Tendu Leaf Waste Utilisation to Improve Soil Properties

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Abstract: ***Management of solid waste is very important difficulty in developing as well as under developing countries like India. The manufacturing industries are major source of solid waste. In the Solapur city the production of bidies from the Tendu leaf is main source of income for the low and middle income group. The bidee production produces large quantity of its by products which directly dump into nearby the production yard and indirectly environment as whole without any pre-treatment. This paper tries to deliberate on the parametric study on the surroundings of dumping yards. During the experimental study in laboratory as well as on the study area, the primary observations place conclusion that the solids waste from beedi industry needs effective management to diminish and control the original quality of local environment.***

Keywords: Bidee industry, Environmental hazardous, Solapur, Tendu leaf, Vermicomposting

1. Introduction

Rationale & Significance

In India Bidee industry is one of the most important unorganized agro industry which occupies significant place in the national Economy. Bidee rolling is manual in all its stages, with use of only ordinary scissors, winnows and wire nets. The two principal raw materials are used for bidee making there are Bidee tobacco and Bidee leaves (Tendu or kendo leaf). They fit a Bidee in the Bidee industry where no foreign exchange, machinery electric power, skilled labour or any others infrastructures are required. It needs just two ingredients i.e. the right type of tobacco and tendu leaves to wrap the tobacco in the blended tobacco and leaves for wrapping are brought from indigenous sources. The instruments of production are only the unskilled female labours that roll out the bidees and supplement their family income. Since independence from the British in 1947, India has relied heavily on forest resources, including extraction of *tendu* leaves, to provide livelihood options for its marginalized tribal and forest-dependent communities. *Tendu* leaves are used to make *bidees*, an indigenous leaf-rolled cigarette made from coarse uncured tobacco, tied with a coloured string at one end. It is widely smoked in the Indian subcontinent and is gaining popularity globally, especially in USA, Germany, Middle East, Eastern Europe and Japan (Tobacco Board of India 2010).

As there is generation of 20T [5] waste tendu leaf per day in Solapur city it leads problem of disposal. This seminar is effort to manage the tendu leafs waste generated by making its use for vermicmposting or any other source to dispose it. Otherwise it will consume more land in future & may disturb the ecological cycle.

1.1 Concept Of Bidee

A **Bidee is** a thin, Indian cigarette filled with tobacco flake and wrapped in a tendu or possibly even *Bauhinia racemosa* leaf tied with a string at one end. The name is derived from the Marwari word *beeda*—a leaf wrapped in betel nuts, herbs, and condiments. A traditional method of tobacco use throughout South Asia and parts of the Middle East,today bideees are popular and inexpensive in India. There, bidee consumption outpaces that of conventional cigarettes although these tobacco-filled leaves deliver more nicotine, carbon monoxide, and tar and carry a greater risk of oral cancer. Bideees accounted for 48% of Indian tobacco consumption in 2008. As with many other types of smoking, bidees increase the risk of certain kinds of cancers, heart disease, and lung disease. Its disposal is measure problem today. This home industry of bidee making produces cuttings of tendu leaf as refuse which pollutes the dumping sites creating solid waste disposal problem of alarming scale. About 7200 tonnes of Tendu leaf waste is generated per annum in Solapur, India **[5]**

Scientific Name of Tendu leaf

Coromandel Ebony or **East Indian Ebony** (*Diospyros melanoxylon*) is a species of flowering tree in the family *Ebenaceae* that is native to India and Sri Lanka and that has a hard, dry bark. Its common name derives from Coromandel, the coast of southeastern India. Locally it is known as *temburini* or by its Hindi name ***tendu***. In Odisha and Jharkhand it is known as ***kendu***. The leaves can be wrapped around tobacco to create the Indian *bidee*,[3] which has outsold conventional cigarettes in India. Commonly in regional languages it is kinown as (Oriya) : Kendu, (Bengali) : kend, kendu ,(Hindi) : abnus, kendu, tendu, timburni, (Nepali) : abnush, tendu,(Sanskrit) : dirghapatraka,(Tamil) : karai, karundumbi, tumbi, (Telugu) : tuniki, bidee aaku, (Trade name) : ebony

Generation and collection of Tendu Leafs

Tendu leaves are obtained from tendu tree (Diospyros melonoxylon) and leaf of tendu is considered the most suitable covering on account of the simplicity with which it can be rolled and its wide availability. Leaves of many other plants like Plash, Sal are also find use as Bidee wrappers in different parts of the country but the texture, flavour and workability of tendu leaves are unique. The major use of tendu leaves in Bidee industry is due to their enormous production, agreeable flavour, flexibility, resistance to decay and capacity to retain fires. The broad morphological characters on which leaves, are selected and catagorised for Bidee making are size, thickness of leaves, texture, and relative thickness of midrib and lateral veins.

