Role of Decomposer Microbial Consortium in Sericultural Waste Management

J. Ravikumar[1], P. Samuthiravelu[2], S.M.H. Qadri[3], L. Hemanthkumar[1], R. Vijayakumar[1],N. Sakthivel[4], S. Masilamani[5], R. Balakrishna[1]

[1]Regional Sericultural Research Station, Salem, Tamil Nadu, India; [2]Research Extension Centre, Hosur, Tamil Nadu, India; [3]Central Sericultural Research Institute, Karnataka, India; [4]Research Extension Centre, Srivilliputtur, Tamil Nadu, India; [5]Research Extension Centre, Krishnagiri, Tamil Nadu, India, Email: jravicsb@gmail.com

ABSTRACT

The utilization of chemical fertilizers has been increased tremendously in recent years in India. Especially, the consumption of nitrogenous fertilizers has shown very significant increase in all crops which resulted in high incidence of pests and diseases. Of late, the concept of Integrated Nutrient Management (INM) is gaining momentum among the farming community. The role of compost is inevitable in INM. Hence, a study was taken up with the compost of Seri farm residues decomposed by Decomposer Microbial Consortium (DMC). The objectives were to find nutrient content; microbial load of compost and its impact on mulberry growth parameters and silkworm rearing. A quantity of 1 kg of DMC was mixed with one ton of moistened Seri farm residues and 50 kg of cow dung. Initial composting was completed in 45 days and the samples were analyzed for NPK and microbial load. The compost was applied to mulberry and observations were made on mulberry leaf yield, and cocoon yield. The results indicated that the N and P content were more (3 and 5 times respectively) in the compost prepared by using DMC than FYM. However, the K content was almost same in both. The bacterial population consisted of *Bacillus* and *Clostridium* spp. and in fungal population of *Aspergillus*, *Penicillium and Trichoderma* spp were found predominantly in the compost prepared by DMC. The mulberry growth parameters such as shoot length, biomass, leaf yield, shoot weight and the leaf shoot ratio were found significantly better in the treated than control plots. The impact on silkworm rearing was also observed and found better with all the rearing parameters viz., single larval weight, single shell weight, and single cocoon weight and shell ratio % better besides improvement in cocoon yield. Thus, the DMC can be better exploited in Sericultural Waste Management (SWM) effectively to enhance nutrient content in the compost, mulberry leaf quality and quantity besides cocoon production.

Keywords: Decomposer Microbial Consortium, Sericultural Waste

INTRODUCTION

The people of farming community keep the manure in heaps over the months for decomposition and subjected to heat and rainfall in open courtyard. Because of its exposure, highly mobile and volatile nutrient like nitrogen is lost and humus particles are removed. Hence, it is essential to decompose the organic matter in a scientific manner by composting. It is the process of reducing vegetative and animal refuse to a quickly utilizable condition for improving and maintaining soil fertility. Generally, in sericulture industry, the sericulture waste of 5-6 MT can be generated from one acre of mulberry which contains 112 -120 kg of nitrogen, 36 kg of phosphorus and 300 kg of potassium. By

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adopting anaerobic and aerobic process of composting it is possible to generate approximately 4-6 tones of well decomposed and nutritionally rich seri compost from a Sericultural farm of one acre every year. One of the possible ways of increasing the nutrient content of the final compost product is microbial enrichment technique with nitrogen fixers, P solubilisers and cellulose decomposers [1].Keeping this in view, a study was taken up with the objectives to study nutrient content; microbial load of the compost by recycling Seri farm residues using Decomposer Microbial Consortium (DMC) and also its effect on mulberry growth.

MATERIALS AND METHODS

An experiment was conducted at Avathanapatti village in Krishnagiri taluk of Tamil Nadu as farmers' participatory research. In this experiment, Farm Yard Manure (FYM) was treated as control. A quantity of 1 kg of DMC having ligno – cellulolytic microorganisms obtained from Tamil Nadu Agricultural University and 50 kg of cow dung was mixed with one ton of moistened sericultural waste. The mixture was spread as a layer for a height up to 90 cm and plastered with red soil. The holes were made in the heap for the exchange of heat during decomposition process. The water was also sprinkled in a weekly interval to keep the moisture at 60% and allowed for decomposition up to 90days. A thatched shed was erected to protect the material from rain and direct sunlight. Total nitrogen content was estimated by Microkjeldahl's method [2] and phosphorous by vanadomolybdate method and potassium by [3]. The C:N ratio was also calculated for harvested compost. The microbial load of compost was enumerated by serial dilution method and plating technique [4]. The compost was applied in mulberry garden and collected data on mulberry growth parameters namely, shoot length (t/ha/crop), biomass (t/ha/crop), leaf yield (t/ha/crop), shoot weight (t/ha/crop) and leaf shoot ratio. Thus, harvested leaves were utilized for silkworm rearing and collected data on single larval weight (g), single cocoon weight (g), single shell weight (g), shell ratio (%) and cocoon yield / 100 Dfls.

