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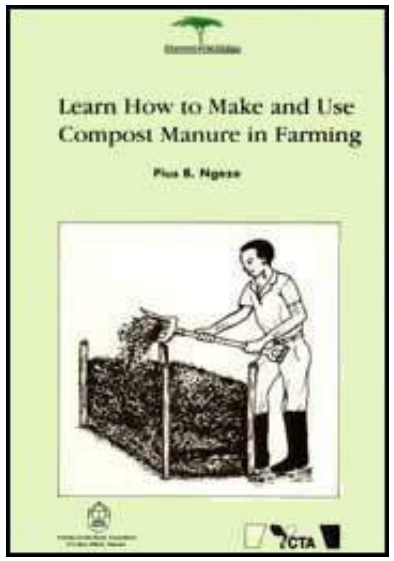

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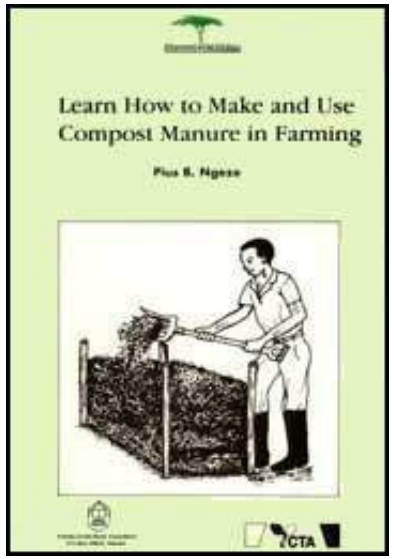
Learn how to Make and Use Compost Manure in Farming (Friends-of-the-book Foundation, 1992, 54 p.)

- ***(introduction...)***



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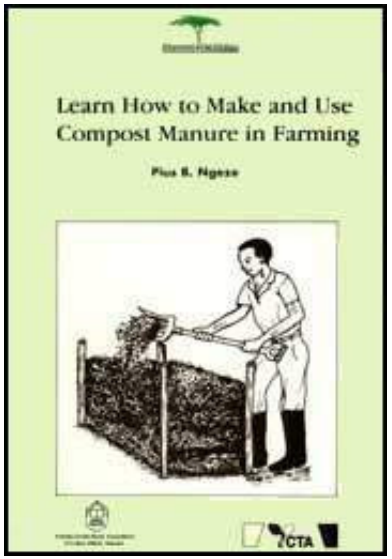

Back cover

Compost manure is the fertilizer that is made by farmers from plant and animal remains that decompose due to the action of the micro-organisms existing in the heap. This mixture of plant and animal left-overs is concentrated in a small area, thus hastening the decomposition. The heap is made up of items that can enhance decomposition - cowdung, ash and soil. Compost manure is environmentally friendly and promotes soil concentration.

This book deals with the preparation of high quality compost manure and how to use it on the farm. It is divided into six chapters: Chapter one provides a brief explanation about soil, which is one of the key resources in agriculture. Chapter two is about fertilizers in general, while chapter three gives reasons for the use of plant and animal left - overs in the preparation of compost manure. Chapter four is concerned with basic requirements in the preparation of compost manure and

chapter five centres on the major steps in the preparation of compost manure. Chapter six summarises the characteristics, merits and use of compost manure.

The author of this book, Pius B. Ngeze, holds a degree in Agriculture and has written several books on the subject. It is our hope that, by using this book, farmers will be encouraged to adopt proper techniques for preparation of compost manure and will result in better yields and productivity.

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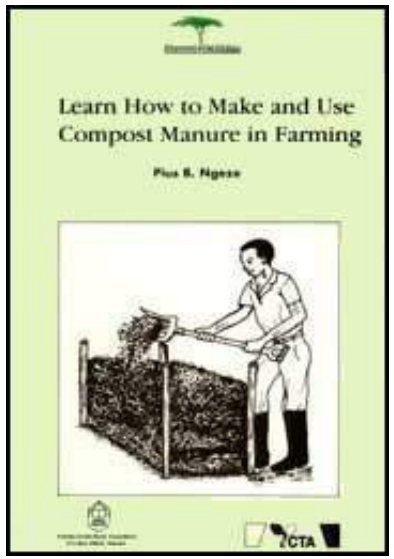

Introduction

As crops grow on the farm, they absorb plant nutrients from the soil. Among these, the most important are nitrogen, phosphorus, potassium, calcium and iron. Plants use these nutrients for establishing themselves, growing and becoming fruitful, thus giving us higher and better yields. Nearly all parts of the plant, i.e. roots, the stem, leaves, flowers and fruits have nutrients. However, not all of these parts are edible. Normally, man utilizes the flowers, leaves, seeds, fruits and the tubers. However, the usefulness of any part of a plant depends on the type of produce or plant. Still, the parts that are not useful to man or to domestic animals contain nutrients. In the event that these left-overs are casually discarded or burnt off the farms, the nutrients are wasted and are of no benefit either to the farmer or to the nation. The best way to ensure that left-overs are made good use of is by recycling. This entails decomposing and making compost manure out of them. The same applies to the wastes of animals, especially cattle.

Animals feed on plants and part of this food is utilised by the animals to grow, reproduce, work and live. The remaining part is excreted. This excretion or dung

contains many essential plant nutrients.

The best way to utilize the dung is to convert it into compost manure which can be applied to the soil for plant growth. Soil productivity and the life of other living things are thus maintained.

It is my hope that readers will use this book to improve their use of compost manure in the country.

P.S. Ngeze
Rulenge, Tanzania
16th February 1992

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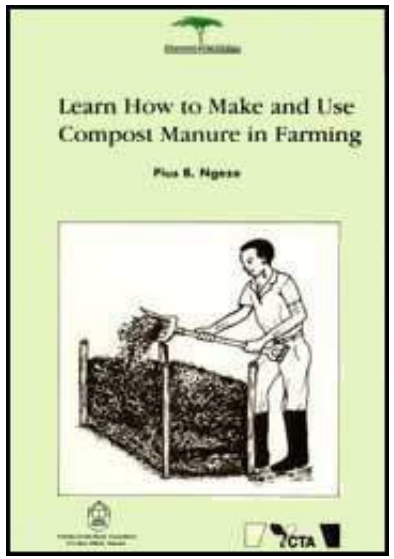

Chapter One Soil

1. Soil composition

Soil is a mixture of several minerals, plant and animal left-overs, humus, rocks, water and air. A typical soil consists of minerals (45%), water (25%), air (25%) and organic matter (5%). See Fig. 1 below.

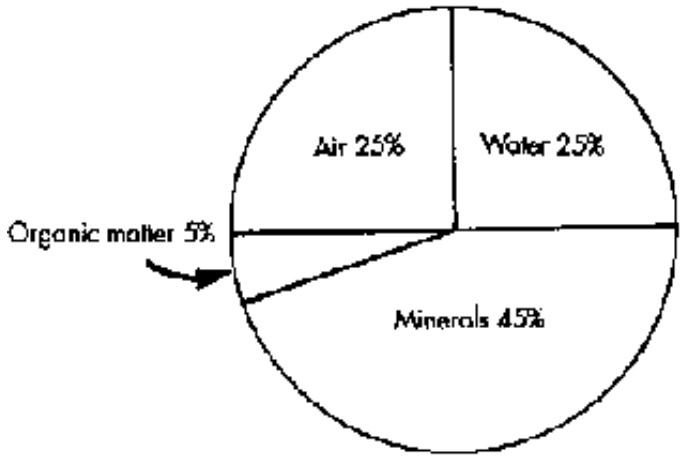

Fig. 1: Composition of typical soil

Soil acts as a store for plant nutrients. Plants use their roots to absorb nutrients as well as water from the soil.

Soil has two major parts:

(i) Living things, which consist of bacteria, plant roots, insects, etc., and

(ii) Non-living things, which include gravel, sand, remains of plants, animals and insects, as well as humus, among others.

2. Uses of soil

The following are the important uses of soil.

(a) It provides plants with a root penetration surface, enabling them to stand firm.
(b) It stores water which is used by animals and plants and other organisms in the soil.
(c) It stores air for use by both plants and other organisms in the soil.
(d) It is a store for different types of minerals and plant nutrients used by plants.

3. Origin of soil

Through the process of weathering, rocks split and get crushed, giving rise to soil. This process, which is still in progress, is necessitated by the following factors.

(a) Variations in temperature

During the day when there is a lot of heat, the rocks expand. At night, it becomes very cold and the rocks rapidly contract. This expansion and rapid contraction of rocks gives rise to the formation of cracks in the rocks. This results in the rocks disintegrating into small particles.

(b) Effects of wind

In most cases, some of the rock particles are blown by the wind. This causes them to rub against each other, thus forming soil particles.

(c) Impact of rain drops

The impact of rain drops causes rocks to gradually wear out and fall off as small particles.

(d) Passage of water

As the water flows, it pushes and carries with it small particles of rock. These collide, giving rise to finer soil particles.

(e) Plant roots

As the plant roots grow, they penetrate the cracks in the rocks, thus creating further cracks in the rocks.

(f) Effects of animals

Animals by their movements, cause rocks to collide against each other. So do

activities of people. These result in the pieces of rock breaking into finer pellets, eventually becoming soil.

When the pieces of rock described in (a) to (f) mix with air, water, humus and microorganisms, they altogether form soil.

4. Types of soil

The type of soil depends on the type of the originating rock. There are several types of soil. However, they are, generally, classified into three major types depending on the sizes of their particles.

