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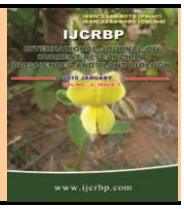


**Original Research Article**

# Changes in Percentage of Organic Carbon during Biodegradation Process of Leaf Residues of *Tectona grandis*

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**Abstract**

India has enormous amount of litter residues that can be effectively converted into good quality of compost/organic manure. Organic manures are by large bulky in nature and low in plant nutrients. Their nutritive value can be enhanced with addition of chemicals including urea, pyrite and rock phosphate and cellulolytic cultures through cow dung slurry and other external applications. The present study is an attempt in this direction to convert leaf residues of *Tectona grandis* with use of rock phosphate and cowdung. Study revealed the application of 10% rock phosphate and cow dung resulted enhanced the biodegradation process leaf residues of *Tectona grandis*.

**Keywords**

Bioconversion
Biodegradation
Organic carbon
Organic manure
*Tectona grandis*

## Introduction

The knowledge about the soil to mean is as old as the arrival of *Homo sapiens* on the earth *i.e.*, about 250,000 years old. In India earliest Upper Palaeolithic Culture existed about 20,000 years ago. Much advanced state of Neolethic Civilzation existed about 25000 BC. Well known Harappan Culture existed about 1700 BC. Aryan probably came to India in about 1500 BC after leaving their original place of South Russia in about 1800-1600BC. Rigveda was completed in 1500-1400BC. Soil and their management are of broad societal concern. Great civilization has almost invariably had good soils as one of their natural resources. They made possible stable and organized communities and even cities. In contrast to the nomadic, shifting societies associated with upland soils and with their concomitant animal grazing. Soil destruction or mismanagement was associated with downfall of some of the civilization which good soils had helped to build (Shweta, 1993). Before 1950's the main source of replenishing soil fertility was organic manure in India. During 1960's with green revolution the adsorption of high yielding varieties of crops brought greater use of chemical fertilizers, unlike organic manures are less bulky and thus easier and cheaper to transport and produced much greater crop response, the use of organic manures in field crops lost popularity due to its bulk and low nutrient content. With the increasing crop productivity there is increase

nutrient removal from the soil. This continuous mining of nutrients has to be replenished to sustain crop productivity. The gap between nutrient removal and addition through the external application can only bridged with use of organic manures. India has potential of 356 million tonnes of crop residues production, that may profitably recycled either by *in situ* incorporation as a part of natural crop production cycle or composting the organic wastes. The present study is aimed to enrich organic matter of soil with bioconversion of naturally available of leaf residues of *Tectona grandis*.

## Materials and methods

Leaf residues of teak plant (LT, *Tectona grandis*) were degraded independently and with the help of inoculants. Dried leaves were crushed and kept in high density, small holed (aeration required for metabolizing reactions of microorganisms) polythene bags for 90 days. Eight treatments of leaf residues of teak plant with rock phosphate and cow dung in different combinations (LT + 5% Rock Phosphate; LT + 10% Rock Phosphate; LT + 15% Rock Phosphate; LT + 20% Rock Phosphate; LT + 5% Rock Phosphate+ 10% Cow dung; LT + 10% Rock Phosphate+ 10% Cow dung; LT + 15% Rock Phosphate+ 10% Cow dung; LT + 15% Rock Phosphate+ 10% Cow dung) were studied. The total organic carbon was determined by weight loss method following Hesse (1971) at different interval of days during biodegradation process.

## Results and discussion

Changes in organic carbon (%) during biodegradation process of *Tectona grandis* leaf residue presented in Table 1. It is evident from the generated data percentage of organic carbon decreased as the decomposition advanced. The maximum losses (78.67%) in percentage of carbon were observed with addition of 10% rock phosphate and cow dung slurry while, minimum losses (53.88%) in degradation process of leaf residues independently. The addition of more than 10% rock phosphate slows the loss of organic carbon by 6.07 to 7.03%. Application of cow dung slurry favored reduction in organic carbon. A total organic matter including organic wastes includes organic carbon and, highly condensed elemental organic carbon (charcoal, graphite and coal) altered and rather resistant residues of animals plants and microorganisms (Humus or humate). The organic carbon is determined by getting it digested with excess of potassium dichromate and sulphuric acid, and the residual unutilized dichromate is then titrated with ferrous ammonium sulphate (Walkely and Black, 1934). The elementary carbon (graphite, charcoal, etc.) are not affected by this reaction. Thus the organic matter is calculated by multiplying the organic carbon values by conversion factor 1.724 (Shweta, 1993).

**Table 1. Changes in organic carbon (%) during biodegradation process of *Tectona grandis* leaf residues.**

| Sl No. | Treatments | Sample intervals in days | | |
|---|---|---|---|---|
| | | 30 | 60 | 90 |
| 1. | Leaves of *Tectona grandis* (LT) | 46.17±3.80* | 47.46±4.31* | 46.12±4.30 |
| 2. | LT + 5% Rock Phosphate | 41.54±4.54 | 34.50±3.24 | 31.01±3.40 |
| 3. | LT + 10% Rock Phosphate | 40.05±4.52 | 32.40±4.21* | 26.95±4.15* |
| 4. | LT + 15% Rock Phosphate | 45.87±3.11* | 30.55±2.35* | 34.96±4.25* |
| 5. | LT + 20% Rock Phosphate | 48.34±2.04 | 30.35±4.10 | 38.83±3.40* |
| 6. | LT + 5% Rock Phosphate+ 10% Cow dung | 38.40±2.02* | 28.54±2.24 | 22.31±3.30* |
| 7. | LT + 10% Rock Phosphate+ 10% Cow dung | 35.38±4.03 | 25.38±2.45* | 21.33±4.25 |
| 8. | LT + 15% Rock Phosphate+ 10% Cow dung | 40.32±3.21* | 32.48±3.26* | 28.06±4.40 |
| 9. | LT + 20% Rock Phosphate+ 10% Cow dung | 41.35±1.10 | 31.78±4.24 | 2 9.04±5.30* |
| All values are mean and standard deviation of three replicates. * Significant ($p$<0.01). | | | | |

Organic carbon is a major determinant of soil texture, moisture, pH and nutrients. It is present in varying forms ranging from un-decomposed animals and plants remains to amorphous dark coloured substances which are stable product of complex decomposition action. The residues of plants and animals at all stages or decomposition mediated by soil microorganism are found in the soil organic matter. It plays a significant role in cohesion of soil particles and encourage granulation, water holding capacity; regulates moisture regime and temperature of soil; prevents rapid leaching of nutrients; to withstand fauna with draught spell much better; extraction of elements from minerals by acid

humus; reduces mulching; encourage cation adsorption capability of soil and also the instant source of energy for micro-organisms. Rasal et al. (1996) noted that the reduction in C/N ratio activated the natural or applied cellulolytic organisms thereby causing further reduction in organic carbon. The reduction in organic carbon was observed in plant waste charged with 10% pyrite, 1% urea and 5% by Namdeo et al. (2000). Mathur et al. (1986) observed maximum organic carbon loss (55.2%) in rock phosphate treated substrate with *Aspergillus niger* over the control on 9$^{th}$ week of composting. Verma and Mathur (1991) observed 33% decomposition of paddy straw treated with *Trichoderma reesi* and *Pleurotus sajor-caju*. The study revealed the use of 10% rock phosphate with cow slurry may help to enhance bioconversion process of naturally available leaf residues of *Tectona grandis*.

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