For collection and processing of tendu leaves standardized same procedure is used throughout India. Tendu leaves are collected from the trees in the month of April after 45 days cutting the upper branches. The leaves are collected in bundles of 100 leaves, which are dried in sunlight for about a week. The dried leaves are sprinkled with water to soften them and then filled tightly in jute bags and exposed to direct sunlight for 3 days. During collection of leaves, the collectors prefer fresh and disease free leaves.

Revenue Generation

Thousands of families are associated in making bidee. One person earns Rs 80-100/- per day by making bidee from tendu leaves. Bidee rolling is the primary job which looks very simple but need practice and consistency in work. It is a source of subsidiary occupation and supplementary income to lakhs of people. Bidee industry provides employment to the rural people during off season for collection of bidee leaves. Bidee industry has a vital role in rural welfare and in promoting rural economy.

2. Aim and Objectives

The main aim of this study is effort to manage Tendu leaf waste generation and by making its scientific use for its proper utilization and disposal.

Objectives

a) To study and analyze the performance of Tendu Leaf under various test parameters.
b) To reduce waste of Tendu leaf by management
c) To understand composter mechanism Tendu leaf waste
d) To study the uses & recovery aspects of Tendu leaf
e) To understand the organic characteristics of leaf.

Scope and Limitations

In study following considerations are taken into account which is necessary for proper utilization and its disposal.
1) Unplanned utilization
2) Uncontrollable generation
3) Indirect parameter affecting the quality.
Socio economic effect through the industry

Effect of Tendu Leaves on Environment & Ecosystem

a) For disposal of waste Tendu leaves land requirement is more
b) Smoking of bidees leads to air pollution; it is harmful for both active & passive smokers
c) Due to large quantity dumping it disturbs the ecological cycle.
d) Due to storage for more time it invites flies & mosquitoes which are responsible for spreading of pathogenic diseases.
e) In rainy season due to moisture odour problems created.

3. Literature Review

3.1Tendu leaves refuse as a Biosorbent for COD removal from Molasses Fermentation based Bulk Drug Industry Effluent. [1]

Physico-chemical properties of effluent from a molasses fermentation based bulk drug unit were analyzed and found to be typical of the effluent from molasses fermentation excepting for high amount of phenols. The Chemical Oxygen Demand (COD) removal capacity of tendu (Diospyros melanoxylon) leaves refuse of bidee industry and its comparison with Granulated Activated Carbon (GAC) has been presented. Batch kinetics and isotherm studies were studied under varying experimental conditions of contact time, COD concentration, adsorbent dose and pH. Maximum COD removal was observed at a narrow pH range between 7 and 8. The kinetic data were best fitted to the pseudo-second-order chemisorption model. The adsorption followed both Langmuir and Freundlich isotherms. As per Langmuir model, maximum adsorption capacity was found to be 48.54 mg and 154.8 mg COD per g for tendu leaves refuse and GAC, respectively. The results illustrate how tendu leaves refuse, a solid waste disposal menace from bidee industry, is effective biosorbent for the removal of COD; offering a cheap option for primary treatment of the effluent.

3.2 Potential of Tendu Leaf Refuse For Phenol Removal in Aqueous Systems [2]

The potential of tendu (Diospyros melanoxylon) leaf refuse from bidee industry waste to remove phenol from aqueous solution was studied. For this purpose, the tendu leaf refuse was carbonized by subjecting it to chemical treatments with sulfuric acid. Batch kinetics and isotherm studies were carried out under varying experimental conditions of contact time, phenol concentration, adsorbent dose and pH. Adsorption equilibrium of tendu leaf refuse and chemically carbonized tendu leaf refuse was reached within 2 hr for phenol concentration 10-25 mg/l and 1 hr for phenol concentration 20-200 mg/l, respectively. The adsorption of phenol decreases by the increase of the pH value of the solution. The kinetic data followed more closely the pseudo-second-order chemisorption model. The adsorption data were modelled by using both Langmuir and Freundlich classical adsorption isotherms. The maximum adsorption capacity of chemically carbonized tendu leaf refuse as per Langmuir model was 4 times higher than that of raw tendu leaf refuse. The results illustrate how tendu leaf refuse, a solid waste disposal menace from bidee industry, can be used as an effective biosorbent for phenol in aqueous solution.

