Use of vermicompost in tasar sericulture

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Tasar sericulture, the production of tasar silk is a forest based activity. Tasar culture is traditionally undertaken by communities living in forest villages. Major production phase in Tasar Sericulture is consists of two biological processes of growing / maintaining Tasar food plants and carrying out silkworm rearing. Tasar silkworms are reared out door, under natural conditions on Tasar food plants. Asan (*Terminalia tomentosa)* and Arjun (*T. arjuna*) are its primary food plants.

Fig. 1 : Healthy plant- healthy Tasar silkworm larvae

During past few years production and productivity levels in Tasar sericulture has gone up substantially, thanks to technological interventions and better extension support. However, this has led to exploitation of soil, affecting soil health and productivity adversely. As the Tasar food plants growing in forests are put to use by Tasar sericulturists, the forest dependent communities, it is rare that fertilizers are supplied to soil. Due to regular exploitation of host plants, year after year, without supplementation with chemical and or organic fertilizers, manures etc. through the soil, the host plant leaves might have deteriorated nutritionally to support the viability of silkworm. This is established fact that such non-supplementation led to degradation of soils. It is high time that due attention is paid to stop soil degradation and host plant deterioration. In order to bring back the productivity of soil, it needs to improve physical, chemical and biological health. Vermicomposting and Vermicompost application is one of the answers. Vermicompost application may ensure proper maintenance of soil fertility and health, leading to production of good quality leaf.

What is vermicomposting?: Vermicomposting is a process that has been adopted throughout the world, but it is particularly popular in India. Vermicomposting is the process by which earthworms are used to convert organic materials (usually wastes) into a humus-like material known as vermicompost. Here the earthworms feed the organic material and excrete. The excrements or vermicasts obtained is called vermicompost that is known to be the world best organic fertilizer. In the simplest words Vermicomposting is the process by which we can convert organic waste into rich humus by using earthworms. Vermicomposting is compatible process with sound environmental principles that value conservation of resources and sustainable practices. For farmers, this process provides an economical means of achieving high agricultural yields while repurposing animal waste. The utilization of vermicompost results in several benefits to farmers, industries, environment and overall national economy. In India, an estimated 200,000 farmers practice vermicomposting (Source: OACC Manual of On-Farm Vermicomposting and Vermiculture).

Fig. 2 : Vermicompost

Objective of vermicomposting: The chief objective of vermicomposting is to compost organic wastes to produce superior quality manure to feed our "nutrient/organic matter hungry" soils. Its benefits include its simplicity, low cost and ability to produce vermicompost year round.

Benefits of vermicomposting and vermicompost application:

– Reducing organic wastes in landfills.

– Vermicompost act as soil conditioner for plant growth.

– Vermicompost supplies a suitable mineral balance, improves nutrient availability and could act as complex-fertilizer granules.

– Vermicompost provides many benefits to agricultural soil, including increased ability to retain moisture, better nutrient-holding capacity, better soil structure, and higher levels of microbial activity.

– Vermicompost stimulates further plant growth even when the plants are already receiving optimal nutrition. Atiyeh *et al*. (2002) stated that "vermi-composted organic wastes have beneficial effects on plant growth independent of nutritional transformations and availability. Whether they are used as soil additives or as components of horticultural soil less media.

– Ability to suppress disease. There has been considerable anecdotal evidence in recent years regarding the ability of vermicompost to protect plants against various diseases. The theory behind this claim is that the high levels of beneficial microorganisms in vermicompost protect plants by out-competing pathogens for available resources (starving them, so to speak), while also blocking their access to plant roots by occupying all the available sites. This analysis is based on the concept of the "soil foodweb", a soil-ecology-based approach pioneered by Dr. Elaine Ingham of Corvallis, Oregon (see her website at http:// www.soilfoodweb.com for more details).

– Vermicomposted manure has higher N availability than conventionally composted manure on a weight basis. Studies showed that the supply rate of several nutrients, including P, K, S and Mg, were increased by vermicomposting as compared with conventional composting (Short *et al.*, 1999; Saradha, 1997, Sudha and Kapoor, 2000).

– Vermicompost proves to be excellent quality organic manure for sustainable agro-practices.

– According to Indian zoologist Arvind Kumar, Vermicomposting, compared with regular composting, destroys pathogenic bacteria such as *E. coli* and *Salmonella*.

– Vermicomposting can be a useful cottage industry for the underprivileged and the economically weak as it can provide them with a supplementary income.

– It is an eco friendly technology

Earthworms suitable for vermicomposting?: There are an estimated 1800 species of earthworm worldwide (Edwards and Lofty, 1972), these are of three types Anecic, Endogeic and Epigeic (Information sourced from Card *et al.*, 2004).

Anecic (Greek for "out of the earth") – these are burrowing worms that come to the surface at night to drag food down into their permanent burrows deep within the soil. Example: the Canadian Night crawler.

Endogeic (Greek for "within the earth") – these are also burrowing worms but they come to the surface only rarely as their burrows are typically more shallow and they feed on the organic matter already in the soil.

Epigeic (Greek for "upon the earth") – these worms live in the surface litter and feed on decaying organic matter. They do not have permanent burrows. These "decomposers" are the type of worm used in vermicomposting.