(a) Sandy soil

This type of soil consists of large independent particles. Therefore, it does not retain water. This type of soil is common in the tropical regions. The main features of this type of soil are as follows:

(i) The particles, being large in size are easily seen by the naked eye.

(ii) It loses fertility very fast. Therefore, in order for the soil to continue being useful, the farmer has to frequently apply fertilizers such as compost manure or cow dung.

(iii) It can not retain much water.

(iv) It has many air spaces.

The crops that may grow on this type of soil are mainly tubers, such as yams, sweet potatoes, coconuts, cassava and groundnuts. Millet, pineapples and cashewnuts may also do well.

(b) Loam soil

This is a common type of soil in most parts of Eastern Africa. It is a mixture of azonal soil and silt. The ratio of the mixture differs from one region to another. Due to this, it may be more of sandy soil in one area but more of clay in another.

Other characteristics of this type of soil are as follows:

(i) Its particles are not easily seen by the naked eye.

(ii) It has adequate fertility.

(iii) It has an average number of air spaces.

(iv) It is easy to stir up and dig.

(v) It has capacity to retain adequate humidity that is necessary for plant growth.

This type of soil is suitable for growing a variety of crops such as fruits, vegetables, maize, wheat, bananas, coffee, tea and legumes in general.

(c) Clay soil

The main characteristics of this type of soil are as follows:

(i) It has very tiny soil particles which are not discernible to the naked eye. These particles may only be seen through the use of a microscope and are very difficult to separate.

(ii) It is very fertile.

(iii) It does not easily let in air and water because it expands when in contact with water, and the air spaces are very tiny. It also retains water for a long time.

(iv) When watered, it becomes sticky and digging is difficult.

(v) During the rainy season, water settles on the surface for a long time, especially in flat areas.

(vi) When water dries up, or during the dry season, the soil becomes too loose to dig and has many cracks.

(vii) In a forested area, this soil contains more humus than the one found in homesteads.

The crops best suited for this type of soil are sugar-cane, finger millet and rice.

It is important for every farmer to know the type of soil being cultivated as each type of soil has unique characteristics. This calls for different approaches in preparing the soil for different crops. Fertilizer requirements also differ from soil to soil.

5. Conservation of soil

Conservation of soil is important. Neglect of the soil may result in its degeneration and may eventually lead to desertification. One way of identifying poor soil conservation is the emergence of soil erosion, which is occasioned by:

(a) wind,
(b) running water,
(c) strong waves and
(d) snow.

This means that erosion is caused by topography, the weather, the absence of land-covering vegetation, characteristics of the soil and earth agitations such as tremors.

Soil erosion causes loss of organic matter and plant nutrients.

There are two ways of conserving the soil:

(a) Replenishing the soil with amounts of fertilizer that exceed those that are extracted by plants from the soil, and especially by an adequate application of natural fertilizers.

(b) Prevention of soil erosion. This helps to keep the soil together so that it is not carried away by either water or wind. Some methods of preventing soil erosion are as follows:

(i) Letting plant left-overs and non-harmful weeds decompose on the

farms.

(ii) Preventing the development of water channels on the farms and sealing the existing ones.

(iii) Conserving river banks.

(iv) Irrigating the farms in an orderly way.

(v) Planting creeping plants.

(vi) Planting trees in areas where there is a high likelihood of soil erosion occurring.

(vii) Avoiding overstocking as hooves of livestock loosen the soil, making way for easy erosion of soil.

(viii) Avoiding careless burning of vegetation on the farm.

(ix) Practising contour ploughing and making terraces, especially in areas where soil erosion is more likely to occur.

(x) Practising sensible crop rotation.

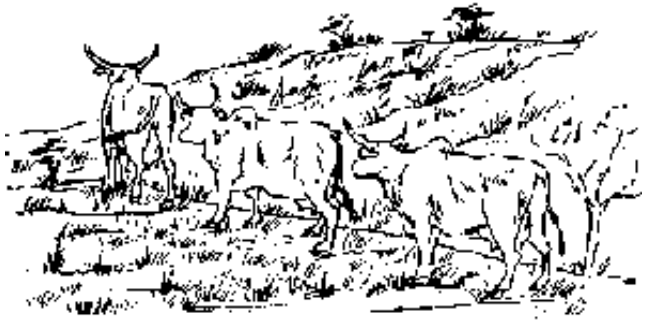

Fig. 2: *Keeping fewer cattle is one way of preventing soil erosion*

6. Making the soil fertile

Barren soil is of no use to the farmer. However, soil fertility depends on the effort and ingenuity of the farmer. There are several ways in which the soil can be made fertile. These include periodic cultivation so as to allow some rest to the soil, mixed farming, and application of fertilizers. In the following chapter, a few tips on the use of fertilizers are offered.

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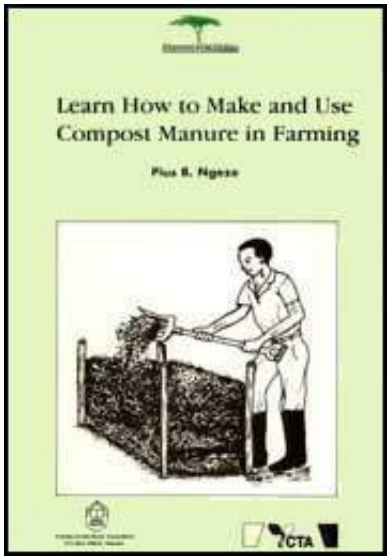

Chapter Two Fertilizers

1. Definition of fertilizers

In the previous chapter, it was stated that one way of making the soil fertile is through the application of fertilizers. Fertilizers improve the quantity and quality of the produce. To grow well, plants require several elements which are divided into two major groups. The first group consists of nine elements that are required by the plants in large quantities. These are carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, magnesium, calcium and sulphur. The second group consists of eight elements which are required by plants in small quantities. These are iron, boron, molybdenum, copper, zinc, chlorine and cobalt. Some of these elements may be available in air but many of them are found in fertilizers. Those found in air are carbon, hydrogen, oxygen and nitrogen. The remaining elements are available in fertilizers. Every element has a unique role in the growth of the plant.

2. Types of fertilizers

Fertilizers are classified into two major groups - artificial fertilizers and natural fertilizers.

(a) Artificial fertilizers

These originate from either natural minerals that are dug from the soil or from minerals which are industrially manufactured. They are grouped into four categories:

(i) Nitrogen fertilizers.

(ii) Phosphorus fertilizers.

(iii) Potassium fertilizers.

(iv) Mixed fertilizers - packaged after being blended in a special ratio of nitrogen to phosphorus to potassium.

Fig.3: Bags of artificial fertilizers

(b) Natural fertilizers

These are made from animal and plant sources. They are passed out as left-overs in the form of either dung or urine. The fertilizers in this category include:

(i) droppings from poultry, birds and the smaller animals;
(ii) ashes;
(iii) left-overs from carcases;
(iv) fertilizers from green plants;
(v) cow dung; and
(vi) compost manure.

3. Differences between artificial and natural fertilizers

Characteristic	Artificial fertilizers	Natural fertilizers
(a) Ease in making.	Difficult for farmers to make. They are made in specialized industries or extracted from the earth.	Easy to be make. Every farmer can make them.
(b) Cost of purchasing.	Very high.	Low and in most cases there are no costs.
(c) Ease in its being used by plants.	Used slowly and take a long time to be used and exhausted in one season.	Easily found and quickly exhausted in the soil.
(d) Quantity of element per unit of weight.	High.	Low. For this reason, one needs large amounts of fertilizer in order to get the quantities of elements required.

(e) Danger to the soil.	Very high if the farmers do not heed advice from agricultural experts.	None.
(0 Danger to plant life.	High if the farmer does not heed advice from agricultural experts.	None.
(g) Difficulty in storage.	Need great care since they easily become damp and get ruined.	Do not require as great care as artificial fertilizers. However, there is a need to protect them away from sunshine and rain.
(h) Potential for changing soil characteristics.	Fertilizers containing calcium reduce soil acidity. However, those with ammonium sulphate raise soil acidity. The other types of fertilizers neither raise nor reduce soil acidity and alkalinity.	None.

Natural fertilizers enable the soil to nourish the crops by:

i) Enhancing soil structure, for example, by changing clay soil into loam soil.

ii) Reducing soil erosion by uniting loose particles, including those of the sandy soil.

iii) Regulating soil temperature for plant growth.

iv) Enabling the soil to retain the amount of water required by plants.

v) Increasing humus in the soil and this, in turn, gives soil a dark colour.

vi) Ensuring life and prosperity for soil organisms which are very important to the farmer.

4. Relationship between quality of soil and yield

Soil may be likened to a dairy cow. If the owner does not feed the cow, the quantity of the milk produced on the first day will be less. If this goes on for a long time, eventually the cow will not produce any milk. The cow will progressively weaken, ail and finally die of either hunger or disease.

Likewise, if the soil is not fertilized for several seasons, the quantity and quality of the yield will progressively decrease until there is no more produce. This happens due to various reasons:

(a) The soil is lacking in many of the elements necessary for the growth of plants.

(b) The soil structure is impaired for lack of humus and loss of the ability to retain water and adequate temperature.

(c) Many of the micro-organisms in the soil that are useful to the farmer have died due to lack of nourishment from natural fertilizers.

