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Original Research Article

Impact of Teak Leaf Litter Addition on Microbial Population in Soil under *Abelmoschus moschatus*

Padmaja H. Kausadikar*, Sindhu R. Rathod, V.M. Ilorkar and Y.R. Khobragade

College of Agriculture, Nagpur, India
**Corresponding author*

A B S T R A C T

The field investigation in relation to "Impact of teak leaf litter addition on microbial population in soil under *Abelmoschus moschatus*" was conducted in the year 2016-17 at Agroforestry Research Farm, College of Agriculture, Nagpur. The experiment was framed in Randomized Block Design (RBD) with ten treatments consisting of various levels of teak leaf litter combined with cow dung and bio-decomposer which were replicated thrice. The study revealed that the teak leaf litter and cow dung addition along with PDKV bio-decomposer significantly affected the microbial population in soil under cultivation of *Abelmoschus moschatus.* The significantly highest colonies of actinomycetes was recorded in treatment T_9 with application of teak leaf litter @ 7.5 t ha^{-1} + cow dung @ 50% of teak leaf litter + bio-decomposer. The population of bacteria after harvest of crop ranged from 84.36 × 10^6 cfu $g^{-1}$to 86.88 × 10^6 cfu g^{-1}. The significantly highest availability of bacteria was recorded in treatment T_7 with application teak leaf litter @ 5 t ha^{-1} + cow dung @ 50% of teak leaf litter + bio-decomposer. Significantly highest count of fungi was recorded in treatment T_{10} with application of teak leaf litter @ 7.5 t ha^{-1} + cow dung @ 50% of teak leaf litter (15.18 × 10^5cfu g^{-1}). Thus, incorporation of teak leaf litter, cow dung and bio-decomposer may increase microbial community in soil and therefore improve soil quality.

Keywords

Teak leaf litter, Cow dung, Bacteria, Actinomycetes and fungi population, Kasturi Bhindi

Introduction

Leaf litter is an important component of tree cropping system. This is because it builds up the forest floor and creates a layer of nutrient and litter on the soil. It is a major source of soil organic matter as it returns nutrients back to the soil through nutrient recycling. Although soil contains different groups of micro-organisms viz., bacteria, fungi and actinomycetes constitute the majority of soil microbial world. Bacteria are a diverse group of microorganisms all of which consist of only a single cell that lacks a distinct nuclear membrane and has a cell wall of unique composition. Bacteria are largely responsible for decay and decomposition of organic matter, producing a cycling of such chemicals as carbon, oxygen, nitrogen and sulphur. Fungi are a group of simple plants lacking chlorophyll. They can either exist as single cells or make up a multicellular body called mycelium, which consists of filaments known as hyphae. Fungi exist primarily in damp situations on land. Fungi produce enzymes which degrade the organic matter of plant origin. They help in soil structure improvement. Some fungi produce ammonia and few have a major role in wood decay. Actinomycetes are a group of gram-positive mostly anaerobic non-motile

microorganisms. They play an important role in decay and decomposition processes, especially in complex substrate decomposition processes.

The present study was conducted to study the effect of teak leaf litter addition on microbial population in soil during litter decomposition.

Materials and Methods

The field investigation in relation to "Impact of teak leaf litter addition on microbial population in soil under *Abelmoschus moschatus*" was conducted in the year 2016-17 at Agroforestry Research Farm, College of Agriculture, Nagpur. The experiment was laid out in Randomized Block Design (RBD) and the treatments were replicated thrice. The ten treatments consist of various levels of teak leaf litter combined with cow dung and bio-decomposer. The experimental site where experiment was conducted is a teak plantation of year 1991. The teak was planted at 2 m distance (tree to tree) and 12 m row to row spacing. Teak leaf litter required for the experiment was obtained from teak plantation of Agroforestry research farm. During late winter i.e. in the month of February litter fall of teak starts. The teak leaf litter was collected from surface and was dumped in pit where it was crushed. The teak leaf litter samples were then analyzed for nutrient content. From the result it was observed that C: N ratio of teak leaf litter is 30.40 which is narrower. Anonymous (2011) concluded that, understanding C: N ratios of crop residues and other material applied to the soil is important to manage soil cover and crop nutrient recycling, providing quality habitat for soil micro-organisms.