RESULTS AND DISCUSSION

The compost prepared from sericultural wastes have good amount of nutrients and microflora. Further, its impact on mulberry growth and silkworm rearing parameters are discussed below.

Nutrient content of Seri compost

The results of the study indicated that the N and P content were more (3 and 5 times respectively) in the compost prepared by using DMC than FYM. However, the K content was almost same in both (Table 1). However in contrary to this study, it is reported as the resultant seri compost contains approximately 2.0-2.24% nitrogen; 0.93-1.0% phosphrous and 1.5-1.8% potash beside zinc, iron, manganese and copper as micronutrient. The product is found to be much superior compared to farmyard manure which contains 0.3-0.4 nitrogen, 0.2 -0.4% phosphorous and 0.3-0.6 % potash [5]. The addition of microbial inoculants increased the nitrogen (36%) and phosphorous (1.16%) when compared to compost material without enrichment of poultry litter compost [6]. Similar results were obtained by [7] that there was 27% increase in nitrogen content, when mechanized compost inoculated with *Azotobacter* and rock phosphate. It is also evident from the experiments of [8] that *Azotobacter* inoculation helps in increasing the N content of compost. Similarly, the phosphate enrichment at the rate of 2% was more effective than 4% P enrichment. Pyrites addition was not effective in increasing the total P content but it increased organic P and N content [9].

Table 1. NPK analysis of compost using DMC *Vis a Vis* FYM.

Particulars	C: N ratio	N %	P%	K%
Compost	17: 1	1.48	0.49	0.33
FYM	25: 1	0.50	0.10	0.34
t-value	2.71	3.92	3.11	0.98
Level of significance	*	**	*	NS

Population of Microflora

The results revealed that the population of bacteria, fungi and actinomycetes were found significantly more in seri compost than FYM. Among the bacterial population, *Bacillus* and *Clostridium* sp. and in fungal population, *Aspergillus*, *Penicillium and Trichoderma* sp. were found predominantly in the compost prepared by DMC (Table 2). The beneficial microorganism has all the nutrients, energy from the enriched substrate. The nutrient lacuna in compost is made up with organic additives. The population of bacteria, fungi, actinomycetes was 50 and 40 times more in field soil grown with turmeric, paddy, sesame, cotton and groundnut on spent wash irrigations [10].

Table 2. Microbial load of compost using DMC *Vis a Vis* FYM.

Particulars	Bacteria (x 10^7 CFU s /gm)	Fungi (x 10^6 CFU s/ gm)	Actinomycetes (x 10^6 CFU s/ gm)
Compost	109.00	17.33	6.33
FYM	12.7	0.42	0.06
t-value	3.28	2.96	3.42
Level of significance	**	*	**

Impact on mulberry growth

In the present study, mulberry growth parameters like biomass, leaf yield and shoot weight was found significantly more than FYM applied plot (control). However, the shoot length and leaf shoot ratio was found non-significant (Table 3). This was further corroborated with the findings of [11] and [12] who reported that the application of compost and 50% reduction of urea could able to improve mulberry leaf yield up to 16.72%. This might be due to easy availability of macro and micronutrients along with humic and fulvic acids. The Indole Acetic Acid (IAA) and Gibbrellic acid (GA) content was more in the treatment applied with spent wash and microbial inoculum. According to Kavitha and Subramanian, the increase in the growth promoter content was contributed by microbial inoculums which might also be the one of the reasons for the improvement of mulberry growth.

Table 3. Impact of DMC mediated Seri compost on mulberry growth.

Particulars	Shoot length (t/ha/crop)	Biomass (t/ha/crop)	Leaf yield (t/ha/crop)	Shoot weight (t/ha/crop)	Leaf shoot ratio
Treatment	132.48	23.84	11.62	12.22	0.95:1
Control	123.13	14.49	7.22	7.27	0.99:1
t- value	0.073	3.61	2.75	2.80	0.46
Level of significance	NS	**	*	*	NS

Impact on Silkworm rearing

The impact of DMC mediated Seri compost on silkworm rearing was also observed and found that all the rearing parameters *viz*., Single larval weight, single shell weight, Single cocoon weight, shell ratio % was better besides improvement in cocoon yield (Table 4). This was mainly attributed due to improvement in mulberry leaf qualitative parameters.

Table 4. Impact of DMC mediated Seri compost on silkworm rearing.

Particulars	Single larval wt. (g)	Single shell wt. (g)	Single cocoon wt. (g)	SR%	Cocoon yield/100 Dfls
Treatment	5.09	0.34	1.51	22.19	70.51
Control	4.95	0.29	1.45	20.21	62.39
t- value	2.21	2.28	2.89	2.92	3.12
Level of significance	*	*	*	*	*

It is known fact that enrichment is obligatory for compost prepared from any waste. Decomposer Microbial Consortium contributes for maximum level of nutrients to the compost with small expenses. The added benefits in turn reflect on mulberry leaf and cocoon productivity.

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