5. Relationship between artificial and natural fertilizers

Research has established that artificial fertilizers are faster than natural fertilizers

in bringing about results, and in giving higher and better yields. However, the crop is even better when the two types of fertilizers are used jointly rather than singly. All the same, artificial fertilizers are too expensive to be affordable to the majority of farmers. Besides, the country cannot provide adequate quantities of artificial fertilizers for lack of sufficient foreign currency. Therefore, what every farmer can afford are natural fertilizers and some of these, which include compost manure, can be made by the individual. In the following chapters, suggestions are made on how to make and use compost manure.

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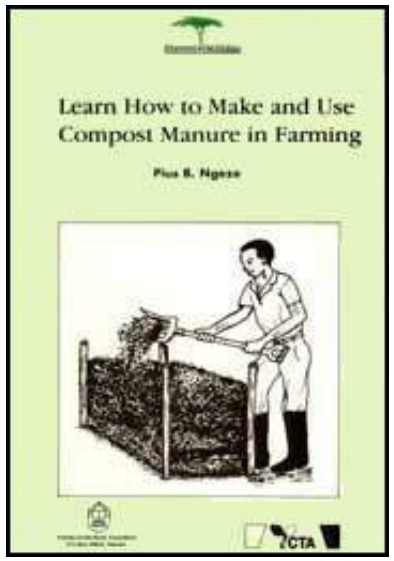

Chapter Three Using Animal and Plant Sources to Make Compost Manure

Artificial fertilizers are either manufactured in industries or dug from the earth. They are costly to produce and have negative effects on the soil if not used properly. On the other hand, natural fertilizers are easy to make. They may be made by the farmers themselves and do not have negative effects on the soil but improve it. A common type of natural fertilizers is compost manure.

1. The making of humus in forests

This book explains the importance of compost manure, how it is made and its uses. In doing so, we are interested in getting humus and other plant nutrients in plant and animal left-overs so as to use them in growing other crops. Most farmers are familiar with humus; they frequently see it amidst constant growing plants, such as coffee and bananas on their farms, and in forests. The soil in the forests gets a supply of humus at all times from leaves and branches of trees, or even the trees themselves, when they fall onto the ground and rot. In addition, animals, birds and insects die and decompose in the forests. This decomposition is hastened by the action of microorganisms, earthworms, nematodes, birds and insects. Through this process, the plant nutrients in these dead parts are recycled back to soil.

Decomposition of plant and animal left-overs in the forests takes a long time.

Although there is no urgency for this process to take place as far as forests are concerned, farmers need a shortened period of decomposition that fits in with the planting seasons. Preparation of compost manure is one way of accomplishing this.

2. Compost manure

Compost manure is that fertilizer retrieved by farmers from plant and animal leftovers that have been decomposed by the existing micro-organisms. The compost heap is a collection of many plant and animal left-overs that are concentrated in a small area, enabling them to decompose very fast. Structurally, the heap is composed of layers of rotting parts, dung and soil.

Fig. 4: ***The making of humus in the forest***

3. Reasons for preparation of compost manure

The rationale for making compost manure stems from a realization that as plants grow, they absorb from the soil nutrients which enable their growth. Therefore, a conclusion can be drawn that barren soil cannot sustain plant growth. A careful analysis of a plant shows that every part of the plant - roots, the stem, leaves flowers, fruits and seeds has one or more nutrients. This shows that if a farmer only uses the crop harvest and does away with the other parts of the plant, there

will have been loss of nutrients that could have been recycled into the soil for the growth of other crops.

4. Purpose of making compost manure

Plants may be classified into two major groups.

(i) Non-produce plants which include weeds. Some of these plants are eaten by animals.

(ii) Produce plants which grow and are harvested eventually. A large proportion of these plants is used by the human population while the remaining part is fed to livestock. In most cases, remains, as well as harvests, of plant crops are eaten by livestock and as a result the animals get the nutrients contained therein, enabling them to grow.

Faeces and urine from animals also contain nutrients. If these are casually discarded, the nutrients are wasted instead of being used for the growth of plants and crops which would, in turn, have been used by humans and livestock. Therefore, the purpose of making compost manure is to recycle the nutrients in the plant and animal left-overs back to the soil and to also create humus. The farmer does this by facilitating the decomposition of the left-overs.

5. Requirements for optimum decomposition of compost heaps

Micro-organisms are responsible for the decomposition of plant and animal remains. The more the number of micro-organisms the better the quality and rate of decomposition.

Micro-organisms are living creatures. Therefore, to remain alive and multiply they need an appropriate environment. Such an environment is one where there is adequate humidity, food, air and warmth. Organic material to be decomposed also needs to be properly arranged and mixed to facilitate the work of micro-organisms, as better decomposition results in better quality of compost manure. If these conditions are not fulfilled well, the resulting compost manure will be of poor quality. Ultimately, however, a low-quality compost manure is better than none as it might be the initial step towards achieving a high-quality one.

Good quality compost manure is one with as many nutrients as possible, especially nitrogen. This is a vital element for plant growth and yet a very difficult one to conserve as it evaporates into the atmosphere. Therefore, good preparation of compost manure is that which ensures that nitrogen is not lost from the pile.

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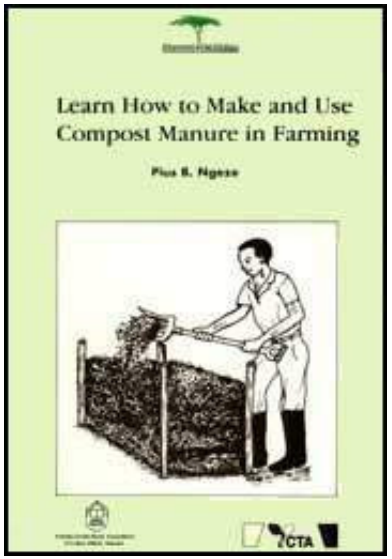

Chapter Four Basic Requirements for Preparing Compost Manure

As explained in Chapter Three, compost manure results from the breaking down of the refuse by a large number of micro-organisms in the soil in an environment that has adequate moisture, warmth, and oxygen, where the ratio between the carbon and nitrogen in the left-overs is 35 to 1. In these conditions, micro-organisms use the atmospheric oxygen and food from the left-overs and give out carbon dioxide, moisture and energy. This means that for the farmer to make the best compost manure, it is necessary to ensure that the agents of decomposition are given the right surroundings. In the remaining part of this chapter, we will discuss the important requirements that the maker of compost manure should understand and follow.

1. Refuse

Refuse or decomposing matter is the source of food for micro-organisms. It is

refuse that has to decompose for the farmer to get compost manure. In setting out what ought to be done, there are several factors that need to be considered.

(a) Availability of nitrogen

Without adequate nitrogen in the refuse heap, micro-organisms cannot effect the decomposition process. It is, therefore, necessary to ensure that there is a good ratio of carbon to nitrogen in the stack of refuse, the initial ratio required being 35 to 1. If the ratio exceeds this, the process of oxidation will be lengthy before enough carbon is released. If it is less, the essential nutrient-nitrogen will escape into the atmosphere as ammonia gas. It should be understood clearly why this ratio between carbon and nitrogen is essential in the making of compost manure. Every fertilizer that results from the decomposition of plant left-overs consists of carbon and nitrogen. However, as plants grow and harden, it becomes more difficult for micro-organisms to cause decomposition. In such plants there is a lot of carbon but only a little nitrogen, which is not easily available to micro-organisms. This means that the refuse resulting from such plants will not decompose at a good rate. Hence, if the heap to be decomposed lacks nitrogen, its decomposition will be slow or the process will not be complete. In such cases, there is need for the introduction of other sources of nitrogen, an event that will enable the micro-organisms to breakdown the carbon in the refuse heap into small particles. There are three such sources, two of which can be easily found:

(i) Manure from livestock

An example of this manure is fresh droppings from goats, sheep, pigs, horses and poultry. This waste matter contains nitrogen.

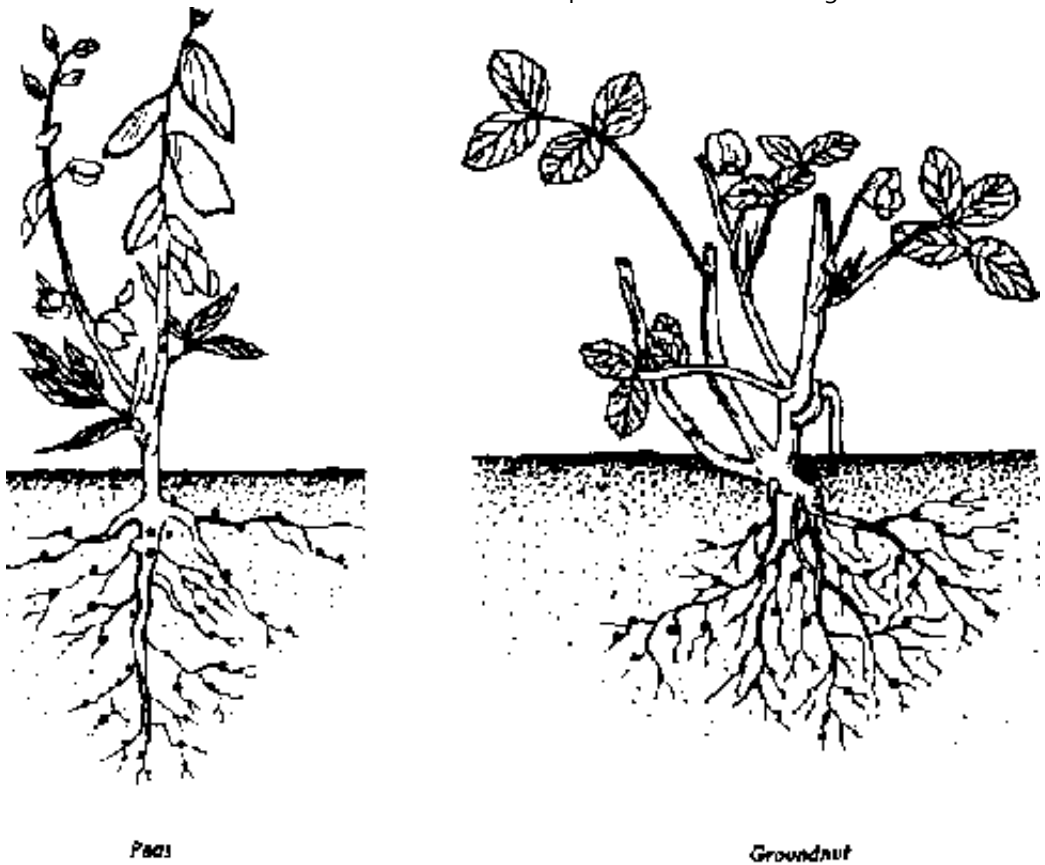

Fig. 5: Some* common *sources of nitrogen (legumes)