The soil under experimental area is light textured soil with good drainage. In order to study the nitrogen mineralization soil samples up to 0-15 cm depth were collected at 30, 60 and 90 DAS of Kasturi Bhindi. Standard procedures were applied for analysis of soil samples. For isolation of fungi actinomycetes and bacteria from soil three different media were selected. Dilution plate technique is one of the most popular method for isolation and enumeration of soil born fungi, antinomycetes and bacteria as described by Dhingra and Sindair (1993) was followed for estimating the colonies of microbes.

Results and Discussion

Colonies of the micro-organisms were calculated after harvest of *Abelmoschus moschatus* and the data regarding their population is presented with tables and figure.

Actinomycetes

The population of actinomycetes in all treatment combinations was significantly influenced by application of teak leaf litter level. The population of actinomycetes after harvest of crop ranged from 22.36 × 104 cfu g-1soil to 24.94 × 104 cfu g^{-1}.

The significantly highest colonies of actinomycetes were recorded in treatment T9 with application of teak leaf litter @ 7.5 tha-1+ cow dung @ 50% of teak leaf litter + bio-decomposer. The second highest treatment T_5 with application teak leaf litter @ 2.5 t ha^{-1}+ cow dung @ 50% of teak leaf litter + bio-decomposer, secured second position in increasing availability of actinomycetes to the turn of 24.67× 10^4 cfu g^{-1}. Lowest availability of actinomycetes was recorded in control plot which didn't receive any source of nutrient. The highest in T_9 might be due to addition of sufficient organic matter to soil surface which helped

in maintaining optimum temperature and multiplication of actinomycetes.

Sudhakaran *et al.,* 2013 also found increased population of actinomycetes in soil in organic farming system that in conventional farming system. Same findings were confirmed by Gajda *et al.,* in 2000.

Bacteria

The population of bacteria in all treatment combinations was significantly influenced by teak leaf litter level. The population of bacteria after harvest of crop ranged from 84.36×10^6 cfu g^{-1} soil to 86.88×10^6 cfu g^{-1}soil. The significantly highest count of bacteria was recorded in treatment T_7 with application teak leaf litter @ 5 t ha^{-1} + cow dung @ 50% of teak leaf litter + bio-decomposer. The second highest treatment was T_{10} with application of teak leaf litter @7.5 t ha^{-1} + cow dung @ 50% of teak leaf litter (86.75×10^6 cfu g^{-1}). Increasing population of bacteria to the tune of 86.88×10^6 cfu g^{-1}. Lowest colonies of bacteria were recorded in control plot which didn't received any source of nutrient. The organic matter incorporation might be resulted in faster decomposition and thereby increasing the bacterial population in treatment T_7

