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Biofertilizers for Sustainable Sericulture: Improving Host Plant Growth and Soil Health

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Sericulture depends heavily on the availability of healthy host plants, as leaf quality directly influences silkworm growth and silk production. Continuous use of chemical fertilizers may degrade soil health and reduce microbial diversity, creating the need for more sustainable alternatives. Biofertilizers, which contain beneficial microorganisms, offer an eco-friendly approach to improving soil fertility and plant productivity. Microbes such as nitrogen-fixing bacteria, phosphate-solubilizing bacteria, potassium-mobilizing microorganisms, and mycorrhizal fungi enhance nutrient availability, stimulate plant growth, and improve soil biological activity. Their application in sericulture host plants such as mulberry, castor, som, and soalu supports better leaf yield and quality, which ultimately improves silkworm performance and cocoon production. Biofertilizers also contribute to improved soil structure, nutrient cycling, and long-term soil fertility. Therefore, the adoption of biofertilizers can promote sustainable sericulture by reducing dependence on chemical fertilizers while maintaining soil health and productivity.

Keywords: Biofertilizers, Sericulture, Soil health, Host plants, Nutrient cycling

Introduction

Sericulture is an important agro-based industry that provides livelihood to millions of rural families, especially in countries like India. The success of sericulture largely depends on the availability of healthy **host plants**, because the leaves of these plants serve as the primary food for silkworms. The quality and quantity of leaves directly affect silkworm growth, cocoon production, and ultimately silk yield. Therefore, maintaining fertile soil and healthy host plants is essential for sustainable silk production.

Traditionally, farmers have relied on chemical fertilizers to increase leaf yield. Although these fertilizers can improve productivity, their continuous use may degrade soil health, reduce microbial diversity, and increase environmental pollution. In recent years, there has been growing interest in eco-friendly agricultural practices that maintain soil fertility while reducing dependence on synthetic inputs.

One such promising approach is the use of **biofertilizers**, which are formulations containing beneficial microorganisms that enhance plant growth and soil fertility. Biofertilizers help improve nutrient availability, stimulate plant metabolism, and promote sustainable agricultural production systems (Borah *et al.*, 2025; Gul *et al.*, 2015). In sericulture, the application of biofertilizers has shown significant potential in improving host plant growth, leaf quality, and overall productivity.

Biofertilizers and Their Importance in Sericulture

Biofertilizers contain beneficial microorganisms that improve soil fertility and promote plant growth through natural biological processes. These microorganisms colonize the rhizosphere, or root zone, of plants and help convert nutrients present in soil into forms that plants can

easily absorb. As a result, biofertilizers enhance nutrient availability and promote healthy plant development (Saeed *et al.*, 2021; Mahanty *et al.*, 2017).

In sericulture, the productivity of silkworms largely depends on the quality of leaves obtained from host plants such as mulberry, castor, som, and soalu. The application of biofertilizers improves soil microbial activity and nutrient cycling, which supports better growth of these host plants. Healthy and nutrient-rich leaves improve silkworm growth, cocoon weight, and overall silk productivity (Mahanty *et al.*, 2017).

Common microorganisms used in biofertilizers include nitrogen-fixing bacteria such as *Azotobacter* and *Azospirillum*, phosphate-solubilizing bacteria such as *Bacillus* species, potassium-mobilizing microorganisms, and arbuscular mycorrhizal fungi like *Glomus*. These microbes enhance nutrient uptake and improve plant metabolism, leading to better leaf yield and quality (Saeed *et al.*, 2021). Compared with chemical fertilizers, biofertilizers are environmentally friendly and help maintain the biological balance of soil. Their use supports sustainable sericulture by improving soil health while reducing dependence on synthetic fertilizers.

Types of Biofertilizers Used in Sericulture

Several types of biofertilizers are used to enhance the growth of sericulture host plants.

- **Nitrogen-fixing biofertilizers** such as *Azotobacter* and *Azospirillum* convert atmospheric nitrogen into plant-available forms. Nitrogen is essential for leaf growth and protein synthesis, which are important for the nutritional quality of leaves fed to silkworms (Mahanty *et al.*, 2017).
- **Phosphate-solubilizing microorganisms** play an important role in making soil phosphorus available to plants. These microbes release organic acids that convert insoluble phosphates into soluble forms, thereby improving phosphorus uptake. Adequate phosphorus availability promotes strong root development and supports better plant growth.
- **Potassium-mobilizing microorganisms** help release potassium from soil minerals and make it accessible to plants. Potassium is important for plant metabolism, enzyme activity, and stress tolerance. Proper potassium nutrition also helps plants withstand environmental stresses such as drought and disease.
- **Mycorrhizal fungi**, particularly arbuscular mycorrhizae such as *Glomus*, form symbiotic associations with plant roots and enhance nutrient and water absorption. These fungi also improve plant resistance to environmental stress and increase overall plant vigor. The major types of biofertilizers involved in improving soil fertility and host plant growth in sericulture are illustrated in Figure 1.

Fig. 1: Types of biofertilizers and their role in improving soil health and host plant growth in sericulture

Role of Biofertilizers in Improving Soil Health

Soil health is a key factor in the successful cultivation of sericulture host plants. Biofertilizers contribute to soil health by increasing microbial diversity and stimulating biological activity in the soil. Beneficial microorganisms introduced through biofertilizers participate in nutrient cycling processes such as nitrogen fixation, phosphorus solubilization, and organic matter decomposition. These processes increase the availability of essential nutrients for plant growth. As a result, plants are able to absorb nutrients more efficiently from the soil.

Improved nutrient availability supports healthy growth and higher productivity of sericulture host plants.