(ii) Legumes

Examples of legumes are beans, pigeon peas and soya beans. These plants have nitrogen in the nodules on their roots as well as in their leaves.

(iii) Artificial fertilizers

Farmers may also use artificial fertilizers such as ammonium sulphate. Its usage will not be emphasized in this book but this is an easy source of nitrogen for

farmers who are able to acquire it.

(b) Capability of refuse to decompose

Everything in the refuse heap should be able to decompose. Naturally, any refuse will eventually decompose.

The following is a list of things capable of decomposing if they are in a heap:

(i) Left-overs of crops after harvesting, for example stems, branches and leaves from legumes, bananas, grains, raw coffee-berry skins, etc.

(ii) Saw dust.

(iii) Mixture of livestock dung, urine and hay in animal sheds.

(iv) Livestock dung.

(v) Vegetable remains after harvesting as well as chippings from plants. However, big remnants of cabbages or other vegetables should be chopped into small pieces or crushed before being heaped. This will hasten its decomposition. Where the roots are intended to decompose, soil must be removed as it slackens the decomposition process.

(vi) Ashes from the kitchen.

(vii) Trimmings from tree hedges.

(viii) Weeds, especially from gardens. These are important as they contain

microelements. However, roots and stems of destructive weeds such as strangler weeds should be cut into small pieces or crushed before being placed into the heap in order to ensure that they will regrow.

(ix) Household rubbish, especially from the kitchen, for example, outer coats of bananas, cassava, Irish potatoes, sweet potatoes, yams, etc.

(x) Food remnants.

(xi) Cut grass. The grass should not exceed 10% of the heap content. Although such grass is very useful, an excessive amount slows down the decomposition process. Even the allowable percentage must be thoroughly mixed with the rest of the refuse because grass by itself forms a slipping layer, thus slowing down decomposition.

(c) Preparation of refuse

Small refuse bits are decomposed by micro-organisms faster than big ones. Therefore, before forming the heap, all rubbish should be cut into smaller bits. It is also good to note that some items, such as bits of wood, stones, pieces of metal, glass, plastic parts of cups or plates, etc. will not decompose. Therefore, they must not be placed in the heap.

(d) Mixing the refuse

For one to get high quality compost manure, the refuse should be thoroughly mixed. There are two reasons for mixing the refuse.

(i) To provide the micro-organisms with whole meal (this type of mixture consists of one lot of refuse that contains very little nitrogen and another that has plenty of nitrogen, as well as refuse with adequate humidity and one that is dry).

(ii) It raises aeration channels (a thick heap of a single type of refuse like grass, leaves, saw dust, will in the end form a layer that is not penetrated by water, thus hindering the decomposition of the heap).

2. Agents of decomposition

The decomposition of a refuse heap is facilitated by micro-organisms i.e., bacteria and fungi. The others that help in the making of compost manure include:

(a) yeast
(b) actinomycetes
(c) protozoa
(d) snails
(e) earthworms
(f) algae
(g) beetles
(h) ants
(i) termites
(j) millipedes
(k) centipedes
(l) spiders

The creatures that participate in the making of compost manure can be classified into two groups.

(i) Those that are not visible to the naked eye except by use of a microscope. They are collectively called micro-organisms.

(ii) Those which are visible to the naked eye, for example earthworms.

Micro-organisms are responsible for the decomposition of the refuse.

After the micro-organisms have completed the process and the soil has begun to get settled, earthworms (and other similar creatures) set on their role. These creatures set up the refuse in the heap, thereby breaking it down into smaller bits. On the other hand, droppings from the worms help in nourishing bacteria in the heap and these play the actual role of decomposing the refuse.

For the worms to be able to live and reproduce, the heap should not be too high. A very high heap has high temperatures that may not augur well for the survival of the worms. The recommended height for the heap is 1.5 metres.

3. Temperature

The optimum temperature must prevail in the refuse heap if the micro-organisms are to effect the decomposition process. This temperature arises from the process of decomposition. The heap undergoes four stages:

(i) Tepidity

(ii) Rise of temperature to the highest level possible

(iii) Cooling down

(iv) Maturation of compost manure.

During the lukewarm stage (tepidity), compounds such as sugar, starch and fat are broken down. During peak temperature (60°C), weed seeds and the viruses in the refuse heap die. (The level of temperature in the heap is brought about by microorganisms.) As the heap cools down, hemicellulose and other similar compounds are decomposed especially by fungi.

By the time the compost manure is in the maturation stage, some of the compounds begin to destroy each other, giving way to the action of antibodies and, as already explained above, larger creatures of the earthworm type start their work. (The question of maturation will be explained in detail later.) However, the problem is often how to acquire optimum temperature in the heap, especially in small heaps that do not exceed one ton. In such cases, most of the heat escapes into the atmosphere. As a result, some parts in the middle of the heaps do not decompose. This means that the farmer has little chance of getting quality compost manure from smaller heaps. Therefore, farmers are advised to always aim at heaps that can generate temperatures of at least 60°C.

4. Air

The heap rots through the process of aerobic decomposition. An adequate amount of air is needed in various parts of the heap in order for the micro-organisms to

get the oxygen required for breathing.

Air also helps in the expulsion of carbon dioxide from the heap. If air either lacks or is inadequate in the heap, anaerobic decomposition takes place. This occurs when:

(a) the heap has not been made properly;
(b) the heap has too much water;
(c) the heap gets inadequate oxygen.

Under these circumstances, certain micro-organisms affect decomposition with the following results.

(i) A distinctive, unpleasant odour at the site of the decomposing heap.

(ii) The manure takes longer than normal to get ready.

(iii) There is inadequate warmth in the heap. As a result, some weed seeds, certain viruses and refuse containing various diseases do not get destroyed and, therefore, the fertilizer will be of low quality. For this reason, it is important for the farmer to ensure that there is aerobic decomposition in order to get high quality compost manure.

Therefore, an adequate supply of air in the heap is of utmost importance in order for the micro-organisms to perform their functions well. On the other hand, too much air results in a quick loss of moisture amid heat in the heap. Therefore, there is need for moderate levels of air, neither too much nor too little.

There is also the need for the availability of adequate pores in the heap. Under normal circumstances, air will pass underneath the heap. However, it would be good to facilitate this entry. One way of doing this is to lay at the bottom, branches cut from trees, dry grass or dry leaves. The second method is by leveling up the soil at the place where the heap is to be constructed. In summary, the following techniques will enable the farmer to have adequate air in the heap:

- **Laying dry grass leaves and/or branches of dry trees as the first layer at the base of the heap.**

- **Laying sticks in the middle of the heap at the time of construction and removing them when the work is complete. The passages left by the removed sticks will facilitate aeration in the heap.**

- **Having the proper heap size. If the heap is too small, it will not have adequate air. On the other hand, if the heap is too big, the micro-organisms will not function as effectively as required. This will result in very slow decomposition or none at all. The plant stems, branches, roots and even leaves to be used for the refuse heap should be 1 to 5 centimetres long.**

5. Moisture

It is vital for moisture to be present in the heap for the sake of the living organisms existing there. The emphasis here is on moderate moisture. Too much of it will block air passages, resulting in the accumulation of bad smell from the heap. On the other hand, too little moisture renders the micro-organisms inactive. This is why it is imperative to cover heaps of compost manure in areas where

there is plenty of rain, letting through only the required amount. Noteworthy also is the fact that rain water is very important in the preparation of compost manure as it contains some nutrients, such as sulphur.

The required amount of moisture in a heap is 50 to 60 per cent and efforts should be intensified to ensure an adequate amount at all times. The methods of doing so are as follows.

(a) Shielding the heap from wind by planting trees near the site of preparation of compost manure.

(b) Sprinkling the heap with a moderate amount of water frequently, especially during the construction of the heap, and proper mixing of the compost and water.

(c) In drought conditions or during the hot weather, the preparation of compost manure in pits (channels) is more convenient.

(d) Covering the heap with internal as well as external 'covers' as explained below.

6. Covers of the compost manure heap

The heap needs covers as a protection against spoilage of the manure. Too much rain on the heap causes loss of heat, over-saturation, closure of air passages and exhaustion of the plant nutrients. This results in low-quality manure that is not very useful on the farm. For this reason, the use of two types of covers is recommended.