3.3Chromium Adsorption onto Activated Carbon Derived from Tendu (*Diospyros melanoxylon)* Leaf Refuse: Influence of Metal/Carbon ratio, time and pH[3]

The activated carbon produced from tendu (Diospyros melanoxylon) leaf refuse (TLR) was Chemically activated using sulfuric acid and utilized as an adsorbent for the removal of chromium ion (VI) from aqueous solution in the concentration range 50 – 250 mg/L. Adsorption experiments were carried out in a batch process and various experimental parameters such as effect of contact time, initial chromium ion concentration, carbon dosage and pH on percentage removal have been studied. Adsorption results obtained for activated carbon (CA-TLR) were compared with the commercial activated carbon (CA-CAC). Adsorption results obtained, shows that the Cr (VI) uptake being attained at pH 2. The equilibrium adsorption data was better fitted to the Langmuir's and Freundlich adsorption models. It was concluded that activated carbon produced from tendu leaf refuse (CA-TLR) has an efficient adsorption capacity compared to (CA-CAC) sample. The adsorption capacity as calculated from the Langmuir isotherm was 95.2 mg/g at initial pH 2.0 for a 50 mg/L Cr(VI) solution.

3.4Physico-Chemical Analysis Of Tendu Leaf Litter Vermicompost Processed [4]

Here the ash content was observed to be increasing with the increase in the vermicomposting time .There was a substantial increase in the ash content from the vermicompost, as the organic matter was destroyed and the residue of inorganic salts, the ash remained .The enhancement of ash content may be due to faster and consistent increased microbial activity at the time of vermicomposting. It can also be predicted that increasing ash indicates faster consumption of available ORM (tendu leaf litter) because of increased palatability of waste after initial decomposition (Edwards and Lofty, 1977).It is concluded that higher biomass content indicates larger quantity of ash which results in greater utilization of organic manure for greater production of vermicomposting. For maximum availability of vermicompost end product the moisture content also plays an important role as was observed in the present investigation. This indicates that higher decomposition and mineralization of substrate takes place in the ORM of tendu leaf litter.

The increased level of EC is more prominent from the tendu leaf litter produced vermicompost when compared with control i.e. decomposed tendu. In farm waste vermicompost also the increasing trend was noticed in electrical conductivity. This enhanced electrical conductivity from vermicompost might have hastened the nutrient accumulations which in turn influence the plant growth by making available macro and micro nutrients. Maximum biodegradation of the tendu leaf garbage was obtained by using raised bed method processed by earthworm *Eudrilus eugeniae*. The parameters like pH , temperature and moisture of the bed proved to be an important factor for getting better results.

3.5 Effect of tendu (Diospyros melanoxylon RoxB.) leaf vermicompost on growth and yield of French bean (Phaseolus vulgaris L.[5]

Here investigations were aimed to study effect of vermicompost prepared from tendu leaf residues as the tendu leaves on the growth and yield of Phaseolus vulgaris under greenhouse conditions. The seeds of French bean were sown in cement pots containing soil alone (control), soil with various concentrations of vermicompost alone, soil with various concentrations of urea only and different admixtures of vermicompost and urea.

Results: The study revealed that the seed germination, shoot and root length, shoot and root fresh weights, shoot and root dry weights, thousand grain weight and grain weight per plant increased significantly (p B 0.05) compared to control due to application of vermicompost when used at proper proportions. The combined application of tendu leaf vermicompost and urea increased the growth and yield of Phaseolus vulgaris significantly (p B 0.05).

The pot trial experiments suggest that the quantity of chemical fertilizers for French bean plants could be reduced by 25–50 % due to combined application of tendu leaf vermicompost with chemical fertilizer. Moreover, application of tendu leaf vermicompost alone at higher concentrations (100 % N through vermicompost) may reduce certain growth parameters and yield of P. Vulgaris plants.