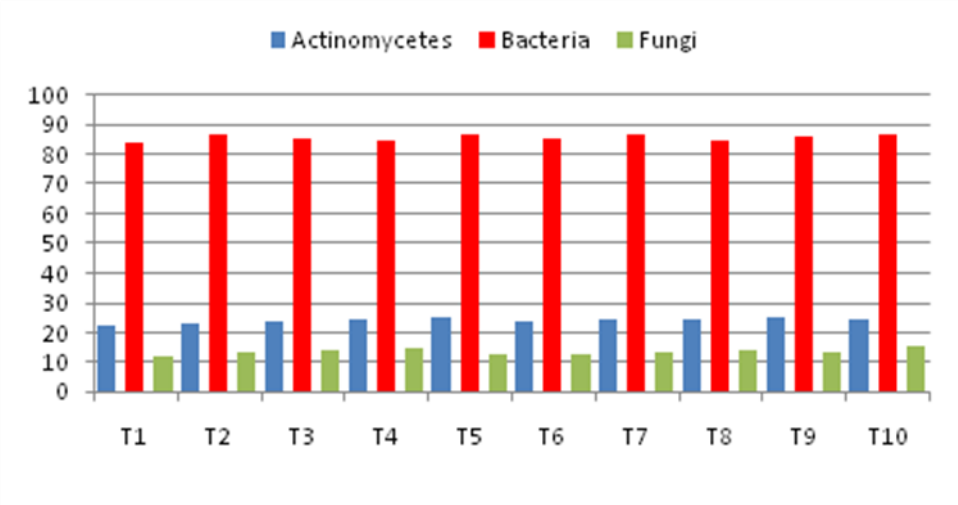
Fungi

The data regarding effect of teak leaf litter addition on fungi after harvest of Kasturi Bhindi is presented in table 1 and depicted in figure 1.

Table.1 Effect of teak leaf litter addition on actinomycetes population (10^4 cfu g^{-1}) in soil

Treatments		A (10^4 cfu g^{-1})	B (10^6 cfu g^{-1})	F (10^5 cfu g^{-1})
T_1	Absolute control	22.36	84.36	11.49
T_2	Teak leaf litter @ 2.5 t ha^{-1}	22.93	86.55	12.95
T_3	Teak leaf litter @ 5 t ha^{-1}	23.27	85.42	13.70
T_4	Teak leaf litter @ 7.5 t ha^{-1}	24.16	84.68	14.75
T_5	Teak leaf litter @ 2.5 t ha^{-1} + cow dung @ 50% of teak leaf litter + bio-decomposer	24.67	86.54	12.31
T_6	Teak leaf litter @ 2.5 t ha^{-1} + cow dung @ 50% of teak leaf litter	23.72	85.71	12.51
T_7	Teak leaf litter @ 5 t ha^{-1} + cow dung @ 50% of teak leaf litter + bio- decomposer	24.11	**86.88**	13.20
T_8	Teak leaf litter @ 5 t ha^{-1} + cow dung @ 50% of teak leaf litter	24.02	84.62	13.55
T_9	Teak leaf litter @ 7.5 t ha^{-1} + cow dung @ 50% of teak leaf litter + bio- decomposer	**24.94**	86.14	13.33
T_{10}	Teak leaf litter @ 7.5 t ha^{-1} + cow dung @ 50% of teak leaf litter	24.5	86.75	**15.18**
SE(m) ±		0.06	0.088	0.064
CD at 5%		0.183	0.264	0.192

Fig.1 Effect of teak leaf litter on microbial count (cfu^{-1})



Significant variation was observed in the population of fungi in all treatment combinations as influenced by teak leaf litter level. The population of fungi after harvest of crop ranged from 11.49 × 10^5 cfu g^{-1} to 15.18 × 10^5 cfu g^{-1}. The significantly highest count of fungi was recorded in treatment T_{10} with application of teak leaf litter @ 7.5 t ha^{-1} + cow dung @ 50% of teak leaf litter (15.18 × 10^5 cfu g^{-1}). The second highest treatment T_4 with application teak leaf litter @ 7.5 t ha^{-1} in increasing colonies of fungi to the tune of 14.75 × 10^5 cfu g^{-1}.

Soil microbial community composition in terms of actinomycetes, bacteria and fungi counts was significantly affected by litter treatment. In particular quantity of total bacteria was higher in leaf litter mixed plots than control plots (Xiao *et al.*, 2016).

The lowest count of fungi was recorded in control plot which didn't receive any source of nutrient. The highest colony count of fungi in T_{10} might be attributed to dead food material available from teak leaf litter. The narrow C: N ratio of teak leaf litter might responsible for easy decomposition and thus resulted in providing food material to microbes indirectly increasing their population in soil.

Badole (2000) reported maximum microbial population (actinomycetes, fungi and bacteria) with application of organic manures.

From the above study it is concluded that teak leaf litter, cow dung and bio-decomposer have a great impact microbial populations. The study indicates that there is a significant difference in microbial populations among the three farming systems. It is found that addition of dead organic matter in the form of teak leaf litter and cow dung has shown more microbial populations than use of any source alone.

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