

# Morus Plant Health, Soil Nutrient Inducer, and Defoliator Insect Pest Management in The Organic Cultivation of Mulberry Crops for Cocoon Production

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## Abstract:

Sericulture is a lucrative, labor intensive industry that benefits the community. From its ancient, land based roots in India, where it provided few employment prospects and financial benefits for farming families, it has made significant progress. Using traditional farming methods like compost, animal waste, and polyculture of various varieties of multivoltine silkworms, India is one of the world's leading food producers. In the past, farmers depended on conventional practices, but now they frequently utilize contemporary methods with chemicals to stimulate plant growth. These chemical approaches, however, have the potential to contaminate both the environment and our food. The influence of organic nutrition on silk fiber from the Cocoon Boom, the PM race, the Nistari race, and the natural multivoltine races was examined. According to studies, the addition of organic compost vitamins to mulberry leaves enhances the output of mulberry crops. The use of liquid formulations was widespread throughout ancient India. In the meantime, organic farmers created plant growth promoters utilizing indigenous knowledge, giving them names such as Amritpani, Panchagavya, Bijamrita, and Jeevamrita. In addition, certain successful bio-dynamic farming methods are employed in India, including BD-500, BD-501, Cow Pat Pit, bio-dynamic liquid fertilizers, and bio-pesticides. Enriched water and Bio sol are also utilized in home organic farming, which many cocoon rearers and companies have found to be beneficial. It is important to note that these recipes are primarily based on cow-based ingredients. Studies on soil nutrient inducer demonstrate that they can greatly improve the organic output of a variety of crops. Organic nutrients can help enhance yields in sericulture, and it has a bright future in the silkworm grainage and reeling sectors.

**Keywords:** Panchagavya, Amritpani, jeevamrita, Azospirillum, organic liquid pesticides derived from natural sources, and soil nutrient inducer.

## Introduction:

India is famous for its agro-based sericulture industry, which produces all four types of natural silk: mulberry, tasar, eri, and muga. The nation's whole silk production is made up of 90% mulberry silk. The mulberry silkworm, *Bombyx mori* L., is a monophagous species since it feeds exclusively on mulberry leaves. Understanding approved natural fertilizers, green manures, vermi compost, bio-fertilizers, and other organic components have all been shown to have positive impacts on mulberry yields and the silk produced. The production of this vital material, which is made from mulberry leaves, relies on the integration of traditional agricultural practices for rearing the *Bombyx mori* L. silkworm-producing larvae. It is thus imperative to monitor the growth and development of mulberry, the host plant, in order to increase cocoon production. Around 36 to 38% of the duties required for a thriving sericulture company are under the purview of mulberry. The overuse of agrochemicals has resulted in detrimental environmental impacts such as groundwater and soil contamination. Soil quality is becoming a danger to food security, product quality, and sustainability as a result of decreasing micronutrient and organic matter concentration. The extensive use of agricultural inputs, particularly chemical fertilizers and pesticides, has also led to pesticide resistance in pests and the permanent extinction of beneficial species such honeybees, pollinators, parasitoids, and predators. As a consequence, the completed silk product

contains hazardous pesticide residue, which has a negative effect on food safety and production (Anonymous, 2006; Majumdar et al., 1935). As a result of the Green Revolution's effects, many countries have understood the necessity to reduce the usage of harmful agrochemicals in the production of sericulture crops. The persistent deficiency of superior agricultural inputs in inorganic farming for both pest and nutritional management is a continuous problem. In response to these challenges, a number of organic farming methods have been created across the country, including Rishi Krishi, Bio enhancer agriculture, Natural farming (Patnaik, H. P., et al., 2012), Nature's farming, Panchagavya farming, and Homa Organic farming. These methods involve developing and using a variety of recipes to produce the desired crop output. Based on our more than ten years of intensive work with organic farming systems, we think that bio enhancers may provide a cost-effective and effective solution to a wide range of problems, including a low-cost alternative to fertigation. The active fermentation of animal and plant waste for a specified period of time results in the production of bio-enhancers, which are organic formulations. These compositions are rich in micronutrients, macronutrients, microbial communities, plant growth enhancers, and immune system boosters. They are frequently utilized to encourage healthier plant growth, boost the soil's organic matter, and treat seeds and seedlings. In many organic farming practices used in India and other nations, cows play a critical role (Venugopal, A., 2010; Pathak et al., 2010). It's important to keep this in mind. Previously, cow dung and urine were used as biological control strategies against plant and human diseases. The five cow products milk, urine, feces, ghee, and curd are used in a variety of organic farming techniques.

