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A Prototype Eco-farming model: Quantization of Biomass energies

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Abstract

In this paper eco-farming model is proposed for the farmers to take advantage of easily available renewable energy in their farm itself. In farming sector generally we have a main renewable traditional energy resource, which is a biomass. Mostly biomass in farming sector is used to cultivate food, fodder, firewood, and remaining for compost fertilizers. Generally, it was processing in farm, house, animal shed, and compost pit. In villages, there are separate individual open pits for the house waste, cattle waste and agricultural waste. It is found that most of the biomass gets wasted through these open pits in villages. Eco-farming model able to channelize this waste biomass eco-friendly through some natural processes by using recent theories and techniques like, animal husbandry business, bio-gas plant, composting and drip irrigation.

Keywords: Organic farming; Biomass; Eco-friendly; Warm-compost.

1. Introduction

Our country is a country of the villages. Sixty percent population depends on farming i.e., Main source of economy is agriculture. Average farmers have four to six family members with one to two Akers of land. For additional resource farmers have their animal husbandry and dairy milk businesses. Mainly, farmers have need of electricity, fertilizers, water and fuel. Farmers fulfill this need from unaffordable sources in market. Today's survey tells us that the majority of the farmers are found to be in loss in their farming business. There are so many reasons behind it. Obviously, most of them are out of his capacity. Definitely, there are some things, which are in his capacity to improve present situation. Usually, Farmers make use of advanced things in their traditional farming without any knowledge and management skills, so they are found to be in loss, hence there is simple and convenient solution for them, which may compensate the loss in farming and prevent the environment from pollution, which is eco- farming. Nowadays, eco-farming becomes only a theoretical concept in organic farming because mostly crop plant requires pesticides or insecticides for their healthy growth [1]. Farmers should achieve the required yield by using chemicals, fertilizers and pesticides, which creates diverse effect on environment and obviously on the health of leaving organism [2].

Biomass has become one of the most commonly used renewable sources of energy in the last two decades [3]; it's such a widely used source of energy. The most common biomass used as firewood for producing energy for heating and cooking for a very long time. It fulfills the need almost 15 % of the world's total energy supply and as much as 35 % in developing countries [4]. Biomass has been converted

by partial-pyrolisis to charcoal for thousands of years. Broadly speaking, it is organic material produced by the process of photosynthesis, which provides local need of energy for fuel and fertilizers. Biomass has to be considered in the search for an alternative source of energy that is abundant in a wide-scale yet non-disruptive manner since it is capable of being implemented at all levels of society [5].

In combination of new technology in drip irrigation, bio-gas plants, warm composting, and animal husbandry business, we may use easily available excess biomass.

To the best of our knowledge and survey, it is found that 60 % of the biomass gets wasted. On the other hand the excess use of water, pesticides and fertilizers goes on increasing in farming. This unused biomass, excess water, use of chemical fertilizers and pesticides create adverse effect on environment like pollution [6-8]. It is necessary to change the mindset of the farmers residing in villages to use the renewable traditional resource like biomass to fulfill their local need of energy; also they should make the use of advanced drip irrigation system to save water and fertility of the soil [9]. In this study, an ideal eco-farming model for the farmers, which prevent the pollution and support them to fulfill energy need at their doorstep, is proposed.

Eco-friendly model

Mechanism of processing of biomass in eco- farming model

Eco-farming model is not a machine; it is a systematic concept of utilization of biomass Eco-friendly through various natural processes. In plants, chlorophyll absorbs sunlight photons of having green wavelength from the sun. Carbon dioxide enters the stomata; an opening in the leaf's epidermis and cuticle. Water is absorbed through roots and carried through stem to the rest of the plant. Water and carbon dioxide create organic compounds of carbon in presence of sunlight, the process is called photosynthesis. In this photosynthesis process, oxygen and water vapors generate, which is send to environment. The chemical material (organic compounds of carbons) is stored and can then be used to generate energy. Thus, the term "biomass" refers to organic matter that has stored energy through the process of photosynthesis in plants.

