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Effect of Teak Leaf Litter Decomposition on Yield of *Abelmoschus Moschatus* and Soil Properties

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Abstract
The field investigation in relation to "Effect of teak leaf litter addition on yield of *Abelmoschus moschatus* and soil properties" 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) with ten treatments consisting of various levels of teak leaf litter combined with cow dung and bio-decomposer which were replicated thrice. Treatment, T_7 supplied with 5 t ha^{-1} teak leaf litter + cow dung @ 50% teak leaf litter bio-decomposer i.e. significantly higher foliage and seed yield (20.34 q ha^{-1} and 18.91 q ha^{-1}). Available nutrients (N, P and K) were also influenced significantly with application of 5 t ha^{-1} teak leaf litter + cow dung @ 50% teak leaf litter bio-decomposer in treatmenr T_7.
Keywords: Teak leaf litter, cow dung, available nutrients, *Abelmoschus moschatus*

Introduction

Medicinal and aromatic plants play a vital role in medicine and perfumery industry. In India, because of varied climatic conditions, more than 2000 species of medicinal and aromatic plants have been recorded. The use of medicinal and aromatic plants and their products is as old as history. Medicinal and aromatic plants play a vital role in medicine and perfumery industry. In India, because of varied climatic conditions, more than 2000 species of medicinal and aromatic plants have been recorded. The use of medicinal and aromatic plants and their products is as old as history. 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. It reduces nutrient loss through leaching and erosion. It is well established that litter decomposition is positively associated with soil and litter nutrient concentrations (Wood *et. al.*, 2006).
The present study was conducted to study the effect of teak lea litter addition on yield of Abelmoschus moschatus and soil properties.

Material and Methods

The field investigation in relation to "Effect of teak leaf litter addition on yield of *Abelmoschus moschatus* and soil properties" 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) with ten treatments consisting of various levels of teak leaf litter combined with cow dung and bio-decomposer which were replicated thrice. 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. The soil under experimental area is light textured soil with good drainage. In order to study the chemical characteristics, a composite soil sample was prepared for the whole field by collecting soil samples up to 0-15 cm depth from randomly selected spots over the experimental field before sowing. Standard procedures were applied for analysis of plant and soil samples.

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. Anonymus (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 should be the goal in improving soil health.

Result and Discussion

Foliage and seed yield

The effect of teak leaf litter addition on Foliage and seed yield of *Abelmoschus moschatus* found significant. The foliage yield of *Abelmoschus moschatus* ranged from 15.78 q ha^{-1} to 20.34 q ha^{-1} while, seed yield 16.95 q ha^{-1} to 18.91 q ha^{-1}. The plot supplied with 5 t ha^{-1} teak leaf litter + cow dung @ 50% teak leaf litter bio-decomposer i.e. treatment, T_7 recorded significantly higher foliage and seed yield (20.34 q ha^{-1} and 18.91 q ha^{-1}).

Regarding foliage yield treatment T_7 found significantly superior among all treatments. The second best treatment i.e. T_8 fertilized with @ 5 t ha^{-1} teak leaf litter + cow dung @ 50% teak leaf litter, recorded 137.28 q ha^{-1} fresh matter and 20.08 q ha^{-1} dry matter yield. Treatment T_7 recorded fresh matter about 23% more yield than control plot and dry matter 23.58% over control plot, and about

19.08% than T_2 which recorded lower yield among other combinations. It was observed that, treatment T_8, T_9 and T_3 were at par with treatment T_7. Though T_3 recorded only 2.02% fresh and dry foliage yield than control it is found significant. Application of @ 5 t ha^{-1} teak leaf litter + cow dung @ 50% of teak leaf litter+ bio- decomposer recorded 18.53% increased seed yield over control.

The highest seed yield in T_7 treatment might be due to higher production of dry matter. The increase foliage or dry matter might have resulted in higher photosynthesis enhancing the fruiting and there by increasing seed yield. All this might be due to the fact that the teak leaf litter which was having C:N ratio might decomposed faster and made availability of major nutrients which are actively involved in vital process ultimately resulted in higher seed yield. The results confirm the findings of Yadav *et. al.*, 2013 in ashwagandha. Chowdhury *et. al.,* (2008) also confirmed that application of 5 t ha^{-1} cow dung increased the leaf yield of tulsi and pudina significantly. The results are in conformity with Sarkar *et. al.*, 2010 also, who reported that addition of different forest tree leaf litters influence dry weight of plants. Chowdhury, 2007 also reported the same finding in the red amaranthus.