3.6The Quality enhancement of macro and micro nutrients of organic wastes(Diospyros Melanoxylon and Eichhornia Crassipes) by vermicomposting (Perionyx Excavatus)[7]

Organic waste composts from Tendu leaf and Eichhorniacrassipes were selected for vermicomposting. These were mixed with cow dung separately in 1:1 ratio for vermicomposting process. Later collected vermicompost was analysed for the physicochemical properties such pH,NPK & micronutrients Cd,Co,Cr,Cu,fe,Mg,Mn,Ni,Pb& Zn. The values of vermicompost were comparatively higher than normal compost. The earthworm P. excavates enhance the nutrient values & reduced the toxic metals of the given organic waste.

4. Laboratory Analysis

The collection and sampling of Tendu leafs need the field and laboratory analysis to obtain the parametric results and its contribution towards the soil and water parameter. The laboratory analysis mainly consist the ph, conductivity, Calcium Carbonate, Organic Carbon, Iron, Zinc, NPK, etc.

Vermicompostnig

The term is also used to refer to the technology of converting raw organic materials into organic fertilizer, called vermicompost, mainly through microbial action and the use of certain species of earthworm. In addition, the technology is applied in waste management by which organic "wastes" are recycled and made available for plant growth. Vermicomposting is a method of preparing enriched compost with the use of earthworms. Earthworms consume biomass and excrete it in digested form called worm casts.

Suitable Species

One of the earthworm species most often used for composting is the Red Wiggler (*Eisenia fetida* or *Eisenia andrei*); *Lumbricus rubellus* (a.k.a. red earthworm or dilong (China)) is another breed of worm that can be used, but it does not adapt as well to the shallow compost bin as does *Eisenia fetida*. To study the vermicomposting one model is prepared by acrylic sheet having dimensions 300mm x 300mm x200mm box. Provided perforations of 3mm & 6mm up to 75 mm alternate lines.Outer box is of 600mm x600mm x500mm.For outer box total 3 holes provided of 18mm,One is at a upper side & two in opposite face at bottom side. Initially locally available black cotton soil collected & its testing done for its content. Results are as follow.

Table 1: Details of sampling result at sampling location near to 14 No. Municipal school

Sample No.	*I*	*Initial Temp.*	*28° C*
Locaiton	*Near to 14No. Municipal School*	*Lab Temp.*	*27° C*
Sr.No.	Parameters	Results	Normal Range
1	pH	8.23	6.1-8.5
2	Electrical Conductivity	0.26	Up to 1.0mS/cm
3	Nitrogen	261	210-670 kg/hc
4	Phosphorous	28	20-60kg/hc
5	Potash	234	150-440kg/hc
6	Calcium	8450	4550-13200ppm

Table 2: Details of sampling result at sampling location near to Murgi nalla

Sample No.	*II*	*Initial Temp.*	*28° C*
Locaiton	*Near to Murgi Nalla*	*Lab Temp.*	*27° C*
Sr.No.	Parameters	Results	Normal Range
1	pH	8.28	6.1-8.5
2	Electrical Conductivity	0.36	Up to 1.0mS/cm
3	Nitrogen	255	210-670 kg/hc
4	Phosphorous	30	20-60kg/hc
5	Potash	236	150-440kg/hc
6	Calcium	8455	4550-13200ppm

Table 3: Details of sampling result at sampling location near to Dhamaka Band

Sample No.	*III*	*Initial Temp.*	*28° C*
Locaiton	*Near to Dhamaka Band*	*Lab Temp.*	*27° C*
Sr.No.	Parameters	Results	Normal Range
1	pH	8.33	6.1-8.5
2	Electrical Conductivity	0.31	Up to 1.0mS/cm
3	Nitrogen	263	210-670 kg/hc
4	Phosphorous	25	20-60kg/hc
5	Potash	241	150-440kg/hc
6	Calcium	8445	4550-13200ppm

Table 4: Details of sampling result at sampling location near to Bedar pool/Bridge

Sample No	*IV*	*Initial Temp.*	*28° C*
Locaiton	*Near to Bedar Pool/Bridge*	*Lab Temp.*	*27° C*
Sr.No.	Parameters	Results	Normal Range
1	pH	8.20	6.1-8.5
2	Electrical Conductivity	0.27	Up to 1.0mS/cm
3	Nitrogen	270	210-670 kg/hc
4	Phosphorous	27	20-60kg/hc
5	Potash	244	150-440kg/hc
6	Calcium	8461	4550-13200ppm

Then 180g of Tendu leaves taken with 9.52 kg of black cotton soil in to the centrl box. This central box is surrounded by black cotton soil 89.29kg.Added 21.25lit water. Added 1kg Eisinia Fetida earthworms in to the soil which allow to help decompose the tendu leaves. Later 13.70 lit water is added to sustain moisture in the soil. After 6 weeks vermicomposted black cotton soil sample tested & found results as follows.