(a) The inner cover

This is a bag that is placed directly on top of the heap and should have the following qualities.

(i) Enabling free flow of air in and out of the heap.

(ii) Resisting decomposition.

(iii) Should be made of hard and durable materials.

The reasons for using this type of cover are:

- **It helps in preserving heat in the heap.**
- **It regulates the flow of air in the heap.**
- **It enables a certain amount of vapour coming from the heap to condense into water.**

The above mentioned cover can be made from worm-out floor mats, gunny sacks, banana leaves or dry grass that has been stacked together in an orderly manner. This cover helps to prevent flies from settling directly on the heap. Hence, flies will not breed on the heap and be a nuisance to the farmer, neighbours or passers-by.

(b) The outer cover

This cover is constructed on top of the heap. It is usually in form of a raised platform, shed or anything similar that serves the purpose. The cover may be thatched with grass, covered in iron sheets, leaves or anything that is easily available to the farmer. It should be built in such a way that it will allow easy access to the heap. A slanted cover rather than a flat one, will enable rain water to flow to one side instead of stagnating on the roof.

7. The pH of the heap

This is a measure of the alkaline or acidic content of a substance. At the initial stages of decomposition, the refuse has some acid. However, after a few days, the acid decreases as the heap begins to get a moderate amount of alkali. The pH in the heap is important because too much alkali in the heap results in the loss of nitrogen which evaporates through the loss of ammonia gas. For this reason, it is not advisable to add lime to the heap.

On the other hand, if the refuse contains a high acid content, it may prevent the heap from having the required amount of luke-warmness, eventually preventing accumulation of heat in the heap thus hindering its decomposition. This is because some micro-organisms in the heap are killed by the presence of too much acid. While it is normal for some amounts of ammonia to be lost to the atmosphere, the loss can be greatly reduced if some soil is added into the heap. The amount of soil added should not exceed one percent of the total weight of the heap. The resultant compost fertilizer may be acidic or alkaline, depending on the type of refuse in the compost heap, its mixture, the amount of air available, moisture levels and the presence of lime. If the farmer raises the pH level of ash or lime in the heap, the

level rises and expels the acid in the resultant compost manure.

8. Shuffling the compost manure heap

It is important to turn and thoroughly mix the heap in order to get high-quality compost manure. A week after the construction of the heap, the central part of the heap would have acquired the proper temperature levels, about 60°C. However, at the base of the heap, on the sides and towards the top parts, the temperatures would be low, resulting in the survival of seeds, weeds and viruses that cause certain diseases. For these to be destroyed, the farmer has to shuffle the heap so that the refuse at the bottom, on the sides and at the top of the heap also get to the centre of the heap for uniform decomposition at the required temperature rate. For this to take effect, it is necessary to observe the proper timing of shuffle intervals.

Usually, after the second shuffle, the decomposition would have fully taken place. Twenty-eight to forty-two days following the construction of the heap and its second shuffle, cooling takes place, and at this point the micro-organisms have accomplished their work and the weight of the heap has decreased by about half. Then follows the maturation of the compost manure, a stage that is reached during this final process in which particles of decomposed refuse slowly turn into humus, which we refer to as compost manure. This manure is now ready for application on the farms but must remain covered for protection against sun rays and too much rain when not in use. On the other hand, refuse that did not properly decompose is reused in the next decomposing heap. This is the one referred to as compost manure.

Before the fertilizer can be applied to the farm, the heap should be continually covered to protect it from the sun's rays and too much rain. Those bits that did not fully decompose may be decomposed in another heap.

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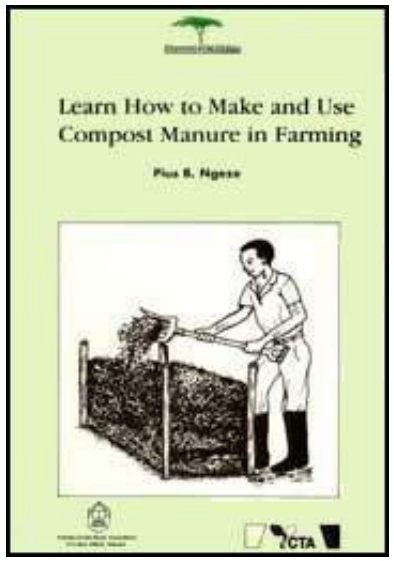

Chapter Five Structure of the Compost Heap and Major Methods of Preparing Manure

A. Structure of compost manure

The construction of a compost heap is similar to that of any other structure. A complete heap comprises layers of various materials and each layer has special functions in the heap. Basically, a complete heap of compost manure consists of the following parts:

1. Layer '0': grass/dry leaves

This layer has several functions.

(a) It helps in aeration of the heap.

(b) It prevents too much water from soaking the refuse as excess water easily trickles downwards.

(c) It absorbs exhausted nutrients from the upper layers of the decomposing heap. This layer should be 10 to 15 centimetres thick.

2. Layer 1: Refuse

This is the layer that is being made to decompose and it absorbs plant nutrients from the overlying layers, preserving them instead of letting them get exhausted in the soil. Usually, the width of this layer is 15 centimetres.

3. Layer 2: Dung

This layer consists of dung or any other type of livestock fertilizer. The function of this layer is to produce nitrogen in the heap so as to enable the micro-organisms function well in the decomposing of the refuse. This layer also adds phosphate and other plant nutrients to the heap. It also fixes bacteria and fungus in the heap. This layer should be 2 centimetres wide. If the farmer does not have livestock dung, he may use other sources of nitrogen, such as legumes, left-overs or artificial fertilizer such as sulphates of ammonia.

4. Layer 3: Ashes

Ashes contain calcium and potassium, which are required by the plant and help in the decomposition process by regulating the pH in the heap. This layer is two centimetres wide.

5. Layer 4: Soil

This layer has the following roles:

(a) Prevents the ammonia produced in the lower layers from escaping into the atmosphere.

(b) Prevents loss of temperature and humidity from the heap.

(c) Increases plant nutrients in the heap.

This layer is two centimetres wide.

NOTE: Water is sprinkled on top of the soil layer. This is intended to increase the moisture in the lower layers, and especially the refuse layer, so that the microorganisms can function well in decomposing it.

6. Inner cover

This is the cover on the heap. As explained earlier, the cover has three roles:

(i) It helps preserve temperature and humidity in the heap.
(ii) Regulates air circulation therein.
(iii) Helps condense the water vapour in the heap, thus maintaining its moisture level.

7. Outer cover

The role of this cover is to prevent too much rain water which may cause:

- **exhaustion of plant nutrients in the heap.**
- **loss of humidity in the heap.**
- **saturation of the heap and**
- **blocking of air spaces in the heap.**

Without this cover, the result would be a poor quality fertilizer.

B. Main steps in the preparation of compost manure

Farmers intending to start the production of compost manure are usually confronted by two main barriers:

(a) Inadequate water.

(b) Lack of dung or other farmland manure since they do not keep livestock.

In an effort to deal with the above impediments, an explanation of how to make compost manure under these conditions is offered below.

There are several ways in which compost manure may be made. Any particular method to be adopted by the farmer will depend on several factors:

(a) The capability and ingenuity of the farmer in making compost manure.

(b) Climatic conditions.

(c) The amount of refuse he possesses.

(d) The type of rubbish available.

In this chapter, three major methods of preparing compost manure will be explained. These are:

(i) On the earth's surface.
(ii) In compost pits.
(iii) In special boxes.

C. Preparation of compost manure on the earth's surface

This method is used by farmers residing in regions that have adequate rains or where there are other sources of water. This availability of water removes one of the impediments in the making of compost manure. When using this method, it is important to achieve a heap that is 1.5 metres high, 3 metres wide and 3 metres long.

(a) Compost preparation in areas with adequate water and livestock dung

Requirements

(i) Grass/dry leaves.

(ii) Adequate refuse especially food remains, banana skins, cassava, yams, Irish potatoes, sweet potatoes, coffee, weeds, rice husks, millet, maize, bulrush millet, wheat, etc.

(iii) Dung and/or other types of manure from livestock.

(iv) Adequate water.

(v) Ashes.

(vi) Soil.

(vii) Inner cover, for example old sacks and mats.

(viii) Outer cover.

(ix) The following implements: matchet, sickle, fork and an irrigation can.

Preparation

(i) Avail yourself of dry grass and leaves.

(ii) Prepare and mix refuse as explained in Chapter Four, Sections 1 (c) and (d).

(iii) Demarcate the area for making compost manure. This area should be 3 metres long and 3 metres wide. However, these measurements can be slightly altered depending on the amount of refuse available. It is important to remember that smaller heaps do not produce quality manure since they do not decompose well. The same applies to larger heaps since the mixing of the component parts is more difficult without special machines. Therefore, if the farmer has a lot of refuse to decompose, it is advisable for him to have several heaps of average sizes instead of one large one.

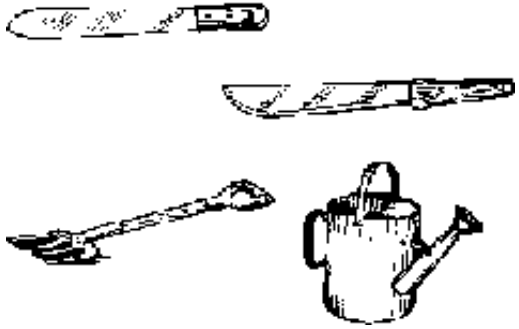

Fig. *6: Various implements used in me preparation of compost manure*

Caution

(i) Where possible, the site for manure preparation should be near the livestock shed in order to get the dung easily.

