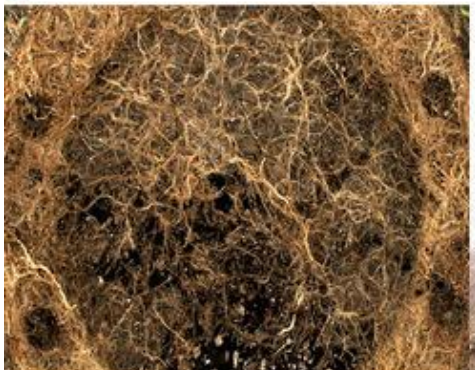
Artemis & Angel Co. Ltd.
99/296 President Park, Sukhumvit 24, Klongtoey,
Bangkok 10110, Thailand
Tel.: (President) +66-86-329-6038; (Sales): +66-993377866
E-mail: artemisandangelcoltd@gmail.com **Website:** www.artemisthai.com

How to Prepare the Soil With and Without Compost

1. Should You Plough Your Land?

- Farmers generally believe that they should prepare their land for planting a crop by ploughing it. Before you plough your land, we advise you to read about the following advice by **The Food and Agriculture Organization of the United Nations (FAO)**, which is an agency that combats global hunger and promotes rural development. It explains why ploughing is so harmful to the soil: http://www.fao.org/docrep/009/a0100e/a0100e07.htm
- Alternatives are provided below.

Some of the Harmful Effects of Ploughing the Soil



Plant roots hold the soil in place.

Ploughing cuts the roots and badly damages the Soil Food Web.

Ploughed soil is eroded by wind and rain. Nutrients are lost.

Crop rows are separated by bare soil.

2. Soil Preparation With Organic Matter

2.1 Suggestions

- Crops grow best in soil, which contains a lot of rich organic matter. Consequently, farmers should make a continuous supply of compost, which they can apply to their crops. But if the farmer has not made any compost before planting his crop, then he should obtain organic matter and use it instead, even if it has not composted it beforehand.
- **Suggested Mixture of Organic Matter Per Tonne:** Chicken dung or cow dung - 300 kgs.; Dried grass, rice or maize straw, leaves, sugarcane bagasse, cassava peels, etc., ground up or cut into 1-2 inch lengths - 600 kgs.; Earth -100 kgs. Black soil is the best.
- If the organic matter is ground up or cut into small pieces, it will decompose quickly.

2.2 Method 1 – Preparing the Soil with Uncomposted Organic Matter

- The easiest way is to collect the organic matter; then spread it over the field, and then plough it into the soil. However, ploughing damages the soil structure. Also, farmers usually do not have enough organic matter to do this over a large area.
- Because of the damage caused by ploughing Conservation Agriculture techniques encourage farmers to lay the organic matter over the soil and to plant through it. Either before or after laying it on the field spray the organic matter with Bio-Plant mixed with water to enrich it with micro-organisms and to make the organic matter decompose faster. Do this at least 2 weeks before planting the crop so that the micro-organisms can do their work before you plant the crop.
- **For a hectare:** 1 litre of Bio-Plant mixed with 1,000 litres of water and 5 MT of uncomposted organic matter is normal for 1 hectare. Using 10 MT or more of organic matter would be better, of course, if a lot of organic matter is available. 5 MT of organic matter is the minimum amount per hectare. If there is a shortage of water, then 500 litres will suffice, but up to 1,000 litres is better as this will make the micro-organisms multiply better.
- If chemical fertilizer has been used on the soil for a long time, or no fertilizer has been used at all, a better way to prepare the soil is to mix 2 litres of Bio-Plant with 1,000 litres of water and 10 MT of uncomposted organic matter (ideally which contains a lot of chicken dung - 30% of the volume). If the farmer wishes to reduce his costs, then he could mix 1 litre of Bio-Plant with 1,000 litres of water and 10 MT of uncomposted organic matter.
- **For an acre**, 4 MT of organic matter will be best amount, especially in the first year, but 2 MT is the normal amount. The usual amount of Bio-Plant for an acre is 250 cc mixed with 250 litres of water. Spray this over the uncomposted organic matter once it has been laid over the ground, and plough it into the soil. If the soil is very weak in micro-organisms and nutrients, spray 500 cc of Bio-Plant mixed with 500 litres of water, at least in the first season.
- **For half an acre,** 1-2 MT with 2 MT being the ideal amount in the first year. The usual amount of Bio-Plant for half an acre is 125 cc mixed with 125 litres of water. If the soil is weak in micro-organisms and nutrients, spray 250 cc of Bio-Plant mixed with about 250 litres of water (or even 500 cc of Bio-Plant mixed with 500 litres of water) over the uncomposted organic matter once it has been laid over the ground.

