The production of organic compost from domestic waste in Koya University campus

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Abstract

This project is the idea of producing compost in Koya University campus is the first step in producing compost in another place in the Koya city. The aim of this study is to prepare Koya University's staff to produce, either collectively or personally, their needs of compost for Koya University garden or for their personal home garden in the university campus. The principle of compost production is the same all over the world but the place, raw material, container, size, weather, duration, work division and participating in the production will change. 50% of home waste is organic coming from kitchens and gardens, and at least 30% of home waste can be used in compost production. The elements that are used in production of compost are carbon, nitrogen that comes from organic substance, humidity and temperatures from outside and organic material in addition to these, of course, microorganisms do the work of decomposing organic material. Koya has a dry hot summer and cold winter, for those composting need different treatments in summer and in winter. The conclusion of this is that production of compost is a strategy of different cities in the world for preserving the environment. In Koya, the university and their staff considered as the elite of this city, the planning of the future of this city depends on them. Composting can be one of these projects that Koya city able to be developed; either by Koya municipality or by Koya inhabitants.

Keywords: organic compost, compost production, domestic waste.

1 Introduction

Compost is the product resulting from the controlled biological decomposition of organic waste [1]. It is usually defined as a natural way to recycle the bio waste

such as food waste, wastewater sludge, grass clippings, paper, leaves, coffee ground, and tea leaves [2]. Compost contains a good range of major and minor plant nutrients, trace elements essential for healthy plant growth, as well as soil microbes and organic fiber for building healthy soil [3]. Unlike chemical fertilizers, compost has a built-in time release mechanism, which chemical fertilizer manufacturers try to duplicate. There are several reasons to encourage production of composting in the city to get healthy environment by:

1- Reducing waste [4]

Garbage is generally sent to landfill sites or garbage dumps. Garbage dumps are expensive to build and maintain, about 30% of all material disposed of in dumps are biodegradable plant wastes from kitchens and yards. The life span of a landfill site can be extended for a number of years if this material is composted.

2- Ecological benefits

Composting provides an excellent soil conditioner that improves plant, garden and lawn growth. It helps break down heavy clay soils allowing better root penetration and improving drainage. Compost improves moisture retention in sandy soils so water loss and leaching are reduced or eliminated [5]. Compost stabilizes and regulates the pH at optimum level for nutrient availability. Compost eliminates or reduces the need for chemicals, which may pollute ground water. There are no toxic or harmful residues in compost. Composting reduces harmful greenhouse gas emissions.

3- Economic benefits

Compost reduces the need for expensive chemical fertilizers. Compost conserves water as penetration and retention are improved, erosion and runoff are reduced [6].

Expensive landfill sites can be used for longer periods. The amount of waste you send to the landfill will be reduced by about 1/3. Composting is free and easy, requiring very little cost to set up and maintain [7].

2 Theoretical background

The compost is rich in nutrients. It is usually used in gardens, landscaping or agriculture. There are many benefits of using compost, such as fertilizing, soil conditioning or humus adding. Use compost as a soil amendment by digging the material into the soil before planting flowers, vegetables and trees as well as for new lawn establishment.

Compost can be used [8]:

- In the flower and vegetable garden or on the soil around trees and shrubs;
- For house plants and planter boxes;
- As part of a seed-starting mix;
- On the lawn as a top dressing (when screened);

- Dug into a garden when preparing the bed for planting, in the spring or fall; and
- Spread in seed furrows, or added to each transplant hole.

There are several methods for producing compost. These methods have the same principle.

These following steps can be the way for Koya University to produce composts unit as an example [9]:

Step 1: It is necessary to build a bin for composting. The bin will keep the place much neater than putting the waste in a pile on the ground. It will also discourage the different animals to come around and disturb or ruin the place. Composting bins keep warmth, moisture in, pets, rodents, and other pests out. They come in just about any size and shape, and fit any budget. There is different decor for choosing bins. We can make bins from plastic, wood, metal and ceramic. We can make our own bin by using wooden pallets, cinder blocks or even old rubber tires. Add a personal touch by painting it with our favourite colour, mounting flower boxes on top or planting a vine around the edges. The type and location of the bin make a difference in the amount of time that we spend ten. Use a tumbling bin for easy aerating. A bin near the house encourages everyday use. Placement next to your garden bed requires less hauling. In addition, a spot in the sun might need more watering, but could be good for a cold climate. With so many options, we can find the bin that fits.

Figure 1: Different sorts of bins.

Step 2: Composting is something anyone can do but there are a few things that we might understand before starting [10]: The four basic requirements for composting are air, water, carbon and nitrogen. The right amount of air and water will ensure the rapid reproduction of decomposers, the organisms that break down the carbon and nitrogen materials in the compost pile. Decomposers include bacteria, bugs, worms and fungi [3], of which bacteria are the most plentiful. Aerobic bacteria grow in an oxygen-rich environment and are the most effective at decomposition. When there isn't enough air in the pile, anaerobic bacteria move in and decomposition becomes slow and inefficient. Anaerobic bacteria also leave behind hydrogen sulphide, which gives off an unpleasant bad smell. To avoid putrefaction, the bin must get enough air and ventilation [11].

