	Green leaf manure
Daincha	Gliricidia	Sunflower	Calotropis
Sunhemp	Cassia	Buck wheat	Adathoda
Kolinji	<i>Pongamia glabra</i>		<i>Thespesia</i>

Table 2: Common shrubs and trees used as green leaf manures

Shrubs	Trees	Green leaf manure
<i>Cassia auriculata</i>	<i>Thespesia populnea</i>	<i>Leucaena leucocephala</i>
<i>Derris indica</i>	Neem	<i>Calotropis gigantea</i>
<i>Ipomoea cornea</i>	<i>Glyricidia</i>	<i>Delonix regia</i>
<i>Jatropha</i>	<i>Cassia tora</i>	<i>Cassia Occidental</i>
<i>Tephrosia candida</i>	<i>Vitex negundu</i>	<i>Hibiscus viscosa</i>

Bio-fertilizers: Biofertilizers are the living microorganisms that are capable of fixing atmospheric nitrogen, solubilizing essential minerals like phosphorus and potassium, and stimulating plant growth through hormone production (Fatimah *et al.*, 2021) [16]. Some biofertilizers can ensure better survival and productivity of the plants by improving its resistance to environmental stress and diseases (Pavankumar *et al.*, 2024) [17]. Biofertilizers are categorized based on their function and act in the soil such as, nitrogen-

fixing (N-fixer), potassium-solubilizing (K-solubilizer), phosphorus-solubilizing (P-solubilizer), and plant growth-promoting rhizobacteria (PGPR) (Nosheen *et al.*, 2021) ^[18]. Certain common bacteria like *Azotobacter chroococcum*, *Azospirillum* spp. Which can fix the atmospheric nitrogen, while the *Azospirillum* plays an additional role by secreting some growth promoting substance like Indole Acetic Acid. It is recommended to apply *Azotobacter* or *Azospirillum* @ 8kg/ acre/ year and *Bacillus megaterium* (P-solubilizer) @ 10 kg/acre/ year along with 500 kgs of FYM in 5 split doses for better productivity of mulberry (Sakthivel *et al.*, 2014) ^[12]. Larger leaf areas, higher shoot numbers, and greater fresh leaf biomass of mulberry plant can be achieved by applying biofertilizer as compared to using chemical fertilizers alone (Borah and Singha, 2022) ^[19]. A comparable or improved cocoon yield, grater effective rate of rearing and higher silk quality can be achieved by replacing 50% of the chemical nitrogen and phosphorus with biofertilizers (El-Khayat *et al.*, 2013) ^[20]. VAM or vesicular-arbuscular mycorrhizae also facilitate efficient nutrient exchange (Douds *et al.*, 2000) ^[21]. Soil based inoculum of VAM containing *Glomus mosseae* and *G. fasciculatum* can be used for raising mycorrhizal mulberry saplings in nursery beds which can reduce 50% of chemical phosphorus application in mulberry cultivation without compromising the quality and quantity of leaves (Sakthivel *et al.*, 2014) ^[12]. If the mulberry cuttings are treated with *Azotobacter chroococcum* and *Azospirillum brasiliense* prior to planting, it increased the sprouting and rooting percentage of the cuttings (Gangawar and Thangavelu, 1992) ^[22]. *Azotobacter* application can increase the leaf yield by 22% in mulberry plant and 50% of the nitrogenous fertilizer application can be saved through the use of *Azotobacter* (Das *et al.*, 1993) ^[23].

Neem oil cake: Neem oil cake contains higher amount of plant nutrients and alkaloids such as *nimbin* and *nimbicidine* which induces resistance against pests and diseases in mulberry (Venu *et al.*, 2019) ^[5]. Application of neem oil cake @ 60 kg/acre/crop combined with N fertilizer significantly increase the mulberry leaf yield and to control the infestation by *Meloidogyne incognita*, application of neem oil cake @ 800 kg/acre in 4 split doses at 3 months interval is recommended (Sakthivel *et al.*, 2014) ^[12].

Pressmud: Pressmud is a soft, spongy, amorphous and dark brown to brownish coloured material generated as waste in sugar factories which contain sugar, fiber, coagulated colloids, including cane wax, albuminoids and inorganic salts etc, having essential plant nutrients. (Ghulam *et al.*, 2012, Khan *et al.*, 2012) ^[24,25]. To sustain the yield and quality of mulberry leaves for quality silkworm cocoon production sulphitation processed pressmud can be applied either alone or with FYM in different nutrient combination (Ram *et al.*, 2017) ^[26].

Organic inputs as foliar applition

Foliar application of nutrient is a method of supplying essential nutrients to plants by directly applying liquid fertilizers onto their leaves. Plants can absorb vital elements through stomata and epidermis. Some amount of absorption also takes place through the epidermis and bark (Mahesha and Sannappa, 2024) ^[27].

Vermi-wash: Vermi-wash is a liquid organic fertilizer extracted from vermicomposting units which contains different micronutrients and can be effectively used as foliar spray. A mixture of vermiwash @ 1 liter with 1 liter of cow urine per 10 liters of water can be used as bio-pesticide cum liquid manure (Sakthivel *et al.*, 2014) ^[12].