Biofertilizers also improve soil structure by promoting the formation of soil aggregates. Improved soil structure enhances water retention, aeration, and root penetration, which ultimately supports better plant growth. In addition, increased microbial activity helps maintain soil fertility over a long period without causing environmental degradation. Better soil structure also reduces soil erosion and nutrient loss from agricultural fields. These improvements create favorable conditions for strong root development and sustained plant growth.

The use of biofertilizers also supports the development of a balanced soil ecosystem. Healthy soil microbial communities play an important role in maintaining nutrient balance and improving plant resilience to environmental stress. These microorganisms help protect plants from certain soil-borne pathogens and enhance plant health. As a result, the overall productivity and sustainability of sericulture farming systems can be improved.

Benefits of Biofertilizers for Sericulture Host Plants

The use of biofertilizers offers several benefits for the cultivation of sericulture host plants. First, biofertilizers enhance plant growth and leaf yield by improving nutrient availability in the soil. Increased leaf production ensures an adequate supply of food for silkworms. Second, biofertilizers improve the nutritional quality of leaves, including protein and mineral content. Nutritious leaves are essential for healthy silkworm development and better cocoon formation. Third, the use of biofertilizers reduces the dependence on chemical fertilizers while maintaining plant productivity, thereby lowering input costs for farmers and minimizing environmental pollution (Vejan *et al.*, 2016).

Finally, the improvement of soil fertility through biological processes supports sustainable sericulture practices and long-term productivity (Saeed *et al.*, 2021; Vejan *et al.*, 2016). In addition, the regular use of biofertilizers enhances soil microbial diversity, which contributes to better nutrient cycling and soil stability. These benefits ultimately support the sustainable cultivation of sericulture host plants and improve the overall efficiency of silk production.

Application of Biofertilizers in Sericulture Fields

Biofertilizers can be applied in sericulture fields using simple methods that are easy for farmers to adopt. Regular use of these practices improves soil fertility and promotes better growth of sericulture host plants. Proper application also helps beneficial microorganisms establish themselves in the root zone, where they can actively participate in nutrient cycling and plant growth promotion (Mahanty *et al.*, 2017). The regular use of these application methods helps maintain soil microbial activity, improves plant health, and supports higher leaf production in sericulture host plants.

- **Soil application** is one of the most common methods, where biofertilizers are mixed with compost or farmyard manure and applied during land preparation. This method helps distribute beneficial microorganisms evenly in the soil and improves nutrient availability around plant roots.
- **Root dipping** involves dipping the roots of seedlings in a biofertilizer solution before transplantation. This allows beneficial microorganisms to colonize the root surface quickly and enhances early plant growth.
- **Seed treatment** is another method in which seeds are coated with biofertilizer cultures before sowing. This improves seed germination, root development, and early establishment of plants in the field. The common methods of applying biofertilizers in sericulture host plants are illustrated in Figure 2.

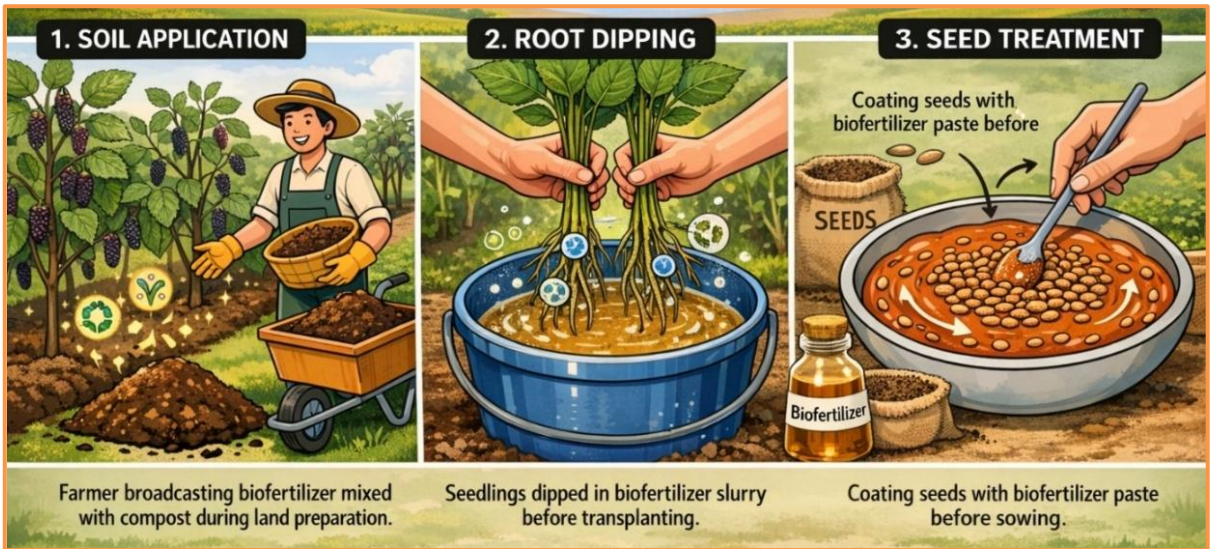

Fig. 2: Application methods of biofertilizers in sericulture fields, including soil application, root dipping, and seed treatment

Conclusion

Biofertilizers offer a sustainable and eco-friendly way to improve soil health and host plant productivity in sericulture. By increasing nutrient availability and beneficial microbial activity, they help produce healthy leaves in host plants such as mulberry, castor, som, and soalu, which directly supports better silkworm growth and cocoon production. Farmers can reduce the use of chemical fertilizers by adopting biofertilizers and maintain soil fertility for a longer time. Therefore, sericulture farmers are encouraged to integrate biofertilizers with their regular cultivation practices to improve leaf yield, reduce input costs, and maintain soil health. The wider adoption of these practices can strengthen sustainable silk production and support environmentally responsible sericulture farming.

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