Soil Properties

Leaf litter plays an important role in nutrient turn over and nutrient transfer of energy between plants and soil. The nutrients from the litter may be released by leaching or mineralization. It is a major source of organic matter pool. The present study is conducted in a teak plantation planted in year 1991. It is major tree species of this agroforestry region. Lot of teak leaves fall on ground every year play a vital role to enrich soil organic matter level and available nutrient status of the soil.

The initial soil analysis data is presented in table 1. The soil of the experimental site was neutral in reaction with 7.10 pH value and the salt content was observed to 0.12 dS m^{-1}. The organic carbon content of experimental soil was found to be moderately high with 6.21 g kg^{-1}. Regarding initial availability of nutrients of experimental soil, it was revealed that, the soil was low in available N and P and was found high in available K.

Chemical Properties

Soil chemical properties i.e. pH and EC were affected non significantly by addition of teak leaf litter, cow dung and bio-decomposer.

Organic carbon

The organic carbon content of composite soil sample before sowing was 6.21 g kg^{-1} which was moderately high. After harvest of *Abelmoschus moschatus* , there was significant change in organic carbon content and value for organic carbon ranged from 6.450 g kg^{-1} to 6.530 g kg^{-1}. The highest organic carbon was recorded in T_4 with application of teak leaf litter @ 7.5 t ha^{-1} (6.530 g kg^{-1}), while the lowest organic carbon was recorded in T_1 (6.450g kg^{-1}). T_9 supplied with teak leaf litter @ 7.5 t ha^{-1} + cow dung @ 50% of Teak Leaf litter + bio-decomposer and T_8 supplied with teak leaf litter @ 5 t ha^{-1} + cow dung @ 50% of teak leaf litter recorded second highest place regarding organic carbon (6.550 g kg^{-1}). Treatment T_4 supplied with 7.5 t ha^{-1} teak leaf litter might resulted in accumulation of highest organic carbon as the amount of litter added was highest and also contain organic carbon.

Treatment T_4 recorded 6.07% and 2.49% increased organic carbon compared to initial and control respectively. Over all analysis regarding organic carbon shows that, there is increase in organic carbon content with addition of organic residues in all the treatments. Treatment T_5, T_6, T_7, T_8, T_9, and T_{10} found at par with treatment T_4 in increasing organic carbon content in soil. Treatment T_5 with application of teak leaf litter @ 2.5 t ha-1+ cow dung @ 50% of teak leaf litter + bio-decomposer increased organic carbon content in soil which was found statistically significant over other treatments. The cow dung and decomposer might have increased the decomposition rate and there by added carbon to soil.

Gurumurthy *et. al.*, (2009) studied the soil properties under different land use system and reported that, the organic carbon content in all the land use system decreased with increase in depth of soil. The high organic carbon content at the surface layers of the soil was due to the accumulation of organic matter in surface horizon, recycling of organic matter, addition of organic manure and also because of crop residues remaining in soil surface.

Table 14: Effect of teak leaf litter addition on chemical properties of soil

Treatments		**Chemical Properties**		
		pH	**EC (dS m^{-1})**	**OC (g kg^{-1})**
T_1	Absolute control	7.08	0.119	6.45
T_2	Teak leaf litter@ 2.5 t ha^{-1}	7.02	0.129	6.46
T_3	Teak leaf litter@ 5 t ha^{-1}	7.17	0.123	6.460
T_4	Teak leaf litter@ 7.5 t ha^{-1}	7.07	0.117	6.610
T_5	Teak leaf litter@ 2.5 t ha^{-1} + cow dung @ 50% of teak leaflitter + bio-decomposer	7.01	0.122	6.500
T_6	Teak leaf litter@ 2.5 t ha^{-1} + cow dung @ 50% of teak leaflitter	7.04	0.119	6.530
T_7	Teak leaf litter@ 5 t ha^{-1} + scow dung @ 50% of teak leaf litter + bio- decomposer	7.05	0.123	6.520
T_8	Teak leaf litter@ 5 t ha^{-1} + cow dung @ 50% of teak leaflitter	7.07	0.123	6.550
T_9	Teak leaf litter@ 7.5 t ha^{-1} + cow dung @ 50% of teak leaflitter + bio- decomposer	7.07	0.122	6.550
T_{10}	Teak leaf litter@ 7.5 t ha^{-1} + cow dung @ 50% of teak leaflitter	7.01	0.119	6.530
SE(m) ±		0.04	0.001	0.040
CD at 5%		--	--	0.134
Initial value		7.10	0.120	6.210