$$CO_2 + H_2O + \text{sunlight} \rightarrow \text{Organic compounds of carbon} + O_2 \quad \text{--- (1)}$$

Biomass stored in the plants may be transferred through the food chain to animal's bodies and there wastes. Most of the biomass is used as fuels in the form of wood products. Secondly, the digestion of food and fodder happens in the stomach of the animals that hold food, while it is being mixed with enzymes that continue the process of breaking down food into a usable form. Stool or waste left over from the digestive process is called dug. Thirdly, this dug wastes left over from the digestive process also organic compounds convertible to bio-gas designated as volatile solid. It is defined as a portion of the feed digestible to form methane. The first stage of bio-gas production process is the conversion of these

organic compounds into simple carboxylic acids as the result of hydrolytic microorganism activities. The second phase is the methane gas formation, which is an anaerobic process. However, sometime a portion of it is always inevitably converted into carbon dioxide (CO_2) as a side product of microorganism metabolism. Waste from the bio-gas plant is in the form of slurry paste at desired temperature.

Finally, bacteria inside the earth warm intestine helps to break down processed biomass food in to warmi wash and warmi compost, which enriched, neutralized and revitalized, thus, making earthworm the best agent to carryout composting.

Composition of Eco-friendly model

This model mainly consist of,

i) Cattle shed with two to three animals
ii) Bio-gas plant
iii) Warmi compost pit
iv) Warmi beds
v) Ventury valve and
vi) Drip irrigation system.

Additional requirement for Eco-friendly model

For efficient and reliable working, there are some additional requirements.

i) Minimum area should be about 1500 sq. feet.
ii) Farmer's residence, cattle shed (1000 sq. feet) and store room (200 sq. feet) should be connected with bio-gas plant near the farm site.
iii) At least two warmi composting pits (100 sq. feet) and warmi beds (200 sq. feet) nearby animal shed.
iv) Separate plumbing pipe system for the regular water and waste water.
v) Ventury location should be nearby the animal shed.

Working procedure of Eco-friendly model

Naturally, in presence of sun radiations plant creates the biomass **(**photosynthesis) by taking water from roots and carbon dioxide from leaves, leaving oxygen and water vapors to atmosphere. The digestion of biomass happens in stomach of cattle. The waste left over from the digestive process is organic convertible compounds send it to bio-gas plant. In bio-gas plant, in first phase (hydrolytic microorganism activity), these organic compounds convert into carboxylic acids. In second phase, methane gas (NH_4) formation takes place (anaerobic process**)**. The waste from bio-gas plant (liquid

biomass paste) gets mixed with excess bio-mass waste from farm (agriculture waste), house (house waste) and cattle shed (fodder waste) in warmi compost pit. This mixture after forty days converts into humus, which is best food for warms. This biomass in the form of humus is kept on a typical warmi beds. The bacteria inside the warm intestine (digestion) decompose the humus into vitamins, proteins, carbohydrates and minerals. The water soluble minerals from warmi bed (warmi wash) is then extracted and solid residue would be harvested away layer by layer from warmi beds. This solid residue is warmi compost, which is best food for the plants. The urinary of the cattle shed and warmi wash from warmi bed are connected to the ventury valve of the drip irrigation system as shown in Figure 1. Therefore crops should receive the nutrient food daily through drip irrigation. Generated methane gas is used for cooking in the kitchen.

