

COMPOST FOR COCONUT PLANTATIONS

Coconut being a perennial is planted and replanted in the same soil resulting a continuous uptake of nutrients over a long period. In addition the utility value of the various parts of the coconut palm is high compared to other trees. Removal from the land, the fallen fronds etc prevents nutrient recycling. The continuous uptake of soil nutrients by the palm depletes the soil on which it thrives. The chemical fertilizers recommended do not replenish all the lost nutrients. After a considerable period, with the break down of the organic matter in the soil, the nutrients get washed away by rains and then, the lowering of the soil fertility, and productivity of the palm, set-in. Presently it is apparent that many coconut lands have been subjected to this situation. When taken in comparison with the temperate countries it is seen that the heat and the relative humidity in the tropics hasten the break down of the organic matter that helps to conserve the soil fertility. In Sri Lanka, heavy rains received in short periods on light textured soils, of the main coconut growing districts, wash of the soil nutrients. Also chemical fertilizers applied from time to time will not enrich the soil as one expects to be, due to the nature of the chemical fertilizers and the methods of application. Experiments have shown rapid growth and flowering and an increase in production when organic materials such as animal and green manure (plant matter) are applied to coconut. But as the required quantities of such materials are large and are not easily available, the application of organic manure has not gained popularity. Due to the recent price increases in chemical fertilizers, and also due to adverse structural changes in soil as a result of repeated application of chemical fertilizer mixtures, it has become necessary to convince the coconut growers the use of organic manure to rehabilitate the soil.

In order to solve this current problem, the use of compost could be introduced for a number of reasons, which is becoming more popular.

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Though historical evidence indicate that the use of compost dates back to thousand of years, only in 1921 in England attention was drawn to its scientific production, followed by India in 1931, extensively.

Compost -its benefits and composition.

The main benefit from compost is the addition of humus to the soil which is a major requirement in retaining the soil fertility. Soils in the temperate countries contain as much as 5-10% organic matter, as against only 1% in the tropics. Compost is also a source of major plant nutrients NPK and constitutes considerable amounts of some of the micronutrients.

Physical effects.

The high organic matter content in compost which is the main constituent, improves the soil fertility considerably. Humus being a colloid, helps to bind the cations and soil particles to form granules, thereby improve the soil texture and the structure. For example humus helps the sandy soils to form granules while in clayey soils hard bound particles are loosened. Granulated soils contain less ions and therefore the agricultural practices are made easier. Compost also helps retention of soil moisture, minimizes nutrient leaching, and improves the soils aeration activities. Finally these soils help the coconut palm to develop a widely spread root system, capable of absorbing the nutrients. Further this acts as a buffer in controlling the soils acidity level.

Chemical effects.

As compost is made using plant materials as well, the major nutrients of such materials namely N P K Ca and Mg and also the micronutrients such as Fe S Mn Cu Zn B are also resupplied to the soil. Compost also enriches the soil with plant nutrients and

considerably assist the palm in the absorption of the nutrients fixed in the soil. Compost helps to maintain the nutrient availability in the soil. The humic acids formed in humus-rich soils, help various plant nutrients like phosphorous, to dissolve in water and be made available to the palm. The micronutrient in the soil too assist in this process. Some compounds formed in association with humus are easily absorbed by the roots.

The CEC (Cation Exchange Capacity) in compost is high and controls nutrient leaching in the soil.

Biological effects.

Application of compost adds large microbial populations to the soil and also enhances the existing microbial activity thus improving the soil. Some micro-organisms living close to roots help to make available certain elements around the roots apart from increasing the soils nitrogen content through ammonification, nitrification and fixing.

It has been reported that high rates of nitrogenous fertilizers increase the nematode population and addition of compost even in the presence of applied NPK fertilizers, suppresses number of plant parasitic nematodes.

Preparation of compost

Producing compost is a bio-chemical process. By the action of a number of microorganisms, the complex organic matter is converted into simple forms. The humus-like substances formed as a result of this change, are mostly similar to the farmyard refuse. The hardness and the density of compost is less compared to the materials used:

Compost formation can occur under aerobic or anaerobic conditions (with or without oxygen) and under ordinary or high temperatures. The nature of the materials used, varieties of micro organisms present, available moisture and aeration, can cause changes in the process. A special feature in compost making is the less energy requirement compared to the other fertilizer manufacturing processes.

A number of methods can be employed in compost making. This could be decided upon

the availability of the raw material, environmental conditions, quantity of compost required etc. The procedures followed so far in compost making, have been based only on experience gathered with a long history of composting, but recently several changes have been introduced after considering the scientific explanations.

Scientific factors

Materials used.

These consist of plant materials like straw, grass, weeds, water plants, farmyard refuse, dung and urine, kitchen waste, etc. With sufficient moisture, the above materials undergo intensive decomposition and finally form into humus. Decomposition is a result of the action of millions of various micro-organisms.