Jeevamrutha: Jeevamrutha is a mixture of 1.25 kg of local cow dung, 1.25 liters of cow urine, 250 g of jaggery, 250 g of pulse flour, a handful of garden soil, along with 25 liters of tap water. This mixture is use to kept in a plastic drum for as 15 days incubation period (Palekar, 2006) ^[28]. This solution is recommended to dilute at a concentration of 5%, 7.5%, and 10% for foliar application in host plants of silkworm (Mahesha and Sannappa, 2024) ^[27]. It is a miracle fermented microbial culture that can supply essential nutrients to the plant.

Panchagavya: It is a well-known organic product of five cow products *i.e* cow dung (7kg), cow urine (10 litres), milk (3 litres), curd (2 litres), ghee (1kg) along with some other ingredients like jaggery (3kg), well ripened banana (12 nos.), tender coconut water (3 litres) and plain water (10litres) . This mixture is very rich in all macro and micro nutrients along with different plant growth promoting hormones like Indole Acetic Acid, Gibberellic Acid etc that are essential for quality leaf production of silkworm host plants like mulberry plant (Sakthivel *et al.*, 2014) ^[12]. This ancient Vedic formulation not only maximize the growth and development of the plant but also increases the yields of the plant (Kumar and Singh, 2020) ^[29].

Future Prospects of Organic Nutrient Management in Sericulture

As a land and labour-intensive agro-industry, with growing concerns over soil degradation, environmental pollution along with the rising costs of inputs for inorganic nutrients, the need for organic nutrient management in sericulture has become more critical than ever. Excessive and unbalanced use of chemical fertilizers over the years has led to decline in soil fertility, reduced microbial diversity and deterioration of leaf quality, which ultimately affects the silkworm health and cocoon yield. Organic nutrient management offers a sustainable alternative by improving soil structure, enhancing nutrient availability through natural process which promotes a balanced ecosystem. As sericulture is closely linked to rural livelihoods, especially among small and marginal farmers, shifting to organic practices can reduce dependency on costly chemicals, lower production risk and ensures more eco-friendly approach to silk farming. So, integrating organic nutrient management is not only necessary for the soil and plant health but also a strategic movement towards sustainable and resilient sericulture.

Moreover, in this 21st century sericulture stands at a pivotal juncture where it must navigate the challenges in terms of consumer demands and market dynamics. Now-a-days, peoples are preferring organic products which are possible to achieve only through the organic farming practices. In recent years, there is a noticeable shift in consumer preferences towards ethically produced and environment friendly textile. This change is driven by increasing awareness about climate change, soil degradation etc. One of the key factors behind this trend is the growing

integration of organic silk production through organic farming system.

Conclusion

The sustainability and productivity of sericulture are deeply rooted in the health of the soil and the nutritional quality of host plant leaves. Organic nutrient management plays a vital role in strengthening the foundation of sustainable sericulture. Balanced nutrient strategies not only minimize the harmful impact of excessive chemical fertilizer but also supports long term viability of soil. It is not merely an alternative to chemical fertilizer but a holistic approach that supports our environment. The future of sustainable silk depends on scientific innovation and commitment to environmentally friendly practices starting from the host plant production to the silk processing. In this aspect, organic farming system with organic inputs are the only way to promote sustainable sericulture.