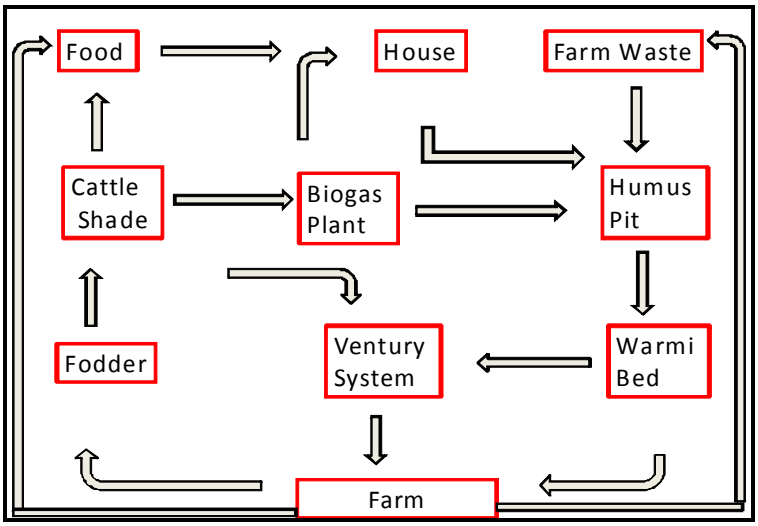

Figure 1. Biomass-energy processing scheme in Eco-friendly model

Experimental Work

The various experimental sites from Kadegaon Tahasil were decided. The farmers were oriented and guided for the use of Eco-friendly model. According to the requirement of the Eco-friendly model as shown in Figure 1, cattle shade, bio-gas plant, residing house and warmi beds were connected to ventury system of drip irrigation by plumbing pipes. The biomass in the form of fodder gets processed initially in cattle shade. The dug from the cattle shade was used as raw material for Bio-gas plant. Waste from the bio-gas plant was transferred to Humus pit. Finally, the Humus material was transferred to warmi beds. From warmi beds periodically the best quality warmi compost was harvested.

Results and Discussion

By the application of the Eco-friendly model, the sugarcane crop was cultivated at the desired

sampling sites. The five years comparative data for expenses and output yield was collected from traditional farming and farming by using Eco-farming model. The expenses (in lacks) variation was plotted against the time (in years) as shown in Figure 2. Similarly, the respective yield (in lacks) was compared with the traditional farming for the same period as shown in figure 3.

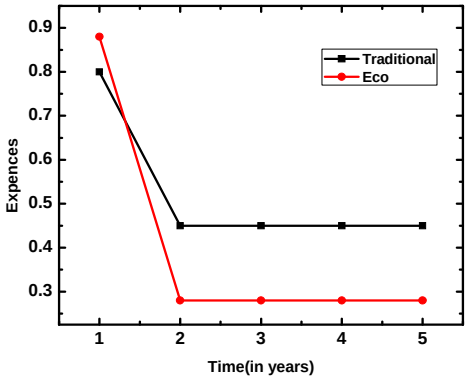

Figure 2. Expenses (in lacks) variations in traditional and eco-farming model

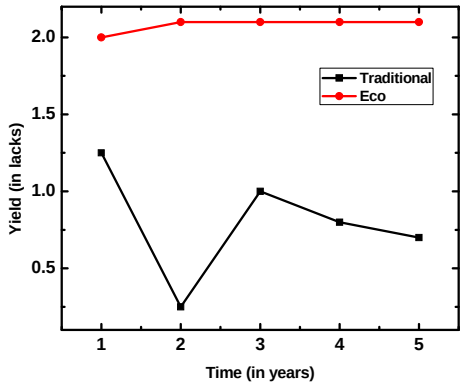

Figure 3. Yield (in lacks) variations in traditional and eco-farming model

Conclusions

i) It is observed eco-farming model is much economically saving than traditional farming.

ii) Initially, it requires the more investment than farming, however, from second year it is almost less or average expense amount in five years is less than the traditional farming.

iii) Output yield is found to be more sufficient and constant for the all years. However, it is continuously decreases in traditional farming.

iv) Though, there is maximum use of warmi composting, instead of other fertilizers, the fertility of the soil should be preserved.

v) Though the excess biomass from farm is used as a fodder for cattle and for the raw material for the warmi composting, it reduces pollution by biomass fermentation in open pits.

vi) The cattle shed is the first processing agent in eco-farming model, it creates additional income source to the farmer.

vii) The bio-gas plant is the second processing agent, which creates methane gas for kitchen.

viii) The warmi composting is a third processing unit in eco-farming model, which generates the best quality fertilizer from agriculture waste and biogas plant waste.

ix) The last part of the eco-farming model is the drip system with ventury valve system, which might supplied daily water soluble minerals and salts from warmi wash and urinary from the cattle shed.

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