The activity is maximized when sufficient organic matter is present as a medium for the production of energy, and these microorganisms use external oxygen and the moisture, and also the food from organic matter. As a result of this activity carbon dioxide and energy are released. A portion of this energy is utilized for microbial activity while the rest escapes as heat.

Simple and quick dissolving sugar in organic matter is readily taken up by micro-organisms and enzymes are used to break down hemicellulose and cellulose before feeding on them.

Important factors in compost making

Only the most important factors are listed below.

1. Carbon : Nitrogen ratio
2. Moisture
3. Air
4. Temperature
5. pH value

Carbon nitrogen ratio

The carbon nitrogen ratio, in the materials used for compost making play a very significant role in the process. Micro-organisms require carbon to build up energy for their development and nitrogen for building up of proteins.

A C:N ratio of 30-40 is optimal for efficient composting and ratios between 25-40, are found satisfactory. If the materials used are poor in nitrogen the C:N ratio increases resulting in poor development of micro-organisms and slowing down the compost making process. The increase in the C/N ratio occurs when plant material such as cereal plant parts like straw, sugarcane, saw dust are used. When the C/N ratio goes below 30, the nitrogen content of the material is more than the required level for micro-organisms resulting in slow process of compost making and unused nitrogen will evolve as nitrogen or ammonia. In most of the freely available materials a higher C/N is observed and this can be lowered by adding small amounts of either a nitrogen based chemical fertilizer or nitrogen rich organic matter containing cattle dung and urine or leguminous plant loppings.

C:N ratio of some materials used in compost making

Material	C:N ratio
Grasses	20
Dry plant parts	45
Straw	100
Farmyard refuse	14
Fibre bristles	300
Saw dust	200
Bone meal	08

Moisture

The moisture content of the materials taken for compost making should be around 50-60%, although a range of 40-80% is not harmful. But when this falls below 40% the decomposition will be aerobic but slow. If moisture is over 80% the process will take place under anaerobic conditions. According to research data about 2700 litres of water are required to turnout 1 M.T. of compost.

Aeration

While supplying oxygen necessary for growth of microorganisms, the carbon dioxide formed should also be efficiently allowed out.

The air circulation in a compost heap or a pit

depends upon the characters of the basic material used. Small particles hinder good aeration, and conversely bigger particles hinder microbial activity. For efficient use of these materials, it is recommended that they should be in sizes ranging 1-5 cm. Aeration could be effected by digging over and mixing the compost heap. If the heap is massive provision of air-holes is advisable.

Temperature

With the increase in the number of microorganisms, the temperature in the compost heap too increases, and the temperature rising above 40°C will change the microbial activity. A further increase in temperature will cause the death of weed seeds, and pathogens. Between 2-7 day period the temperature goes up between 55-70°C and decreases thereafter. At high temperatures breakdown of sugar, fats, and carbohydrates has been noticed. These particles are easily utilized by microorganisms and their number is increased significantly. As a result, a shortage of feeding materials for micro-organisms will take place and micro-organisms are destroyed.

pH level

At the start, the material used for compost making may be slightly acidic or neutral. If acidity is higher, nitrogen will be lost as ammonia. But this will not cause problems if the other factors mentioned above are satisfactory.

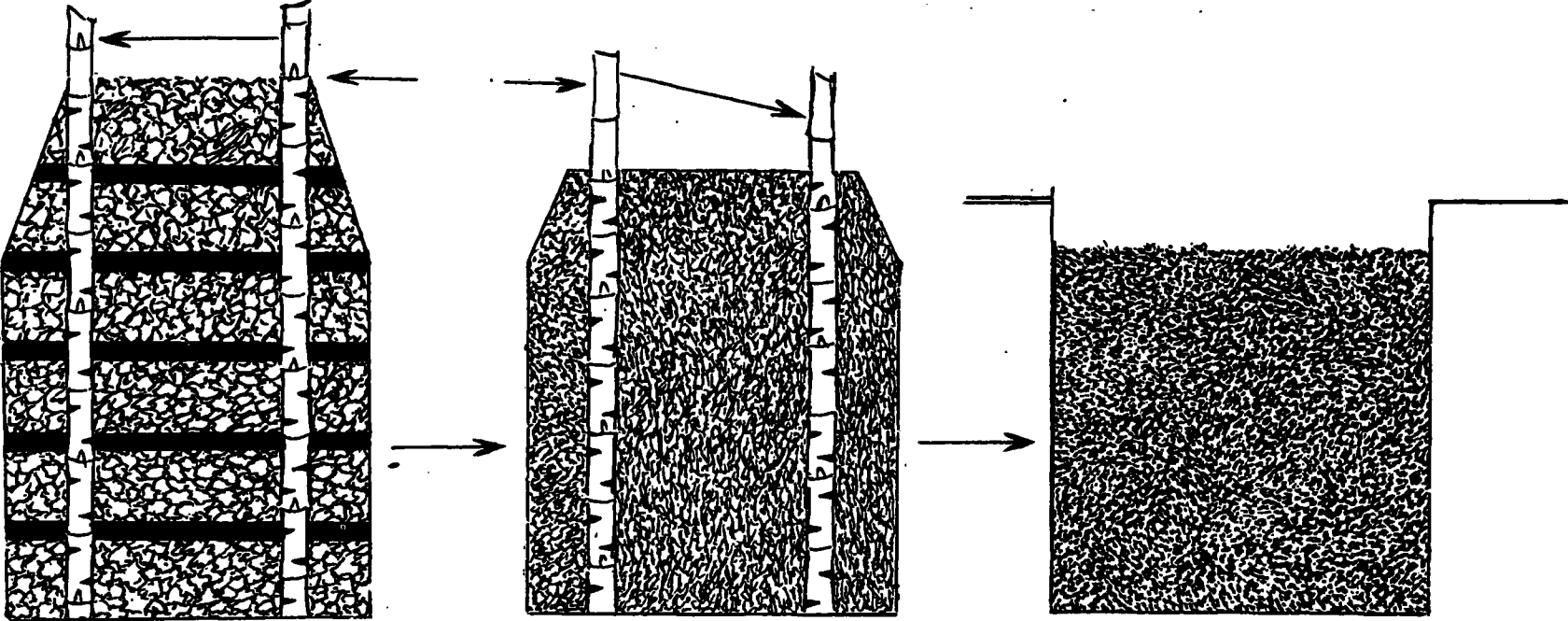
Compost making is done in two ways.