References

1. Anonymous. Studies on the response of soil application and foliar spray of nitrogen and NPK on the productivity and quality of mulberry leaf. Annual Report, CSR&TI, Mysore. 1975; p. 21-24.
2. Shashidhar KR. Organic based nutrient management in mulberry (*Morus indica* L.) and its influence on rearing performance of silkworm (*Bombyx mori* L.). [Ph.D. Thesis]. Bangalore: University of Agricultural Sciences; 2009.
3. Dandin SB, Das PK, Bhogesh K. Recycling of sericultural farm residue for sustainable mulberry production. Natl Sem Soil Health and Water Management for Sustainable Sericulture. 2006 Sep 27-28; Bangalore, India. Regional Sericultural Research Station (CSB); 2006. p. 45-55.
4. Jayaraj S, Dandin SB, Veeraiah TM, Quadri SMH, Krishna Rao JV. INM technology development and dissemination for sustainable sericulture through farmer-participatory mode in three states in south India—an overview. Natl Sem Soil Health and Water Management for Sustainable Sericulture. 2006 Sep 27-28; Bangalore, India. Regional Sericultural Research Station (CSB); 2006. p. 18-26.
5. Venu VS, Jothamani P, Kalpana PV, Devaghi P. Effect of organic nutrition in enhancing mulberry and silkworm productivity—a review. International Journal for Science and Advance Research in Technology. 2019;5(2):595-600.
6. TNAU Agritech Portal. Organic farming: organic input & techniques, training related information gallery. Coimbatore: Tamil Nadu Agricultural University; 2016.
7. Ranadive GA, Gunasekar R, Arun N, Sundaravel KR, Ramachandran. Potentiality screening of FYM and vermicompost in disease resistance of mulberry. Asian Journal of Environmental Science. 2011;6(2):131-135.
8. Ahmed F, Ahmed NU, Sultana R, Ahmed O. Utilization of farm yard manure as a source of nutrients for sustainable mulberry production. International Journal of Agriculture and Food Science. 2022;4(1):38-52.
9. Ram RL, Maji C. Integrated effect of mixed oil cake and FYM on raising of mulberry saplings and establishment of chawki garden for sustainable sericulture. International Journal of Agricultural Sciences. 2020;16(1):1-10.
10. Venugopal A, Chandrasekhar M, Naidu BV, Satyanarayana R. Vermicomposting in sericulture using mixed culture of earthworms (*Eudrillus eugineae*, *Eisenia foetida* and *Perionyx excavatus*)-a review. Agricultural Reviews. 2010;31(2):150-154.
11. Chanotra S, Verma S, Ahmad Bhat M, Angotra J, Verma GR, Langer S, et al. Studies on vermicomposting of sericultural wastes: an eco-friendly approach for effective management of seri-wastes. International Journal of Experimental Agriculture. 2022;44(12):146-156.
12. Sakthivel N, Ravikumar J, Chikkanna KV, Bindroo BB, Sivaprasad V. Technical bulletin: organic farming in mulberry-recent breakthrough. Tamil Nadu: Regional Sericultural Research Station, Central Silk Board; 2014 Jul.
13. Chowdhury PK, Setua GC, Ghosh A, Kar R, Maity SK. Sustainable quality leaf production in S-1635 mulberry (*Morus alba*) under irrigated condition through organic nutrient management. Indian Journal of Agricultural Science. 2013;83(5):529-534.
14. Rathore MS, Nadaf HA, Vishaka GV, Majumdar SM, Reddy BT, Bawaskar DM, et al. Tropical tasar sericulture: current challenges and management practices. Plant Archives. 2024;24(Special Issue VS):98-103.
15. Govindaiah, Suryanarayana NN, Sharma DD, Gargi. Effect of mulching of green leaves for the control of root knot nematode in mulberry. Indian Journal of Nematology. 1989;19:25-28.
16. Fatimah N, Dar SA, Ashraf S, Rashid S, Mukhtar Y, Mir HS. Biofertilizers for sustainable agriculture-an overview. International Journal of Current Microbiology and Applied Science. 2021;10(6):1-14.
17. Pavankumar S, Qadir J, Shalini A, Thakur R, Afreen S. An overview of biofertilizers in agriculture with special reference to mulberry. International Journal of Advance Biochemistry Research. 2024;8(5):389-397.
18. Borah P, Singha TA. Role of biofertilizers for improvement of silkworm host plant. AgriCos e-Newsletter. 2022;3(4).
19. El-Khayat EF, Gaaboub IA, Omer REM, Ghazey UM, ElShewy AM. Impact of bio and inorganic fertilizer treatments on economic traits of mulberry silkworm (*Bombyx mori* L.). Journal of Pest Science. 2013;6(1):1-6.
20. Gangawar SK, Thangavelu K. Evaluation of biofertilizer for establishment of mulberry (*Morus alba* L.). Sericologia. 1992;32:173-178.
21. Das PK, Choudhary PC, Ghosh A, Katiyar RS, Mathur VB, Datta RK. Use of *Azotobacter* biofertilizer in mulberry cultivation. Indian Silk. 1993;6:43-45.
22. Nosheen S, Ajmal I, Song Y. Microbes as biofertilizers, a potential approach for sustainable crop production. Sustainability. 2021;13(4):1-21.
23. Douds DD, Gadkar V, Adholeya A. Mass production of VAM fungus biofertilizer. In: Mukerji KG, Chamola BP, Singh J, editors. Mycorrhizal Biology. Dordrecht: Springer; 2000. p. 197-215.
24. Ghulam S, Khan MJ, Usman K, Shakeebullah. Effect of different rates of pressmud on plant growth and yield of lentil in calcareous soil. Sarhad Journal of Agriculture. 2012;28(2):249-252.

25. Khan MJ, Khan MQ, Zia MS. Sugar industry press mud as alternate organic fertilizer source. International Journal of Environment and Waste Management. 2012;9(1/2):41-55.
26. Ram RL, Chatterjee S, Maji C, Kar R, Singh YV. Integrated effect of treated pressmud and FYM on mulberry leaves and bioassay of silkworm in acid soils of Kalimpong hills, India. International Journal of Current Microbiology and Applied Science. 2017;6(1):767-783.
27. Mahesha HM, Sannappa B. Organic based foliar formulations on mulberry: a pathway to enhance rearing performances of double hybrid silkworm, *Bombyx mori* L. Agricultural Research Journal. 2024;61(3):395-404.
28. Palekar S. Textbook on Shoonya Bandavalada Naisargika Krushi. Bangalore: Swamy Anand Publishers, Agri Prakashana; 2006.
29. Kumar CS, Singh G. Effect of Panchagavya on growth and yield: A review. International Journal of Current Microbiology and Applied Science. 2020;9(12):617-624.