Guidelines

- Spread this uncomposted organic matter sprayed with Bio-Plant over the soil 2 weeks before the planting starts. This will make the soil very rich in micro-organisms, and supply the plant roots with a lot of macro- and micro-nutrients; as well as enable the plants to obtain extra Nitrogen from the air. Plough in the organic matter, if you wish to plough the soil; otherwise leave the organic matter on top of the soil and plant through it.
- Leaving the organic matter with the Bio-Plant for 2 weeks or more before planting allows the micro-organisms to multiply before planting. The water is needed to make the micro-organisms become active and to multiply in the organic matter.
- We recommend this because often chemical fertilizers have been used for so long that the micro-organisms in the soil have mostly been killed off.

3. Soil Preparation With Compost

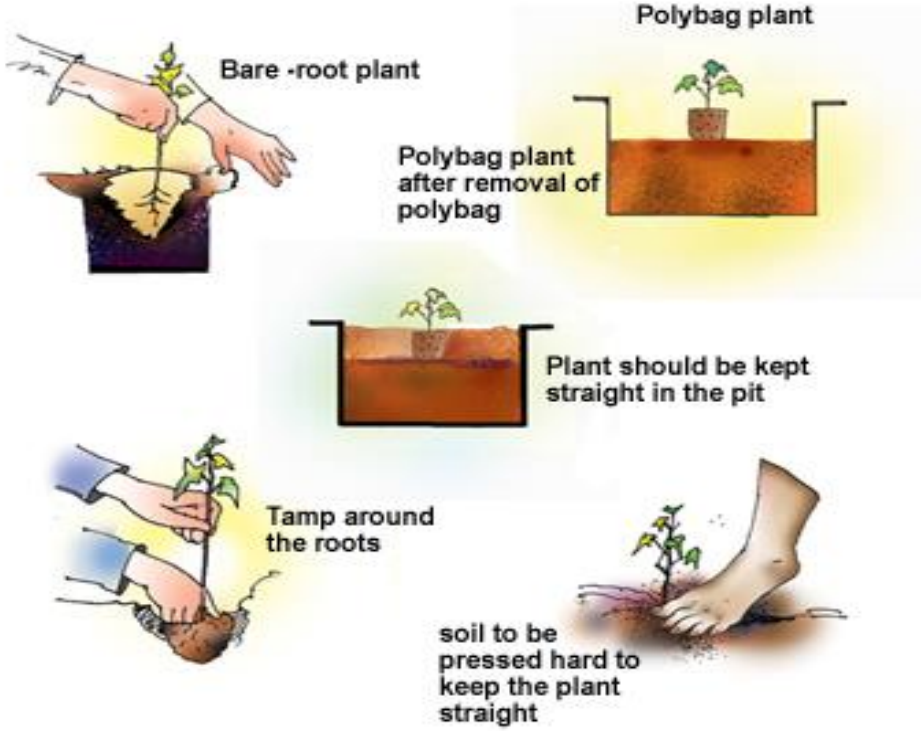
3.1 Method 2: Preparing the Soil with Compost

- This is preferred to **Method 1** above because the organic matter has been broken down and turned into rich compost already.
- In the first year we recommend that the farmers use a minimum of 5 MT per hectare and ideally 10 MT per hectare. The reason for this amount of compost is that the soil has probably been weakened severely for many years by chemicals. If the farmers do this in the first year, the soil will recover very quickly with the bio-fertilizers and in the second year the farmers can reduce the amount of compost by half.

- The farmer could plough this compost into the soil of the whole field during the soil preparation, and then leave it for 2 weeks before planting so that the micro-organisms can multiply. But this involves ploughing. In no-till farming the compost would be placed on the planting rows and the seeds or seedlings would be planted into the compost.
- If the plants will be planted on ridges, then you could place the compost on the ridges only. The seedlings or seeds would be planted into the soil through the compost. In no-till farming there would be no ridges because this involves ploughing, which kills the soil structure and the networks of bacteria and fungi.
- **Soil which has little organic matter:** Where the soil is not organically rich and has little organic matter in it, add 4-6 inches (10-15 centimeters) of compost before each planting season. Lay it on the surface of the soil.
- **Soil which has plenty of organic matter:** If you farm on soil, which is organically rich, 2-3 inches (3-7 centimeters) of fresh compost will suffice before each season.