Available nutrient status of soil

The availability of nitrogen, phosphorus and potassium in all treatment combinations was significantly influence by addition of teak leaf litter levels. The availability of nitrogen and phosphorus after harvest of crop ranged from 277.520 kg ha^{-1} to 294.020 kg ha^{-1} and 15.300 kg ha^{-1} to17.890 P kg ha^{-1}. Available potassium varied from 341.02 kg ha^{-1} to 359.14 kg ha^{-1} after harvest of crop. The significantly highest availability of nutrients was recorded in treatment T_7 with application of teak leaf litter@ 5 t ha^{-1}+ cow dung @ 50% of teak leaf litter. Treatment T_8 ranked second in recording high availability of nitrogen and phosphorus by recording 292.860 kg ha^{-1} and 17.76 kg ha^{-1} available N and P with application teak leaf litter@ 5 t ha^{-1} + cow dung @ 50% of teak leaf litter. Treatment T_7 recorded 5.62% increased N over control and 8.17% over initial value. Treatment T_5, T_8 and T_9 were at par with T_7 in recording available N. Treatment T_5 recorded only 1.33% less available nitrogen than T_7 and found statistically significant over other treatments.

Regarding available P it was observed that, T_7 recorded 14.48% increased p availability compared control plot. Treatment T_5 and T_8 found at par with treatment T_7 after harvest of crop. Treatment T_5 with application of teak leaf litter@ 2.5 t ha^{-1} + cow dung @ 50% of teak leaf litter + bio-decomposer recorded 17.61 kg ha^{-1} P which was 1.57% lesser than T_7 and 13.12% more than control plot. Hence, found statistically significant over other treatments.

Treatment T_6, T_8 T_9 and T_{10} found statistically at par with T_7 treatment. Treatment T_6 recorded 358.72 kg ha^{-1} availability of potassium, which was second best superior treatment. Probable reason behind increasing of K availability maximum in this treatment might be addition of teak leaf litter and its mineralization resulting in solubilization of fixed K increasing the availability of K is soil. T_6 found statistically significant over other treatments.

These results are in close agreement with Surekha *et. al.*, 2004 who reported that litter addition provides a steady supply of carbon and energy for microorganisms and cause increasing microbial biomass pool thereby increasing soil respiration rate which help to enhance availability of N in soil. Chowdhury *et. al.*, (2008) also observed increase availability of N with addition of teak leaf litter. Issac and Nair (2002) confirm the findings. Lal *et. al.*, 2000. Sarkar *et. al.*, 2010 reported that highest available phosphorous in the soil with teak leaf litter. Majumdar *et. al.,* (2004) also observed the high available phosphorous content in agroforestry systems.

Table 15: Effect of teak leaf litter addition on available nutrient status (kg ha^{-1}) of soil

Treatments		N	P	K
T_1	Absolute control	277.520	15.300	341.020
T_2	Teak leaf litter @ 2.5 t ha^{-1}	288.790	16.300	348.020
T_3	Teak leaf litter @ 5 t ha^{-1}	288.790	16.300	352.140
T_4	Teak leaf litter @ 7.5 t ha^{-1}	289.560	16.550	352.450
T_5	Teak leaf litter @ 2.5 t ha^{-1} + cow dung @ 50% of teak leaf litter + bio-decomposer	290.120	17.610	349.440
T_6	Teak leaf litter @ 2.5 t ha^{-1} + cow dung @ 50% of teak leaf litter	285.450	17.150	358.720
T_7	Teak leaf litter @ 5 t ha^{-1} + scow dung @ 50% of teak leaf litter + bio- decomposer	294.020	17.890	359.140
T_8	Teak leaf litter @ 5 t ha^{-1} + cow dung @ 50% of teak leaf litter	292.860	17.760	358.450
T_9	Teak leaf litter @ 7.5 t ha^{-1} + cow dung @ 50% of teak leaf litter + bio- decomposer	289.750	17.540	357.148
T_{10}	Teak leaf litter @ 7.5 t ha^{-1} + cow dung @ 50% of teak leaf litter	287.250	17.350	358.145
SE(m) ±		1.44	0.112	1.364
CD at 5%		4.32	0.336	4.09
Initial value		270	15	340.21

Conclusion

The results of present study, inferred that the combined application of teak leaf litter, cow dung and bio-decomposer are effective in increasing yield and quality of kasturi bhindi and improving soil fertility status. In general, efficiency of the teak leaf litter was pronounced when it is combined with bio-decomposer.

It is concluded that the application of 5 t ha-1 teak leaf litter+ cow dung @ 50% of teak leaf litter and bio-decomposer have positive effects on availability of all the nutrient as well as organic carbon status of soil. It is clear from the results that the application of teak leaf litter along with cow dung and bio-decomposer rather than application of only teak leaf litter succeed to extend significant impact on seed yield of kasturi bhindi as well as oil content N, P and K content in plant as well as seed.

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