(ii) The site for manure preparation should be near a farm.

(iii) For hygienic reasons, the manure should not be prepared near an occupied house.

(iv) It is also advisable that the above requirements be met before the construction of the heap starts because the structure must be started and completed within a day.

(v) If possible, the site should be under a shade so as to prevent the fertilizer from drying due to direct sunshine. If no natural shade is available, you will need to prepare some shelter.

Steps to Follow

Step 1

Prepare three sites, the first one for the construction of the heap and the second and third ones for the shuffling of the component parts.

Label them Site 1, Site 2 and Site 3 (see Figure 7 below). Loosen the soil at Site 1, which is the place for building the heap. There are three main advantages of doing this.

(a) Excess water is removed from the heap.

(b) The worms found in the soil get to the heap.

(c) Aeration of the heap is regulated.

Fig. 7: Construction and shuffling sites of the heap

Step 2

Erect pegs at each comer of these sites. The height of the pegs should be 1.8 metres. The pegs help in guiding the farmer during the preparation and shuffling of the heaps so that he knows their demarcations. If the site is likely to be flabby, the foundation of the heap should be made of leaves or sticks as they help in regulating air circulation. However, if there is no such likelihood, then there is no reason for using the leaves or sticks.

Step 3

Start layer '0' with dry grass or leaves. It should be 10 to 15 centimetres thick.

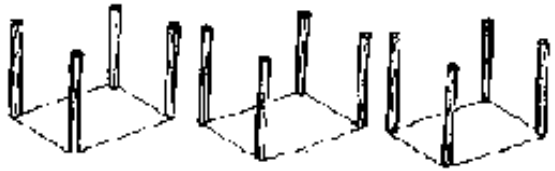

Fig. 8: Site for the construction and shuffling of the compost heap

Step 4

The first layer will consist of the refuse prepared and shuffled as explained in Chapter Four. It should be 15 centimetres thick.

Step 5

The second layer will consist of dung. It should be 2 centimetres thick.

Step 6

The third layer will consist of ashes. It should be 2 centimetres thick.

Step 7

The fourth layer will consist of soil. It should be 2 centimetres thick.

Step 8

Sprinkle water on the above layers. The amount should be only enough to

percolate to all layers; however, too much water will affect the proper decomposition of the heap.

Fig. 9: A farmer sprinkling water on a heap

Step 9

Repeat steps 4 to 8 (see Fig. 11 below). This repetition should be undertaken until the heap attains a height of 1.5 metres; higher than that will make the heap too heavy, resulting in three main problems.

(i) There will be too much heat which the micro-organisms will not withstand.

(ii) Air circulation will be impeded.

(iii) The shuffling of the heap will be difficult, especially in the absence of special equipment.

During the shuffling, erect a peg in the middle of the heap ensuring that it sinks in adequately.

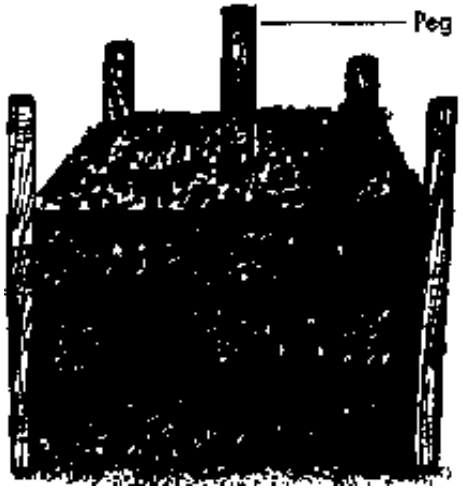

fig. 10: *Erect a peg in the middle of the heap*

Step 10

Remove the pegs from the stalk. At times one peg could be left intact to serve as a gauge of the temperature and the heap. The resultant hole(s) aid in the circulation of air in the heap.

Step 11

Cover the heap with the inner cover.

Step 12

Place or construct a roof (outer cover), a raised platform or shed above the heap and wait for maturation of the manure to take place before applying it to the farm.

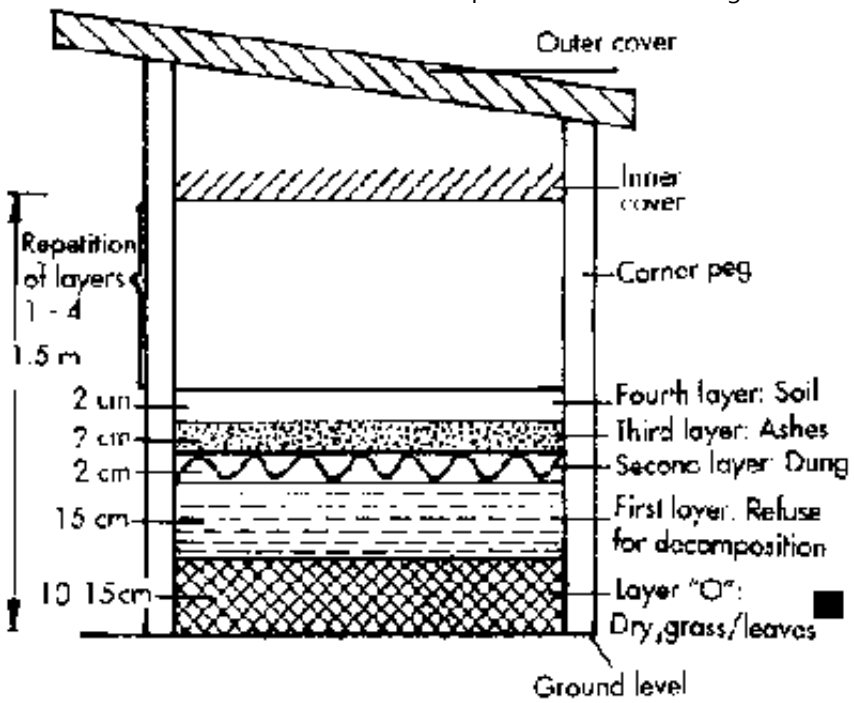

***Fig. 11: A complete heap of compost* manure**

Note

The farmer is advised to sprinkle water on the heap regularly. If there is rain, it is important to remove the inner and outer covers occasionally for the heaps to receive a moderate amount of rain. Care should be taken to avoid soaking the heap with water all the time.

Step 13

Shuffle the heap (see Chapter Four). The first shuffling should be done on Site 2 fourteen (14) days following the completion of the heap structure. The second shuffling should be done 14 days thereafter and should be done on Site 3. The 14-

day period may be extended depending on the rate of decomposition. During the shuffling, ensure that the layers that were at the top, the sides and the base of the heap are put in the middle to enable them decompose properly.

Fig. 12: A farmer thoroughly mixing and shuffling the heap

Shuffling has the following advantages:

(a) It enables every part of the heap to get enough air and moisture.

(b) Every part gets the micro-organisms required (as the shuffling distributes these micro-organisms throughout the heap). In this way, the decomposition process is accelerated.

(c) It enables uniform distribution of warmth in the heap, resulting in uniform decomposition of the heap.

(d) It reduces chances of the formation of layers that might otherwise be air- and water-tight to the point of blocking free penetration into the heap.

If the above steps are carefully followed, the compost manure should be ready for

use after 10 to 12 weeks since the completion of the heap structure. Incase the decomposition was satisfactory, the process of constructing the heap has to start again. The farmer will then correct all the mistakes that may have been made in the first instance. Competent farmers ensure that they always have one or more extra stalks under decomposition. The number applies also to the heaps undergoing maturation or those already mature and are awaiting application on the farm.

(b) Compost preparation in areas without livestock but with availability of water

Requirements

(i) Dry grass or leaves.

(ii) Enough refuse; for example food remnants, banana skins, cassava, Irish potatoes, sweet potatoes, yams, sugar-cane peelings, weeds, etc.

(iii) Domestic ashes.

(iv) Enough water.

(v) Dry grass that can easily decompose.

(vi) An inner cover.

(vii) An outer cover.

Preparation

(i) There should be enough dry leaves or grass.

(ii) Prepare and shuffle the refuse as explained in Chapter Four.

(iii) Prepare three sites whose measurements are as explained above; one on which to construct the heap and the rest for the purpose of shuffling. They should be labelled Sites 1, 2 and 3 as shown in Figure 8.

Step 1

Loosen the soil on Site 1.

Step 2

Erect pegs at the comers of Site 1. The pegs should be 1.8 metres high. Erect two or three other pegs at different places of Site 1. As already explained, if the site is likely to be flabby, start the construction with tree branches. If the site cannot be flabby, then there is no need to do so.

Step 3

At Site 1, place layer '0' that is composed of grass or leaves. The thickness should be 10 to 15 centimetres.

Step 4

Prepare the first layer. This layer consists of the refuse to be decomposed. The

thickness should be 30 centimetres.