3.2 Planting Tree Saplings

- When planting tree saplings in holes, use a 1:1 mixture of compost and soil in the holes where the tree seedlings are to be planted. Make the hole about 60 cms. x 60 cms, and fill the hole halfway up with the mixture.



- Place the sapling with its soil attached to the roots on top of the compost, which you mix with the soil from the top of the hole. Make sure that the top of the roots is at the level of the top of the hole. Then fill in the hole with the soil from the bottom of the hole when you dug the hole. Finally, spread 5-10 kgs. of compost around the stem of the sapling while avoiding placing the compost against the stem.

3.3 Apply Compost to Trees and Crops Already Growing

- Once a month place 5-10 kgs. of compost around trees which are already growing - a minimum of 5 kgs. per tree, if the trees are under 1 metre high, and about 10 kgs. around trees over 1 metre in height. But 10 kgs. can be applied to trees under 1 meter in height as well. Place 15 kgs. around the trees, if the soil is very poor or there is a problem with disease.
- Ideally, apply 5 MT – 10 MT per hectare around plants on Day 30 and Day 60 of a 90-day crop. Do the same once a month or every 2 months in the case of crops growing for 6 months upwards.

- For rice, when water is let into the field every 2 weeks, let 500 cc of Bio-Plant also flow in with the water per hectare.

3.4 Urine

- There are no doubts about the effectiveness of this near perfect, soluble fertilizer on your soil. Urine is sterile. Neat or diluted, it is a popular compost activator. Pour it on because it is loaded with Nitrogen as well as potassium and phosphorous. The Nitrogen is in the form of urea, which is the ideal form for soil uptake and fertilizing plants.
- Urine should be used as fresh as possible to fertilize your plants, but if that's not always possible, put a lid on the jar or container immediately. Urine that has been left in the air for a while will be busy converting urea into ammonia - your compost pile will still love it though.
- For pouring around the roots of your vegetables and other plants, dilute at the ratio of 1 (urine) to 10 (water). For younger plants and seedlings, dilute at the ratio of 1 to 20 with water. For plants in containers dilute 1 to 30 with water.
- Urine is high in Nitrogen and has a lot of mineral salts in it, so it can burn plants. These salts are a good reason to try to avoid applying urine to plant leaves. It is best to pour in the soil around plants. Apply weekly to fast-growing and large plants, less often to very young and slower growing plants.

4. 10 Benefits of Planting a Cover Crop

Note: In the event that the farmer does not have any organic matter or compost when he is planning to plant his crop, he could grow a cover crop on his fields before planting his cash crop. This cover crop will act as his organic matter. Indeed, farmers should grow a cover crop that includes a mixture of 5 or more species of plants before planting the cash crop.

4.1 What Are Cover Crops?

- Cover Crops – sometimes called green manures – are plants that are used primarily to help improve the soil because of the advantages they bring to the soil. Cover crops are often used to help ‘repair’ soil that has lost its fertility or has become eroded. There are many benefits a farmer or gardener can get from planting a cover crop.

4.2 Cover Crops Prevent Erosion

- Bare earth is something to be avoided. Ground that is exposed to the elements is at a greater risk of erosion by wind and water runoff. This can mean the removal of the rich topsoil and the compaction of the soil underneath, making planting much harder. Cover crops help to stabilize the soil, prevent runoff, and both bind the soil together and improve its structure.

4.3 Cover Crops Improve Soil Structure

- The roots of the cover crop will also help to improve the structure of the soil. The foliage of the plants helps to prevent compaction of the soil by protecting it from rain, erosion and, in some cases, livestock. The passages and pore spaces that the roots create allow for moisture percolation and aeration of the soil, as well as means by which insects and other microorganisms, which are themselves essential to the health of the soil, can move through it.

4.4 Cover Crops Provide Organic Matter

- Soil is improved by the addition of organic matter. Organic matter helps stimulate microorganism activity, gives nutrients to the soil, improves the structure and helps with moisture retention. Cover crops add to the organic matter of the soil, both when living as leaves drop to the floor, and when slashed or allowed to die back, when they form a natural mulch or compost. Combining cover crops and compost is one of the most efficient ways to maintain soil quality throughout the year.