Commercially raised earthworms used for vermicomposting are usually of the epigeic type. In India three species of earthworms are generally used for vermicomposting that are:

– *Eudrilus eugeniae* (African Night Crawler)
– *Eisenia foetida* (Tiger Worm)
– *Perionyx excavatus* (India Blues)

Preparation of vermicompost: Technology has been developed for converting the farm wastes into nutrient rich vermicompost. Experts say compost pit of any convenient dimension can be constructed in the backyard or in a field. It may be single pit, two pits or tank of any sizes with brick and mortar with proper water outlets. The most convenient pit or chamber of easily manageable size is 2m x 1m x 0.75m. The size of the pits and chambers should be determined according to the volume of biomass and agricultural waste.

Fig. 3 : Preparation of vermicompost

In a study conducted at RTRS, Bhandara a thatched shed in an area of approximately 6.5 x 6.5 m was constructed. Under this thatched shed two pits measuring 6'x3'x3' were prepared parallel to each other. The pits were lined with black polythene sheet. As a feed for the earth worms the organic waste including weeds and farm waste were mixed with cow dung slurry and mixed with water and filled in the pit. Each pit is filled up with feed having moisture content of 40-60 per cent. Earthworms *viz., Eisenia foetida* in juvenile stage were introduced in the feed. After 2-3 days

of release of earthworms, water was sprinkled regularly to keep the feed moist. A protective cover of wet gunny bag was made on fill (fill is also referred as bedding). Dark (as far as possible), moist and cool conditions were maintained while vermicomposting was under progress to get best result as earth worms do not prefer light. When most of the feed was found as loose granular casts (brown to black in colour) the material was harvested.

Do's and donot's of vermicomposting:

– Use only Bio-degradable matter for vermicomposting. Do not add material like plastic, metal, rubber, glass and printed paper. Do not add greasy wastes in earthworms feedstock unless they have been pre-composted.

– Do not make the bedding too dense to begin with, or packs too tightly as it affects the flow of air. If bedding is too dense or packed too tightly the air flow is reduced or eliminated. The earthworms require oxygen to live. So loose packing is recommended. Earthworms require proper space because worms are surface feeders and won't operate in material more than a meter in depth.

– Do not allow bedding to get dry. Sprinkle water regularly. Earthworms breathe through their skins and moisture content, in the bedding, of less than 50% is not ideal. The ideal moisture-content range for materials in conventional composting systems is 45-60% (Rink *et al.*, 1992).

Days required to make mature vermicompost: The vermicompost is ready when the material is moderately loose and crumbly and the colour of the compost is dark brown, as indicated by the presence of earthworm castings (vermicompost) on the top of the bed. It will be black, granular, lightweight and humus-rich. Experts says that in 60 to 90 days (depends up on the size of the pits) the vermicompost should be ready.

Harvesting of vermicompost: To facilitate separating the worms from the compost, stop watering two to three days before emptying the beds. This will force about 80 per cent of the worms to the bottom of the bed. The harvested material should be placed in a heap to dry, so that most of the worms move down to the cool base of the heap. The worms can also be separated by using sieves/meshes. The earthworms and the thicker material, which remains on top of the sieve, filled back in the pit for reuse and the process of vermicomposting starts again. It is often asked "Is organic waste can be applied in between, when vermicomposting is on?" Experts say yes. New layers of waste can be applied to beds on a regular basis and the earthworms move upwards into the fresh waste to feed and to process the material.

Projecting quantum of vermicompost output: In general, outputs from vermicomposting processes can vary from about 10% to closer to 50% of the original weight of the inputs. This will vary with the nature of the inputs and the system used. The greater the proportion of high-C inputs to high-N inputs, the greater will be the weight of final output as a proportion of input weight (Source: OACC Manual of On-Farm Vermicomposting and Vermiculture).

Effect of vermicompost application on Asan plants and Tasar cocoon production: Freshly prepared Vermicompost, produced at field Khapa of RTRS Bhandara, was supplied to Asan plants @ 2.0 kg/plant. At the time of application it was ensured that soil has sufficient moisture.

Effect on leaf yield : Soil application of vermicompost resulted in 8.95 % improvement in leaf yield over control (Table 1). It was noted that in treated plants leaves remain available for longer period, at the end of season (*i.e.* during III crop) as compared to control plants.

Table 1 : Effect of soil application of vermicompost on leaf yield in *Terminalia tomentosa* during yr 2011-12 (average of three crops)

Leaf yield/plant (kg)		% increase in leaf yield over control
Control	Vermicompost soil application	
4.02	4.38	8.95

Effect on Tasar cocoon production: Rearing of Tasar silkworms on plants supplied with vermicompost resulted in increase in cocoon yield by 9.03%. Larval weight was also more in case of vermicompost treatment as compared to control. Similarly single cocoon weight and single shell weight increased in case of cocoons harvested from vermicompost treated plants. In case of treatment SR% increased by 2.155% (Table 2).

Table 2 : Effect of feeding DTV silkworms on Asan plants that were supplied with Vermicompost (soil application) on rearing performance during yr 2011-12 (Average of three crops)

Parameters	Control	Vermicompost application
Matured larva weight (g)	28.01	29.91
Cocoon yield/dfl (No.)	47.9	52.23
Single cocoon weight (g)	9.44	9.83
Single shell weight (g)	0.925	0.983
Silk ratio %	9.798	10

Looking at beneficial effects of vermicompost application it is recommended that technology of its preparation and its use in Tasar sericulture may be popularized among Tasar sericulturists so that they get economic benefit with least of investment.

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