#### **Soil nutrient inducer:**

The field of plant life known as vriksh ayurveda is focused on cultivating and feeding plants with liquid manures (produced from plant and animal materials). Some verses, such as Varahamira's Brahatasambhita, Surpala's Vriksh ayurveda, and Sharangadhara's Upavana vinoda, provide specifics on irrigation methods that utilize water and herbal and animal products from different plant species to enhance agricultural output (Sadhale, 1996; Thippeswamy, T., 2005 & Jaishanakar, 2007). The term 'Kunapajala,' which, according to Sanskrit dictionaries, is made up of the words 'Kunapa,' which means dead or decaying material, and 'Jala,' which refers to the water produced by this dead material. According to Das et al. (1990) and Dandin (2002), Kunapajala is often used for plant protection methods and promotes the flowering, fruiting, and vegetative growth of green plants.

**The following features define soil nutrient inducer:** good source of micronutrients and macronutrients, contains components that promote plant growth, boosts immunity, has fungicidal and pesticide properties, and is influenced by factors like the components utilized and the way it is made. Used to enhance mulberry leaf production, improve soil fertility, increase waste breakdown, and treat seeds and seedlings is an effective useful instrument for fertigation. Soil nutrient inducer; in general, stand out for falling into two categories. The features are listed below:

**(i) Plant-based:** These recipes include whole tender plants and leaves like sun hemp, dhaincha (Sesbania), Erythrina, and other legumes as a good source of nitrogen, as well as weeds like Parthenium, stinging nettle, Cassiatora, etc. leaves of neem, pongamia, Subabul (Leucaena leucocephala), glyricidia, lantana, Calotropis, and other indigenous plants with pesticidal properties are used in this manner. honestly.

**(ii) Animal based:** These are constructed using cow dung, sheep and goat excrement, and fish manure (Yadav, DS et al., 2009 & Etebari, k. et. al., 2003). Crop productivity is more affected by combinations of plant and animal byproducts (FAO, 2006). Animal and plant remains are actively fermented for a specific amount of time in order to produce liquid fertilizer and liquid manure (Anonymous, 2006). Organic liquid manures are crucial for encouraging growth and providing the plant system with defense (Sreenivasa et al., 2010). Naturally obtained compounds are increasingly used in sustainable production inorganic farming systems (Suthar, 2010; Samokhvalova, GV. et. al., 1972 & Tayade, DS., 1983). Farmers in several states utilize a variety of liquid manure preparations. Only a few important and widely used formulations are addressed as follows. Bio-enhancers may be categorized into fundamental and specialized preparations according to their method of production. In the paragraphs below, they are summarized briefly:

**Unique soil nutrient inducer:** In several organic farming strategies, the impacts of bio-enhancers derived from cows have been observed, both when used alone and in conjunction with a few more ingredients. The primary features and consequences of some of the selected soil bio-enhancers are discussed here.

**Bio dynamic preparation (502-507):**

In compost production, biodynamic agriculture employs preparations. These preparations are rich in microbial load and make use of cosmic energy in compost piles. These compost preparations are made with a variety of herbs. Biodynamic preparations 502, 503, 504, 505, 506, and 507 are among them. The microbial analysis of these bio dynamic preparations included counting the numbers of various beneficial microbial communities, such as bacteria, fungi, actinomycetes, Pseudomonas, gram positive bacteria, gram negative bacteria, p-solubilizing bacteria, Rhizobium, Azotobacter, and Azospirillum. 36 microbial cultures were examined for PGPR activities; one showed HCN synthesis, eight showed chelating, and eight others showed IAA production characteristics (Ram and Singha, 2020).

**Cow horn manure (BD-500):** Biodynamic preparations were subjected to standard microbial analysis methods (Ram et al., 2010) in order to count different beneficial microbial populations, such as bacteria, fungi, actinomycetes, Pseudomonas, gram-positive bacteria, gram-negative bacteria, p-solubilizing bacteria, Rhizobium, Azotobacter, and Azospirillum. By regularly applying preparation-500, you may offer all of the soil characteristics mentioned below: solid humus production, Enhanced soil tilth and crumb structure a rise in the number of germs, The rhizobacteria activity (nodulation) of all legumes, including gram, pea, moong, sun hemp, etc. , increases. Boosting the amount of phosphate-solubilizing bacteria the soil's capacity to absorb and retain water is enhanced by the increased activity of earthworms. (Note) According to international research, using BD-500 in soils requires 25% less irrigation than traditional soils, and Plants establish a large root system (Ray, D. et. al., 1976; Sahindran Nair et. al., 1999 ).