The bin must keep moist, but not soggy. When moisture decreases, the reaction of decomposition it will be slows [12]. Too much moisture and it becomes air deficient, encouraging the growth of anaerobic bacteria. Carbon comes from dry, lifeless materials from kitchen waste and garden, and nitrogen from the moist, fresh waste. Compost forms best with a 30:1 carbon-to-nitrogen ratio [13]. Although maintaining of the balance of these elements in bin compost is important but the exact ratio isn't that critical.

Without enough greens, the organic material will decompose very slowly. Without enough browns, it may smell bad. So, it's important that we have this balance. If we have a hard time figuring the ratio, it's better to error on the side of too many browns. If it's mushy, we need add some carbon. If it doesn't seem to be decomposing much, we need to add more nitrogen.

As green nitrogen-rich materials decompose, we may notice an ammonium odour coming from the compost pile. To prevent odours be sure to mix carbon-rich browns thoroughly into the pile and cover newly added greens with brown materials. By burying the greens with browns, we'll not only alleviate odours, we'll keep pests and flies from infesting your pile.

For composting, it is better to use small items. Smaller pieces of material break down faster than bulky items.

The balanced mixture:

- The green stuff such as young weeds, leaves, the various manures of animals. Fruit and vegetable scraps, plants [14].
- The brown stuff such as fall leaves, old flowers, dead plants and weeds.
- We can also use other items but in moderation, such as egg shells, paper towels.

It is important to never compost the following items for reasons of health, hygiene and inability to break down: meat and meat scraps; bones; fish and fish bones; plastic or synthetic fibres; oil or fat; pet or human faces paper and magazines [15].

Step 3: Mixing the different materials in the bin. Start with a layer of lightweight brown material, to help keep enough air near the bottom. In the first half part of the bin, put three layers of brown materials, then one layer of green stuff. In the second half put whatever the material, depending on what there is.

Step 4: Turning the pile regularly, once every week or two, to keep air flowing inside the pile, which encourages aerobic decomposition. Anaerobic decomposition will smell stinky and they decompose materials more slowly. Temperature and humidity of the compost pile are very important, they effect on the microbial activity [16]. Hot, dry climates may need a little extra water to reach the right moisture level. It's partially determined by climate. Warm temperatures increase microbial activity and speed up the decomposition process. Cool temperatures slow things down. In order to microorganisms do their work, they need to breathe. Turning the compost often will ensure the proper aeration.

Step 5: When compost is finished, it will have no resemblance to the materials we tossed in the pile. If it looks dark and crumbly, it might be ready to use. But

we must be sure. An immature mixture that still contains food scraps could attract rodents or other vermin [17].

With a little extra care, we could have finished compost in just three months.

The time it takes to compost to mature varies. It's partially determined by climate. Warm temperatures increase microbial activity and speed up the decomposition process. Cool temperatures slow things down. The types of materials that we used and the amount of attention that we gave to the countenance of the bin with enough air and moisture also affect timing. Our compost might be ready to use in three months or it could take more than a year before it's fully mature. When compost is finished and ready, it should have a pleasant, earthy smell to it. It has to be spread on or dug into the garden beds. Very fresh compost can grow plants, but it can also rob the soil of nitrogen as it continues to break down.

3 Conclusion and impact on Koya city

People throw away millions tons of trash every day, 30% of it comes from our kitchen and yard waste, and generally ends up in our landfills. Composting is an ecological process that reduces the trash. The amount of waste we send to the landfill will be reduced by about 1/3 [18]; prevent air pollution and soil pollution by reducing the use of chemical fertilizer by reusing compost as fertilizer. Composting saves money. Composting can be a collective project in city or districts in a specific area or it can be individually at home for own garden. Creating a collective composting process helps to better understand the biological cycle and how the waste can be re-used. Collective composting has a positive effect on the relationship between city residents to adapt the responsibility award each other's. Contrary to what people might think, composting doesn't smell bad, it isn't expensive to set up and it's easy to do. In fact, microorganisms do most of the work in this process.

Moreover, it can be a good way to integrate the students, teachers and technical services in the life of the site.

The University of Koya can be the leader of this project for Koya city.

Figure 2: An ideal area in a university village for putting compost bins.

It can also be a subject of many projects or memories in the science departments in Koya University:

- How and why the natures of the composted bio waste influence the chemical composition of the compost?
- Which kind of bio waste is better to recycle to have a compost rich in nutriment?
- Feedback of the composting process: how can we have a better efficiency?
- Learning the responsibility of protection towards our environment.
- Make design for preparing bins with different shape and material for small local artisans.

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