4.5 Cover Crops Suppress Weeds

- Cover crops are sometimes referred to as 'living mulches'. One of the reasons for this is their ability to suppress weeds. The roots of the cover crops compete vigorously with weeds for available nutrients, depriving the weeds of the elements they need. The leaves of the cover crops also compete for light and space above ground, typically shading out the weeds so that they cannot photosynthesize effectively. Furthermore, when crops die back or are slashed back, they perform a more conventional mulching function of smothering the weeds and their seeds.

4.6 Cover Crops Conserve Soil Moisture

- Planting a cover crop is an effective way to conserve and even increase the moisture content of the soil. Besides preventing runoff by limiting the erosion of the topsoil, the crops do this in two ways. Firstly, simply by providing a cover for the soil, they protect it from evaporation by the sun and the wind. Secondly, many cover crops send down deep roots, which can bring up moisture from lower down in the soil profile.

4.7 Cover Crops Provide Nutrients

- Another benefit of cover crops is they add valuable nutrients, such as Nitrogen, an essential element that all plants need. Species in the legume family of plants have a special ability to 'fix' Nitrogen from the air into the soil. They have nodules on their roots that provide a habitat for certain Nitrogen-fixing bacteria. Not only does this increase levels of Nitrogen in the soil while the plant is growing, when the plant dies back, after harvesting for example, the Nitrogen is released into the soil and becomes available for other plants to use, so if you are planting a food crop after the cover crop, it will have a good nutrient load with which to get started.
- Farmers and gardeners do not always have to let these leguminous crops grow through their life cycle; they can be periodically slashed back and the stems and foliage left to rot in order to release their nutrient load into the soil. In traditional agricultural methods, the cover crop would be cut down then ploughed into the soil. To avoid this destructive technique, the cut plants can be mulched to quicken breakdown. Examples of leguminous cover crops include vetch, field peas and clover.

4.8 Edible Cover Crops

- It is not only the soil that benefits from the presence of a cover crop; it may add something to your kitchen as well. Certain species of cover crops can provide an edible harvest. Legumes such as peas and beans perform both functions, while mustard plants and daikon are also suitable cover crops that you can eat.

4.9 Biodiversity

- Instituting cover crops adds to the biodiversity of your permaculture plot. All species of plants have their own unique characteristics, including how they interact with other plants (such as providing shade or fixing Nitrogen) and organisms (such as attracting beneficial insects, or repelling insects that could damage neighbouring specimens). The cover crops can also attract wildlife to your fields or garden, by providing habitat, feeding opportunities (on insects attracted by the plants, for instance), and protection from the elements and predators.

4.10 Insects

- This biodiversity is a major part of attracting a wide variety of insects to your plot. By planting cover crops rather than leaving bare earth, you will bring more species of insect to your site. Some insects will predate on others and so prevent populations booming which may impact upon your crop yield. Attracting insects also increases the number of pollinators on your site, helping propagate your plants.
- The increased organic matter and nutrients in the soil also feeds beneficial microbes that can keep fungal and bacterial infections in check, and limit the number of nematodes, microscopic organisms that feed on plant roots and stems, and which can carry viruses that they transmit to the plants.

5. Intercropping

5.1 Why Intercrop?

- If a farmer wants to plant a crop soon and:
  - He does not have any compost; or
  - He does not have any organic matter to spread over the field; or
  - He does not have time to grow a cover crop;

  then he would benefit tremendously by intercropping.

5.2 What Is Intercropping?

- Intercropping is a cropping practice involving growing two or more crops in proximity. The main goal of intercropping is to produce a greater yield on a given piece of land by making use of resources or ecological processes that would otherwise not be utilized by a single crop.
- There is very helpful information about various types of intercropping practices as well as about the push-pull intercropping innovation at: https://www.infonet-biovision.org/PlantHealth/Intercropping-and-Push-Pull

5.3 What Crops Intercrop with Each Other Well?

- In order to know what crop to intercrop with your crop, and how to intercrop with it, please refer to the crops at: https://www.infonet-biovision.org/crops-fruits-veg .