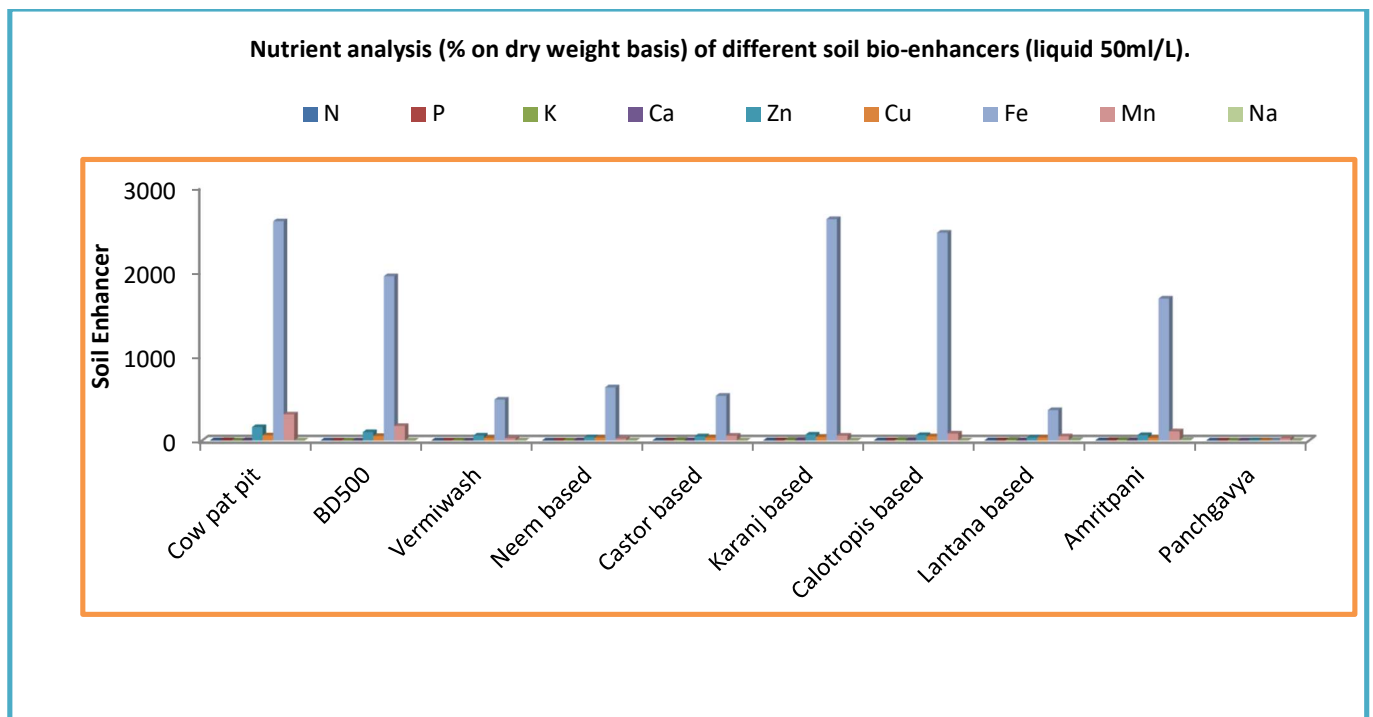
**BD-501:** Cow horn silica The king BD-501 employs a flawless focal mechanism constructed of cow horn to concentrate the earthly or cosmic flow of energy onto the material that fills the horn. Silica in cow horn has been used to extract known helpful microbes for controlling soil and plant health (Ram et al., 2010).

**Cow Pat Pit (CPP):** CPP is a useful tool because it is a concentrated source of beneficial microbes and a powerful soil enhancer. As per a study by Ram et al. (2010), the bacterial loads of Rhizobium ( $1.9 \times 10^6$ ), Azospirillum ( $0.2 \times 10^6$ ), Azotobacter ( $8.0 \times 10^5$ ), and fungi ( $2.5 \times 10^6$ ) were all lower than that of CPP, which had the highest at  $4.8 \times 10^6$  per gram. The plant also had the highest concentration of the pathogen-resistant bacterium *Bacillus subtilis* ( $1.9 \times 10^6$ ) (Proctor, 2008). The three plant growth hormones in CPP were Gibberellic acid (23.6 mg/kg), Kinetin (7.6 mg/kg), and Indole Acetic Acid IAA (28.6 mg/kg) (Perumal et al., 2019). CPP provides nourishment and supports plant growth by encouraging microbial populations and protecting against fungal diseases (Perumal, K. V et al., 2006; Pain, AK. , 1961 & Parpiev, BA. , 2020).