- i. pit method
- ii. heap method

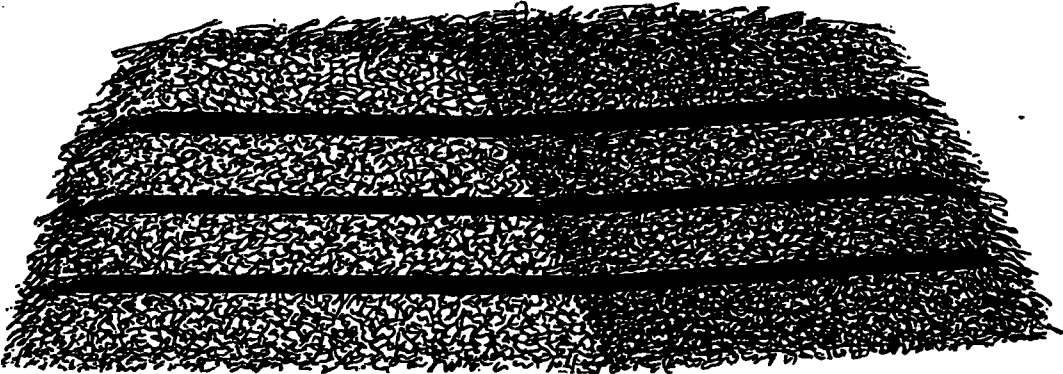
Whatever method is adopted, it is important to select the suitable site.

- i. The site should be close to the field where compost is to be applied
- ii. Water should be available
- iii. The soil surface should be hard.
- iv. Raw material should be freely available
- v. Site should be free from direct sunlight
- vi. Site should be free from water logging

Pit Method



Heap Method



The pit method

The pit should be 1.5 to 2m wide and 1m deep. The length could be decided as required. At the bottom of the pit the first layer should consist of the plant material cut into 5 cm bits. On this, the second layer of a slurry consisting of cow dung, cattle urine and compost or old cow dung and kitchen ash mixed together should be placed. These are then alternated watering liberally each layer. Finally the 90% of the total weight of compost could be water. Although it is not necessary to fill the entire pit at once, the exercise should not exceed 7 days. When layers are placed they should not be compacted and finally a 5cm thick layer of soil is placed to cover the pit.

If the materials used for composting are in small particles, this will result in a too close packing, and the aeration will be poor. To avoid this, aeration can be provided by inserting perforated bamboos in to the pit.

Heap method

This is suitable for areas where heavy rainfall is experienced. The width could be about 2.5 m from the base of the palm and the height about 1.5 m on the surface it should not exceed 1.5 meters. The length could be

decided as desired. Materials are placed similar to the pit method and artificial aeration is not required.

Mixing of materials

Proper mixing is an important key for making high quality compost. In both systems mixing should follow the steps given.

After 2, 6 and 8 and weeks from the final filling of the compost pit or the heap, 3 mixing are done. At each occasion mixing is done thoroughly and sufficient water is added to avoid drying the materials. After another 4 weeks a well prepared compost heap is ready for use.

The chemical composition of compost is given below. However the figures very much depend on the type of materials used for the preparation of compost.

C:N ratio	15-20
Organic matter	8-10%
Nitrogen	0.3 - 0.6%
Phosphorus	0.1 - 0.4%
Potassium	1 - 0.3%

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