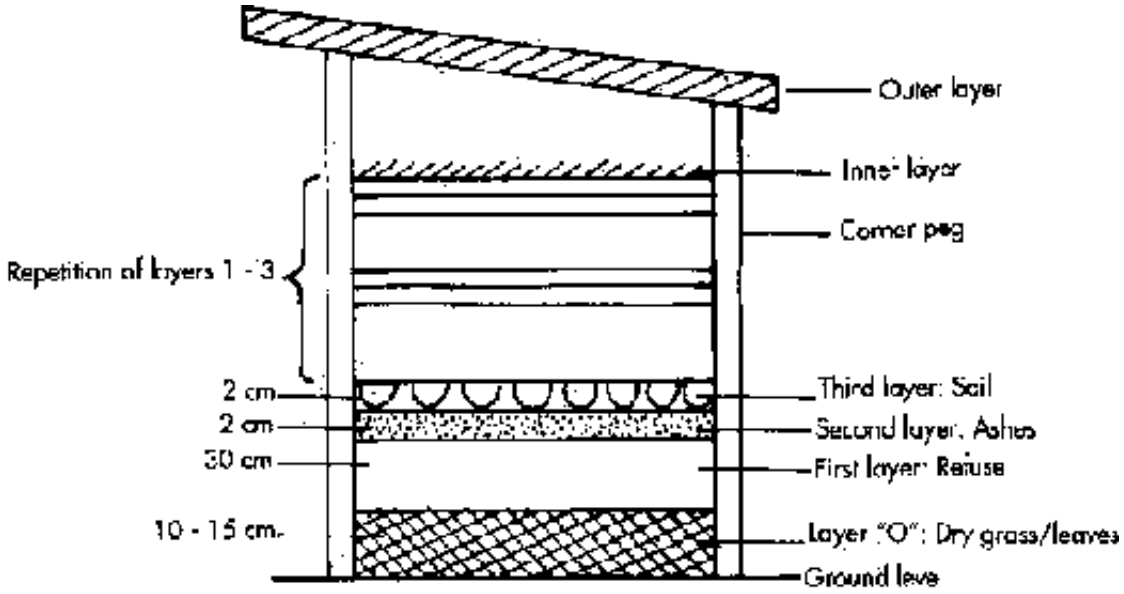

fig. *13: Heap of compost manure showing me various layers*

Step 5

The second layer consists of domestic ashes (or lime) and it should be 2 centimetres thick.

Step 6

The third layer consists of soil and is 2 centimetres thick.

Step 7

Sprinkle adequate water on the fourth layer so that all layers are adequately moist.

Step 8

Repeat steps 4 to 7 until the stack reaches a height of 1.5 metres.

Step 9

Remove the pegs that are in the middle of the heap.

Step 10

Place the inner cover over the heap.

Step 11

Place the outer cover over the heap.

Step 12

If decomposition progresses well, after a few days the height of the heap reduces by 15 to 30 centimetres and the shuffling should be done on Site 2 after 30 days. During this process, ensure that the refuse on top, at the sides and the base of the heap is put in the middle. This facilitates uniform decomposition.

Start preparing another stack at Site 1, which is now empty. After another 30 days, transfer the decomposing refuse from Site 2 to Site 3 and that one on Site 1 to Site 2. By the third month, the compost manure will be ready. The compost manure (which is now humus) should be removed from Site 3 and be either applied to the farm or stored for future use. The refuse in Site 2 may be shuffled

onto Site 3 and that on Site 1 onto Site 2. A new stack may be prepared on Site 1, which is now empty. Following this process, after the first four months, the farmer may have fresh compost manure on a monthly basis.

(c) Compost preparation without use of water in areas with plenty of fresh coffee foliage and cattle

Requirements

(i) Plenty of easily decomposing plants.

(ii) Ashes.

(iii) Leguminous plants and products.

(iv) Plant remains; for example, fruit peelings, barks of coffee trees, etc.

(v) Soil preparation: the farmer should ensure that there is an adequate supply of plants that hold a lot of water. One preparation method is that of growing these plants. The farmer should also have enough legumes.

Prepare three sites 1, 2, and 3 for the construction and shuffling of the compost heap. Each site should be 3 metres in length as well as in width.

However, these measurements may be reduced depending on the amount of available refuse and manure, as well as other needs. The steps to be followed are as follows:

Step 1

Cut the plants into 10-centimetre bits and split them where necessary. The split bits should be left for one week in the cattle sheds so that they may mix up with dung and urine. The same applies to legumes. The mixture should be removed from the cattle shed after one week.

Step 2

The construction of the heap should start on Site 1 by placing a layer of grass or leaves. This layer should be labelled '0' and should be 10 to 15 centimetres thick.

Step 3

Arrange the mixture explained in step 1. This first layer should be 40 centimetres thick.

Step 4

Arrange the second layer which consists of barks of fruits, coffee berries, etc. The width of this layer depends on the amount of bark available.

Step 5

Arrange the third layer which consists of ash. It should be 2 centimetres thick.

Step 6

Arrange the fourth layer which consists of soil. Its should be 2 centimetres thick.

Step 7

Press the layers down sufficiently by trampling upon them.

Step 8

Repeat steps 3 to 7 until the stack is 1.5 metres high.

Step 9

Place the inner cover on top of the heap.

Step 10

Construct the outer cover.

Step 11

Use Site 2 to shuffle the heap after 14 days. After 21 more days, relocate the refuse heap on Site 2 onto Site 3.

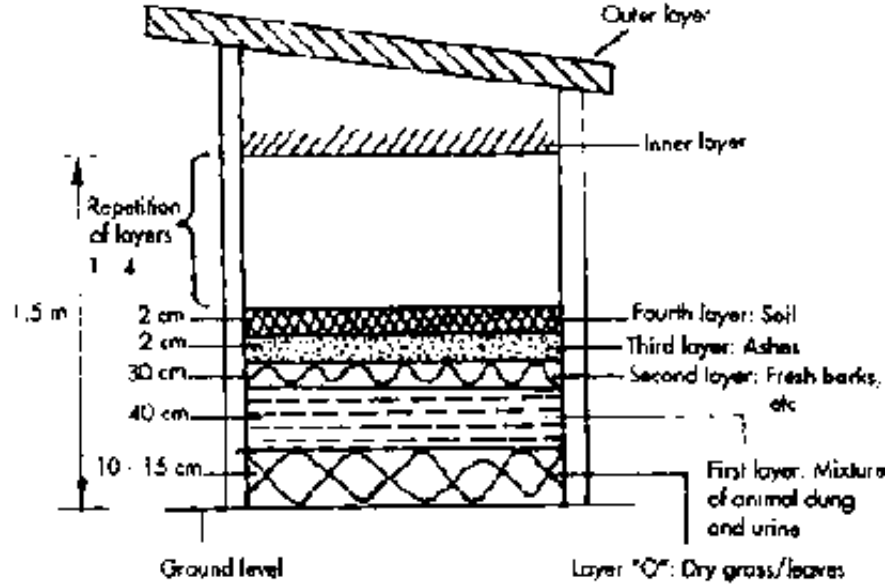

Fig. 14: Structure of the compost heap

As explained earlier, this process is continued on rotational basis. After 21 more days (which is the maturation stage) the compost manure will be ready for application on the farm.

D. Preparation of compost manure in pits

The second main method of making compost manure is through the use of compost pits. However, this is applicable only where there is lack of water or rain. Generally, the three ways of making compost manure which were explained earlier are used where there is plenty of water or rain; they are also applicable in the making of compost manure in pits. This means that the explanation offered above in respect to making compost manure is applicable to preparing it in pits. Therefore, repetition is not necessary here, except to emphasise that the site for making the pit should have the following requirements:

(a) It should be flat.

(b) The water table should be low - there should be no possibility of availability of underground water.

(c) There should be no possibility of water getting into the pits.

(d) To limit the problem of inadequate air the pit should not exceed a depth of one metre.

(e) The edges of the pit should have a slope so as to facilitate good service to the pit, especially that one of shuffling the contents. The pits are numbered 1, 2, and 3 similar to the sites explained earlier. After filling the pits, cover them with the inner and outer covers.

E. Preparation of compost manure in boxes

The third major method of making compost manure is through the use of boxes. This is done by farmers who need small quantities of manure or those with small quantities of refuse but who have the ability to buy or make the boxes.

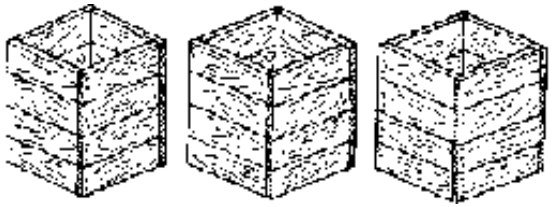

Fig. 15: Three boxes used for the preparation of compost manure

The boxes are open on both ends, the top and the bottom. Each box measures one

square metre and may be made from bricks, timber, iron sheets, etc. as long as they are able to preserve heat, facilitate circulation of air and retain adequate moisture. Three boxes are required for a good shuffling of the manure.

Requirements

(a) Adequate rubbish.
(b) Three boxes open both at the top and bottom.
(c) Livestock manure, especially cowdung.
(d) Domestic ash.
(e) Enough water.

Preparation

(a) Prepare and shuffle the rubbish to be decomposed as explained in Chapter Four.
(b) Prepare the boxes.
(c) Prepare livestock manure, domestic ashes and enough water.

Steps to Follow

Step 1

Loosen the soil at the site where the compost manure will be prepared.

Step 2

If necessary, put in place a mechanism for letting in air from the bottom as

explained earlier. Leaves, timber, layers of bricks, etc. may be used.

Step 3

Place or build the box on top as stated under Step 2.

Step 4

Build a heap inside the box as follows:

Layer '0'- Dry grass/leaves - 3 centimetres
Layer 1- Refuse -15 centimetres
Layer 2 - Dung - 2 centimetres
Layer 3 - Ashes - 2 centimetres
Layer 4 - Soil - 2 centimetres

Step 5

Sprinkle water on these layers.