**A biodynamic liquid manure/pesticide:** Biodynamic liquid manure/pesticide can be made readily using cow manure, urine, leaves of leguminous trees, neem leaves, fish waste, castor leaves, and other therapeutic plant components. In addition to cow manure, there is cow urine and one set of BD preparations (502–507). Furthermore, biodynamic liquid manure/pesticide contains vital nutrients, beneficial microorganisms, and insecticidal capabilities. In this studies conducted by Ram, R. A and Verma, et al. (2011) and Newmann, S. et. al. (1982), the biodynamic liquid insecticides were effectively used to control mango hopper populations. Panchagavya has the potential to boost the plant system's defenses and promote growth against defoliator pests and illnesses. A 3% solution has been shown to be consistently effective against a broad spectrum of plant pests and diseases, including rust, mildew, blight, and leaf spot of vegetables. Furthermore, treated plants were shown to have inhibitory effects on foliar caterpillars (Selvaraj, 2006; Hanson, B, et. al., 2004 & Muniandy, S., 2001) as well as sucking pests like aphids, thrips, white flies, and mites.

**Table1: Nutrient analysis (% on dry weight basis) of different soil bio-enhancers (liquid 50ml/L).**

Preparations of different soil bio enhancer	N (%)	P (%)	K (%)	Ca (%)	Zn (ppm)	Cu (ppm)	Fe (ppm)	Mn (ppm)	Na (%)
Cow pat pit	2.10	3.85	0.42	4.25	160	62	2595	309	0.30
BD 500	1.26	1.32	0.57	0.45	100	55	1945	173	0.20
Vermi wash	0.27	0.64	1.73	0.69	60	31	485	28	0.75
Neem based bio dynamic pesticide	0.29	1.09	1.47	3.25	40	34	630	24	1.07
Castor based biodynamic pesticide	2.10	1.83	5.87	2.06	50	37	530	57	1.00
Karanj based biodynamic pesticide	2.04	2.06	5.95	6.57	70	44	2620	58	1.12
Calotropis based biodynamic pesticide	2.25	1.86	6.30	6.76	65	50	2460	83	1.02
Lantana based biodynamic pesticide	3.20	1.51	5.87	2.97	35	36	360	51	5.87
<i>Amritpani</i>	2.37	4.91	6.45	3.35	65	33	1680	109	6.45
<i>Panchagavya</i>	0.007	0.01	0.06	-	2.9	2.4	1.7	25.8	trace



**Jeevamrita:** Jeevamrita is created by fermenting cow manure, urine, jaggery, pulse flour, and virgin soil in rudimentary facilities that were constructed in the hamlet with little expenditure. Groups of beneficial microbes make up the rich bio combination known as jeevamrita. The best outcomes for the application of Jeevamrita, as determined by a thorough microbiological study conducted from the 0th day to the 20th day of preparation, should be obtained between 6 and 9 days (Ram et al., 2010).

**Beejamrita:** Using components that are easily available locally, it is a special bio-enhancer for soil that is made for treating seeds and seedlings. Since preparation is simple and affordable, small and marginal farmers may easily produce and utilize it. Fresh Beejamrita should be made and used to treat seeds, seedlings, and other plant

components before planting or transplanting. Microbiological testing of Beejamrita indicates that it should be used on the seventh day after it is made (**Ram et al, 2010**).

**Amritpani:** In contrast to the use of 350gN, 150gP<sub>2</sub>O<sub>5</sub>, and 350g K<sub>2</sub>O/tree, the organic mulching, the application of 250g of rhizospheric soil from a *Ficus benghalensis* tree, and the use of Amritpani in the inorganic production of guava resulted in the highest returns (INR1,27,746/ha) and benefit cost ratio (4.4) (Ram and Verma, 2011). A systematic microbiological analysis of Amritpani between days 0 and 20 revealed that the optimum results are obtained when it is utilized between days 6 and 9 after manufacturing. It includes beneficial bacteria like biological agents and those that fix nitrogen and dissolve phosphorus (**Horie, Y, et al., 1980; Ram et al., 2010**). After being applied to the soil, it improves mulberry output as well as humus content, earthworm activity, and hence soil fertility.