Table 5: Details of sampling result at sampling location near to 14 No. Municipal school after vermicomposting

Sample No.	*I*	*Initial Temp.*	*28° C*
Locaiton	*Near to 14No.Municipal School*	*Lab Temp.*	*27° C*
Sr.No.	Parameters	Results	Normal Range
1	pH	7.38	6.1-8.5
2	Electrical Conductivity	1.36	Up to 1.0mS/cm
3	Nitrogen	525	210-670 kg/hc
4	Phosphorous	43.5	20-60kg/hc
5	Potash	362	150-440kg/hc
6	Calcium	10430	4550-13200ppm

Table 6: Details of sampling result at sampling location near to Murgi nalla after vermicomposting

Sample No	*II*	*Initial Temp.*	*28° C*
Locaiton	*Near to Murgi Nalla*	*Lab Temp.*	*27° C*
Sr.No.	Parameters	Results	Normal Range
1	pH	7.7	6.1-8.5
2	Electrical Conductivity	1.5	Up to 1.0mS/cm
3	Nitrogen	370	210-670 kg/hc
4	Phosphorous	36	20-60kg/hc
5	Potash	284	150-440kg/hc
6	Calcium	9780	4550-13200ppm

Table 7: Details of sampling result at sampling location near to Dhamaka Band after vermi-composting

Sample No.	*III*	*Initial Temp.*	*28° C*
Locaiton	*Near to Dhamaka Band*	*Lab Temp.*	*27° C*
Sr.No.	Parameters	Results	Normal Range
1	pH	7.4	6.1-8.5
2	Electrical Conductivity	1.40	Up to 1.0mS/cm
3	Nitrogen	500	210-670 kg/hc
4	Phosphorous	40	20-60kg/hc
5	Potash	350	150-440kg/hc
6	Calcium	10300	4550-13200ppm

Table 8: Details of sampling result at sampling location near to Bedar Pool/Bridge after vermicomposting

Sample No.	*IV*	*Initial Temp.*	*28° C*
Locaiton	*Near to Bedar Pool/Bridge*	*Lab Temp.*	*27° C*
Sr.No.	Parameters	Results	Normal Range
1	pH	7.3	6.1-8.5
2	Electrical Conductivity	1.35	Up to 1.0mS/cm
3	Nitrogen	520	210-670 kg/hc
4	Phosphorous	42	20-60kg/hc
5	Potash	360	150-440kg/hc
6	Calcium	10370	4550-13200ppm

4.8 Laboratory Result analysis for soil.

Laboratory analysis is done for four samples taken in consideration with soil nutrients/properties