5.4 The Most Important Benefits of Intercropping

- Intercropping can produce a higher yield on a given piece of land, because it makes use of resources that cannot be utilised by a single crop.
- Plant diversity enhances soil fertility and food security.
- There is a lower incidence of crop-specific pests, diseases and weeds.
- There are increased numbers of natural enemies such as spiders or parasitic wasps, which help to limit pest and disease outbreaks.
- Combinations with legumes, a very common practice also in Africa, increase crop yields without the use of synthetic fertilizers, because legumes can fix Nitrogen.
- Better soil cover helps reduce soil erosion and reduces weed germination.
- Better use of the planting season if intercrop partners keep on growing after the harvest of the main crop.
- High-growing plants or climbers are given structural support by their companion crop.
- Delicate plants are given shade or protection.

6. Mulching - Benefits of Mulching the Soil

6.1 Why Mulch?

- If a farmer wants to plant a crop soon and:
  - He does not have any compost; or
  - He does not have any organic matter to spread over the field; or
  - He does not have time to grow a cover crop; or
  - He does not want to intercrop;

  then he is left with mulching the soil.

6.2 What is Mulching?

- Mulching is one of the most important ways to maintain healthy landscape plants. A mulch is any material applied to the soil surface for protection or improvement of the area covered.
- Mulching is use of plant material such as straw, leaves, crop residues, green manure crops, or saw-dust, stones or plastic planes etc. that is spread upon the surface of the soil. A mulch cover helps protect the soil from erosion and evaporation, nourishes soil life, increases soil organic matter content and provides nutrients to the crop.

- Mulching is really nature's idea. Nature produces large quantities of mulch all the time with fallen leaves, needles, twigs, pieces of bark, spent flower blossoms, fallen fruit and other organic material.
- There is excellent information about mulching at:
  - https://www.infonet-biovision.org/PlantHealth/Mulching
  - https://www.infonet-biovision.org/Publications/TOF-Module-No-06-Green-manure-cover-crops-mulching-weeding-0

6.3 Benefits of Mulching

- When applied correctly, mulching has the following beneficial effects on plants and soil:
  - Mulches prevent loss of water from the soil by evaporation.
  - Mulches reduce the growth of weeds, when the mulch material itself is weed-free and applied deeply enough to prevent weed germination or to smother existing weeds.
  - Mulches keep the soil cooler in the summer and warmer in the winter, thus maintaining a more even soil temperature.
  - Mulches prevent soil splashing, which not only stops erosion but keeps soil-borne diseases from splashing up onto the plants.
  - Organic mulches can improve the soil structure. As the mulch decays, the material becomes topsoil. Decaying mulch also adds nutrients to the soil.
  - Mulches prevent crusting of the soil surface, thus improving the absorption and movement of water into the soil.
  - Mulches prevent the trunks of trees and shrubs from damage by lawn equipment.
  - Mulches help prevent soil compaction.
  - Mulches can add to the beauty of the landscape by providing a cover of uniform colour and interesting texture to the surface.
  - Mulched plants have more roots than plants that are not mulched, because mulched plants will produce additional roots in the mulch that surrounds them.

6.4 How to Apply Mulch

- Before applying any type of mulch to an area, it is best to weed the area. Spread a layer of mulching materials over the entire plant bed. Keep mulch 2 to 3 inches away from the stems of woody plants. This will prevent decay caused by wet mulch.
- Newly planted trees require a circle of mulch 3 to 4 feet in diameter. Maintain this for at least three years. Do not pile mulch against the trunk.
- For established trees in lawns create a circle of mulch about 2 feet in diameter for each inch of trunk diameter. Increase the size of the mulched area as the tree grows.
- Try to apply the mulch at least 6 to 12 inches beyond the drip-line of the tree. Because the root system can extend two to three times the crown spread of the tree, mulch as large an area as possible.

6.5 How Deep to Mulch

- The amount of mulch to apply depends on the texture and density of the mulch material. Many wood and bark mulches are composed of fine particles and should not be more than 2 to 3 inches deep. Excessive amounts of these fine-textured mulches can suffocate plant roots, resulting in yellowing of the leaves and poor growth.
- Coarse-textured mulches such as pine bark nuggets and straw allow good air movement through them and can be as deep as 4 inches. 4 inches will stop weeds growing.
- Mulches composed of grass clippings or shredded leaves should never be deeper than 2 inches, because these materials tend to mat together, restricting the water and air supply to plant roots.