**Vermiwash:** Using excessive water to soak the vermicompost material results in the production of liquid leachate from vermiwashing. It is composed of mucous replicas of earthworm excrement, as well as nutrients from soil organic molecules. In fact, the high number of earthworms raised in clay, plastic, or concrete pots were used to produce vermi, a bio-enhancer for improving soil quality. Nitrogen-fixing microorganisms like *Rhizobium* sp., *Agrobacterium* sp., and *Azotobacter* sp. were found in the microbiological analysis of vermi wash, along with phosphate-solubilizing bacteria. Phosphate-solubilizing bacteria, *Rhizobium*, *Agrobacterium*, and *Azotobacter* are all present in vermi wash microflora. Additionally, vermi wash contains total heterotrophs like *Pseudomonas* (0.01 x 10<sup>7</sup>), phosphate-solubilizing microbes (0.06x10<sup>6</sup>), *Rhizobium* (0.07x10<sup>5</sup>), *Azotobacter* (0.14 x 10<sup>6</sup>), and *Azospirillum* (0.007 x 10<sup>6</sup>) (**Pathak and Ram, 2013; Machii, K. et al., 1991 & Magadum, SB. et al., 1989**).

**Biosol:** A specific biological preparation made by Gloria in Peru bears the name Gloria Biosol (Weir, 2009). Because of the high concentration of beneficial bacteria and energy found in the Homa atmosphere, Biosol is superior to vermi wash (**Yadav, 2009; Natrajan, 2003 & Selvaray, N. et al., 2012**). With Home methods, it is possible to provide a complete diet to the plants, including the ideal concentration of nutrients in the form of macro elements, oligoelements, and others. Plants benefit from the special medicinal and nutritional properties of biosol. Through a series of procedures and processes that cause the biological breakdown of organic materials, fresh cow manure, water, and worm humus, it is produced until it attains mineral grade. It is a potent bio fertilizer and bio food for the plants due to its high concentration of macro and micronutrients. It may be attacked directly through the root cell membrane of plants and has a strong restorative impact. It is rich in phyto hormones, enzymes, beneficial microbes, and other exclusive and advantageous compounds for the mulberry plant, as well as promoting the health and fertility of the soil.

**Methods for promoting soil nutrient inducers:** The aforementioned records clearly demonstrate the enormous potential of soil nutrient inducer to improve soil fertility, crop yields, and pest management. It is a contradiction to note that, since ancient times, Indian farmers have experienced the majority of the knowledge about these agreements, but a number of reservations persist about the use of soil nutrient inducer, which necessitate the start of organized research for additional variables. A comparative assessment of soil nutrient inducer based on comparable starting components, this medical rationale for their nutritional status, microbial consortia, and other relevant scientific facts can alleviate many concerns. His or her reputation in promoting natural farming will be aided by the influence and position he or she played in the package deal of practices. These can be arranged with minimal help and talent enhancement training sessions. Their rapid acceptance by the scientific and agricultural community depends on the delineation of nutrient status (macro and micronutrients), plant boom-promoting elements, immunity-enhancing ability, and other factors. Soil nutrient inducer can be utilized via drip/sprinkler as fertigation following proper filtration. Comparatively evaluating the aforementioned soil nutrient inducer in terms of their nutritional value and effects will aid in their selection and utilization. They want training sessions on how their contribution can be used in organic production and how frequently it should be used in unique

mulberry cultivars.

#### Conclusion:

From the above list alone, it may be inferred that soil nutrient inducer can be a good way to improve soil fertility, increase crop yield, and produce high-quality crops. Fertigation, which is becoming more prevalent in many crops, is another potential application of soil nutrient inducer. However, caution must be exercised to ensure that the limited amount of soil nutrient inducers utilized are not enough to supply the crop's total nutritional needs. In reality, these hasten the decomposition of organic wastes into humus, and the incorporation of an adequate bio-mass, ideally a combination of monocots and legumes, properly complemented with animal wastes, can be helpful in the exceptional production of humus, which is essential for improving soil fertility and agricultural productivity of mulberry plant. The combination of manures and widespread use of soil nutrient inducers can solve a lot of challenging agricultural issues and may help show the way for sustainable production using organic resources. Natural vitamin software should be researched on a large scale. After extensive trials, the *Morus* plant growth by using natural vitamins sprayed can be accurately used in sericulture for the benefit of the business enterprise. The ones may be recommended to sericulture rearers in order to increase the output of silkworm larvae with the correct nutritional charge for their healthy growth and development and to obtain cocoons of the best quality.

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