1) pH

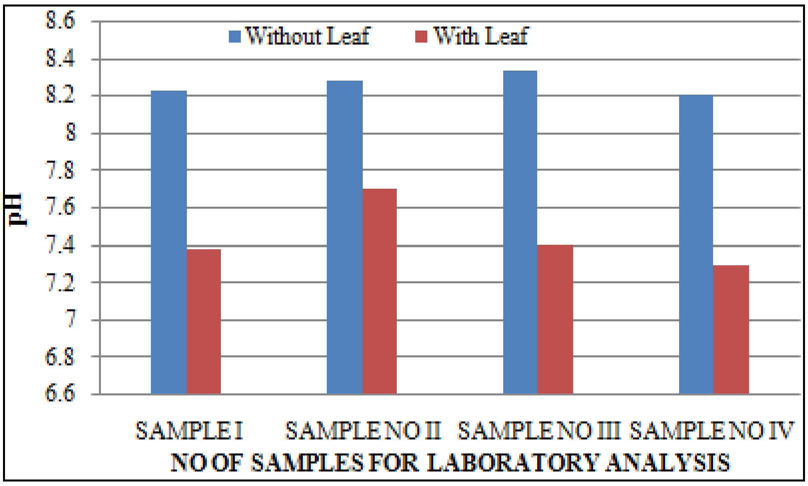

Figure 1: Graphical Representation Showing Variation in pH

2) Electrical Conductivity

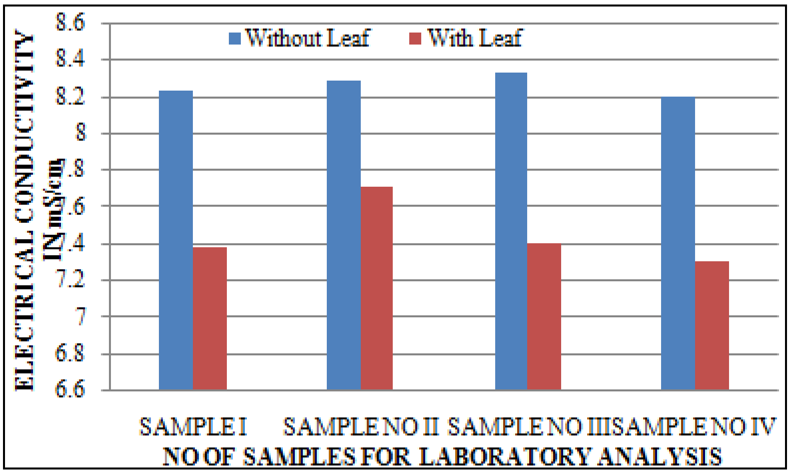

Figure 2: Graphical Representation Showing Variation in Electrical Conductivity

3) Nitrogen

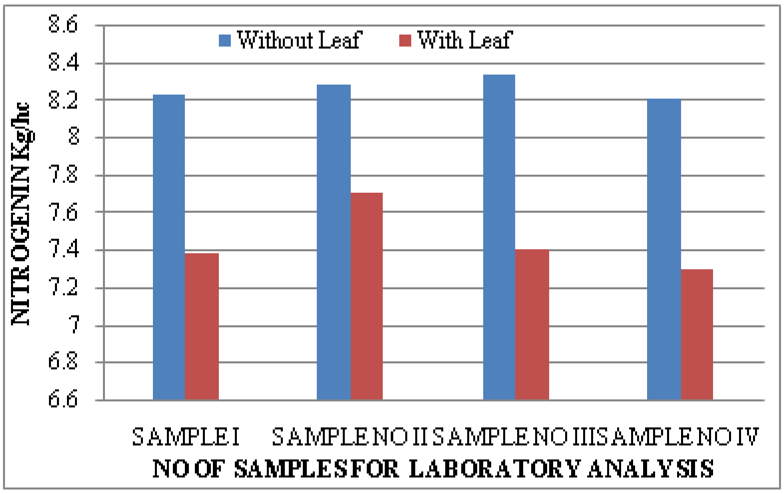

Figure 3: Graphical Representation Showing Variation In Nitrogen

4) Phosporous

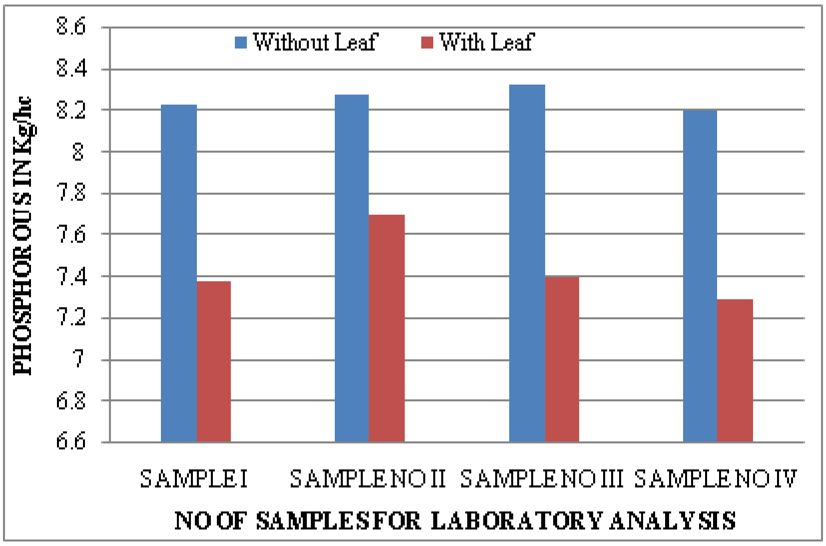

Figure 4: Graphical Representation Showing Variation in Phosphorous

5) Potash

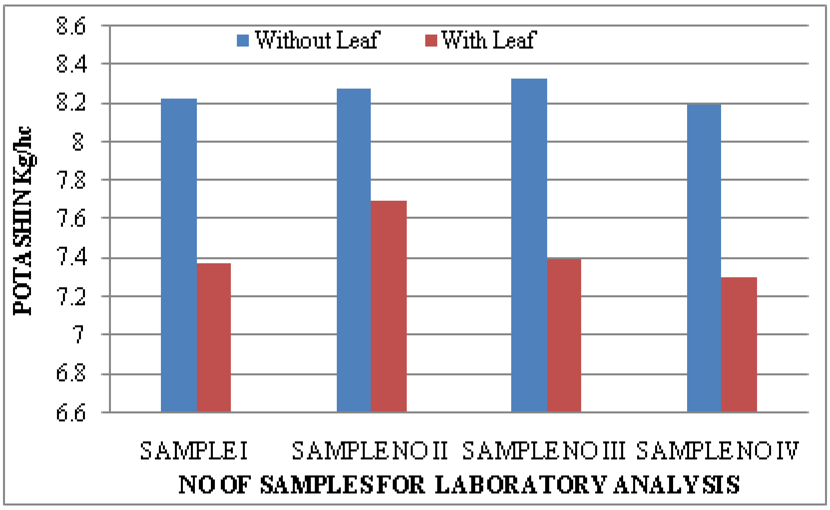

Figure 5: Graphical Representation Showing Variation in Potash

6) Calcium

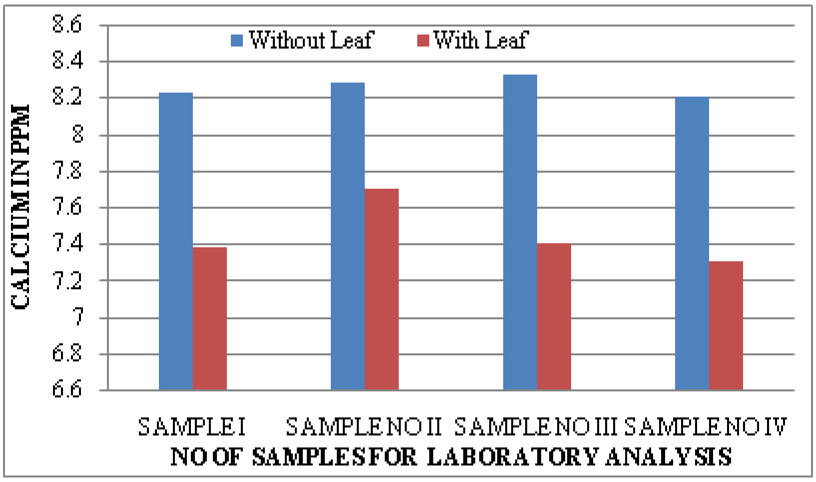

Figure 6: Graphical Representation Showing Variation in Calcium

5. Result & Discussion

After vermicomposting pH value of soil decreases up to 7.38 from 8.23.Electrical conductivity increases up to 1.36mS/cm.. Nitrogen content increased up to 525 kg/hc from 261kg/hc. Phosphorous content increased up to 43.5 kg/hc from 28.Potash value increased up to 362 kg/hc from 234kg/hc.For plant/crop growth nitrogen, phosphorous & potassium plays a very important role. Calcium value increased up tp 10430ppm from 8450.

6. Summery

The tendu leaves used for Bidee industry are responsible for large waste generation. This industry produces cutting of tendu leaves as refuse which pollutes the dumping sites creating solid waste disposal problem of alarming scale. It is necessary to find out effective method of disposal of waste Tendu leaves or its proper utilization which minimize the waste quantity.

As life of thousands families involves in activities from collecting of Tendu leaves to rolling it in to Bidee,it is necessary to pay proper attention to provide required health facilities to them.

7. Future Scope

1) To provide better disposal facility
2) Necessity for public awareness
3) Appropriate action to minimize the waste
4) Detailed study of Life cycle Analysis of Tendu leaves
5) To protect the mother earth with proper solution for disposal
6) Try to get cash recovery product from these Tendu leaf waste generated.

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