Step 6

Apart from layer '0', repeat layers 1 to 4 until the box is full.

Step 7

Place the inner cover on top of the box.

Step 8

Build a roof (outer cover) on top of the box to prevent an improper decomposition of the refuse or spoilage.

Step 9

After 14 days, the heap in box 2 should be shuffled. The second shuffling is to be done after 14 days when the refuse in box 2 is moved into box 3. If another shuffling is necessary, it will be done in another 14 days. Following this, the refuse should be left alone to undergo decomposition and for the fertilizer to mature.

Usually, compost manure is ready for use within 12 weeks following the preparation of the heap in the box.

Note

In cases where the farmer is unable to prepare compost manure due to unavailability of some essential items, the farmer should ensure that all the refuse coming from plants and animals should be made to decompose and returned to the soil. This means that the remains of crop plants after harvest or preparation, food left-overs, rubbish swept from the house, or other refuse, should not be discarded aimlessly.

It is very helpful when farmers see for themselves the good quality of plants brought about by the application of compost manure on the farm. We wish to encourage all farmers to be more modem by preparing and using compost manure, thus contributing to soil conservation and the protection of the environment.

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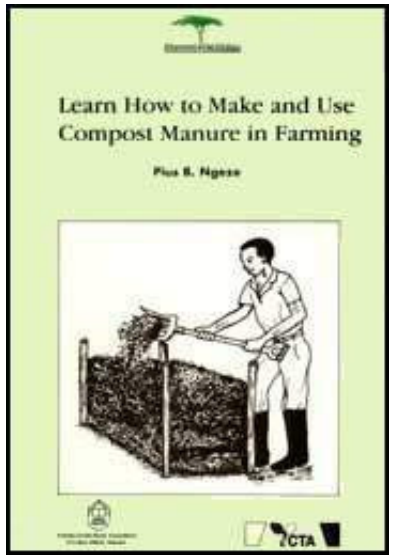

Chapter Six Summary of Characteristics and Benefits of the Use of Compost Manure

A. Summary notes on preparation

The following are some important factors to look at and bear in mind.

1. The site for the preparation of compost manure should be flat and near a water source.

2. All the items to be used in the preparation of compost manure should be available at the site. Whenever possible, legumes should form part of the items to be decomposed.

3. If affordable and where possible, sulphate of ammonia should be mixed with the items to be decomposed so as to effect the process of decomposition. If this is not possible, follow the ways outlined in the previous chapters.

4. Temperature and moisture are very important requirements in the compost heap. These should not exceed or fall below the limits:

(a) The heap should not be too low since the temperature will be low and decomposition will take longer.

(b) A heap that is too deep has too much heat, resulting in unsatisfactory decomposition.

(c) If the peg erected in the middle of the heap has adequate feel of warmth and moisture, it is a sign that the decomposition process is progressing well. On the other hand, if the peg has a lot of heat but the heap is dry, the heap should be turned over and water sprinkled on it.

5. The heap should be shuffled every few weeks as explained in the previous

chapter. This will facilitate adequate air circulation, reduce excess moisture and enable the refuse to decompose well. However, if the heap is saturated with water, it gives out a bad odour and has little heat, turn it over and over again until it ceases to emit the bad smell.

6. Normally, in dry weather water is sprinkled on the heap after every four or five days. During the rainy season, sprinkle water onto the heap depending on its actual state and the climatic conditions.

7. Cover the heap to stop loss of water and plant nutrients from the manure. It is important to remember that an uncovered heap does not decompose well and that the amount of water sprinkled should be only enough to wet the manure. During the rainy season, the heap should be covered with banana leaves, plastic paper, mats and old blankets.

8. In order to be able to make this fertilizer frequently, the farmer should do the following:

(a) The walls of the sites for mixing and shuffling the compost manure should be constructed using bricks, timber or wire.

(b) The floor of the heap sites should be made of concrete to prevent the loss of water through absorption into the earth as well as the exhaustion of nutrients. However, a concrete floor presents the problem of hindering the escape of excess water.

(c) If there is tap water at the site, it is advisable to have a hose pipe and a sprinkling can. These make work easier.

9. If all these steps are closely followed, in 12 weeks, or even less time, the compost manure is ready for application, depending on the method used in the preparation and on climatic conditions.

B. The importance of humus in compost manure

After the proper shuffling of the heap, the dead weight of the heap reduces by half and the work of the micro-organisms is complete. Then comes the maturation period which may last 2 to 4 weeks. During this stage, particles of the decomposed items slowly turn into humus, which is the most important part of the compost manure. Without it, there would be no such thing as compost manure and all preparatory efforts would be useless.

It is important to bear in mind that an immature fertilizer will badly affect the growth of seedlings due to its ammonia content. Therefore, farmers need to ensure the application of mature fertilizer on their farms.

C. Characteristics of good compost manure

The humus in the compost manure gives the manure its coloration and other characteristics. A good compost manure is:

(a) fully decomposed,

(b) darkish-brown in colour,

(c) without too much heat,

(d) of pleasant odour,

(e) smooth to touch,

(f) of good structure,

(g) one that has nearly all component parts (refuse) decomposed except for a few parts that are naturally difficult to decompose or those that never do,

(h) of average moisture content. This shows that the manure preserves adequate water for every period,

(i) one that consists of plant nutrients which it slowly releases to the soil for use by plants,

(j) one that does not have weeds, disease viruses or live seeds of any kind.

D. Benefits of compost manure

Good compost manure has the following benefits:

(a) It is easy and cheap to make and can be made on the farm.

(b) It slowly releases plant nutrients into the soil.

(c) The carbon compounds in the manure make excellent nutrients for microorganisms and other living things in the soil. This makes the soil to

which compost manure has been applied an excellent habitat for the organisms in the soil.

(d) It gives the soil a dark-brown colour.

(e) It regulates soil structure and softens hard soil; it also brings together sandy soil. This facilitates:

(i) adequate air circulation in the soil;

(ii) easy absorption of excess water by the soil;

(iii) enhanced water retention by the soil;

(iv) increase of the soil's ability to withstand erosion by wind and running water:

(v) easy sprouting and growth of roots in the soil by providing them with sufficient spaces and preventing stiffness of the soil when it is dry, not to mention prevention of its saturation and lack of aeration in the event of it getting wet.

(f) It improves the environment and the economy by giving rise to better utilisation of rubbish which would otherwise have caused diseases and by reducing the need to buy artificial fertilizers.

(g) It reduces the use of artificial fertilizers and chemicals, thus preventing negative effects to the soil, plants, farms, human life (those people who

apply them to the farms) and the consumers of the plant produce.

(h) The crops grown on soils having compost manure are:

(i) plenty and healthy,

(ii) not easily attacked by diseases,

(iii) not easily attacked by pests.

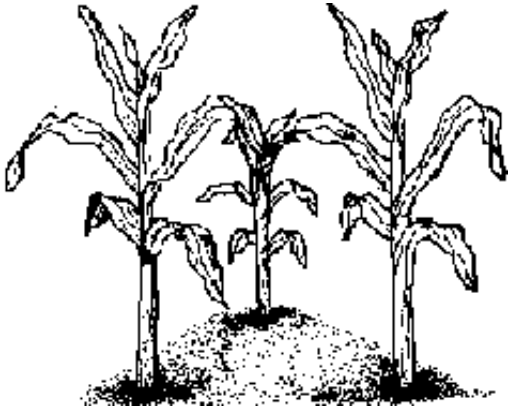

Fig. 16: Maize grown using compost manure

E. How to use compost manure

1. Before using compost manure, it should be sifted so that those bits that are not fully decomposed are isolated and re-used in preparing another lot of compost manure or spread over the farm. All items that did not decompose and cannot do so should be removed and thrown out of the farm.

Spreading compost manure does not in itself result in satisfactory results. The

manure has to be mixed with the soil.

2. Compost manure should be spread over the soil at the time of the preparation of the farm. Normally, it should be applied about one month before planting. The manure should be thoroughly mixed with the soil and not casually heaped on the farm.

3. For perennial crops such as coffee, bananas and fruit trees such as mangoes and oranges, apply approximately a tinful or two of manure per hole. A similar amount should be applied yearly at the bases of the plants.

4. For annual plants, such as grains and legumes, compost manure should be spread over the entire planting area. It could be put either in furrows or rows where crops will be planted.

5. At times, the manure is placed in the holes for planting annual crops. This is a tedious exercise but a very helpful one, especially when the amount of manure is inadequate.

6. One bucket of compost manure is adequate for one square metre of soil. Loosen the soil with a hoe and mix it with the manure. Plant the seeds thereafter.

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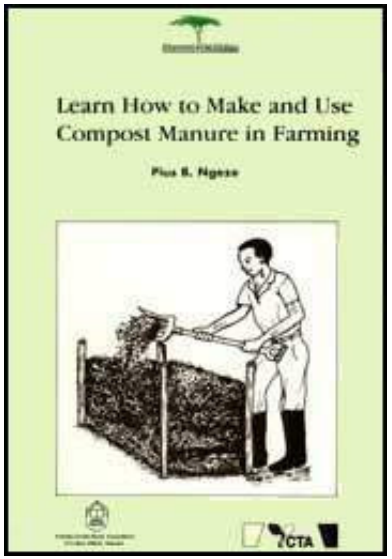
Learn how to Make and Use Compost Manure in Farming
(Friends-of-the-book Foundation, 1992, 54 p.)



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