



Women in Agriculture

Training manual for female extension educators

Composting

Introduction

What is Compost? Compost is a dark, crumbly, earthy-smelling material produced by controlling and improving the natural aerobic decomposition of leaves, grass clippings, and many other organic materials.

Composting in urban and kitchen gardens offers flexibility and improves productivity. Certain composting methods require very little investment or labor and transform what would otherwise be waste into a valuable resource for vegetable production. In small household gardens, the compost produced on site can be enough to improve soil and provide adequate nutrition for the plant. Home composting can even support intensive vegetable production when it is used continuously in conjunction with other techniques.

Often local urban dwellers believe that compost is garbage. They tend to confuse compost with bad smelling piles of refuse in the streets. These piles contain a mixture of inorganic and organic materials, such as plastic bags that are used to carry mixed household waste and vegetable leftovers from markets that are left to rot in huge piles resulting in offending odors.



It is worth our effort as educators to help women understand the many benefits of composting at home:

- Compost reduces the amount of material going to garbage piles, which leads to a cleaner environment.
- Compost is a valuable and free soil amendment that saves gardeners the money used to buy alternatives
- Compost improves soil texture, structure, aeration, and water-holding capacity. It contains a wide range of plant nutrients. All soils benefit from regular additions of compost.
- Compost adds and promotes microbiological life in soil, improving nutrient mobilization and availability to plants.
- Compost suppresses some soil-borne diseases. Populations of some microbes in compost may

out-compete pathogens for food and habitat while others attack or repel plant pathogens.

Learning Objectives

- Instruct extension workers about the importance of composting as a way to improve and maintain soil health and plant nutrition
- Expose extension workers to composting techniques suitable to their environment.

Learning Outcomes

Extension workers will learn:

- how to start and correctly manage compost piles
- how to monitor the composting process
- how to recognize when compost is ready
- when and how to use compost

Materials

- Any organic material that can be found in the garden or at home, such as vegetable scraps from the kitchen, egg shells, card board, newspapers, paper (non-glossy), small branches, chicken feathers, saw dust, wood chips, animal bedding, fresh and dry manure, straw, weeds, ashes, leaves, and grass clippings
- machetes or heavy duty chopping knives
- sample of mature sifted compost
- flipchart or blackboard
- chalk or marker
- Pictures or diagrams of composting structures



In Afghanistan there are many competing uses for material that otherwise could be used for composting and soil fertilization. Cow manure is often dried in patties and used as fuel, as are dried vegetable or plant residues (tomato, eggplants, flower stalks, leaves from trees, branches, sometimes even vegetable peels), while fresh parts might be used for feeding animals. These issues should be considered when helping women decide how and what to compost.

Lecture Notes and Lesson Plan

In nature, decomposition and transformation (breaking down and rebuilding) of organic matter is a continual part of the life cycle.

Have students reflect on this point and give examples of breaking down and rebuilding.

Composting uses the process of decomposition to provide us with a nutrient rich, soil-like substance that will boost microbial and organism activity in the soil and improve soil structure over time.

Ask students to recall soil structure properties and roles.

Good soil structure has enhanced capacity for water permeability and retention. Good quality compost also promotes a soil pH that favors microbiological activity. Finished compost should have pH of 7 (slightly sub-acid to neutral); low quality compost will be as high as 9 or low as 5. This is the optimal pH to enable nutrients in the soil to be available in soluble form for plant intake in the majority of crops.

How is Compost Made?

Bacteria, fungi, and other microbes are the key players in composting. These organisms “feed” on organic matter and use the carbon and nitrogen it contains to grow and reproduce. The heat generated by your compost pile is a result of microbial activity. Microbes are active in small numbers at temperatures just above freezing and are most efficient at 54°–60° C. They are assisted by many larger organisms like earthworms, slugs, snails, millipedes, sow bugs, and various insect larvae that feed on plant and animal matter in soil. These same organisms are responsible for the decay of both forest floor litter and the corn stubble in a farmer’s field.

Composting microbes use carbon for energy and nitrogen for growth (protein synthesis). When you mix various forms of organic material in your compost bin, it is important to achieve a proper balance of carbon to nitrogen (C:N ratio). The proportion can vary; microbes will function well at C:N ratios from 25:1 to 40:1. A mixture of materials containing 30 parts of carbon to 1 part of nitrogen is considered ideal for compost. Most organic materials do not fit the 30:1 ratio exactly, so different materials are mixed together. With the proper mix, microbes and other digesters will quickly start working to make compost for you. Finished compost has a C/N ratio of 20 - 25:1.

Compost Materials

What can be used for composting? Anything that can decompose - In other words, anything capable of rotting!

Have the students list items on the board that can be added to compost and items that should not be used (plastic, glass, metal, rocks).

Composting materials can be separated into two categories:

- **Green materials** - those that are low in carbon but high in nitrogen and moisture (easily breaking down)
- **Brown materials** - those that are high in carbon but low in moisture, slower to break down

A blending of equal parts (by volume or weight) of green and brown materials gives the decomposers an ideal diet.

Note: In most contexts there are some items that should NOT be included in compost, even though they are organic and can decay. They include meat, bones, carcasses, oil, and human fecal matter.

Have the students can sort their list into the two groups.

High-Carbon Materials	High-Nitrogen Materials
cardboard	manures
paper, newspaper	vegetable residues
corn, sorghum, millet, Sudan grass dried stalks and residues and similar	fruit residues
tree bark	green tender leaves
saw dust	grass cuttings
wood chip, shavings	fish residues
dried tree leaves	legume hay
oat, wheat, rye, rice straw	tea/coffee grounds
rice hulls	cotton, soybean, corn meal
non-legume hay	hoof and horn meal
egg shells	blood
ashes	chicken feathers
	urine

High-carbon ingredients are also more fibrous, harder to decompose. That is why we pay attention to the Carbon/Nitrogen ratio and, whenever possible, we keep it around 30:1.

Material that is available for compost will vary from place to place and with the season. This will influence the characteristics of the final product and the time it takes to complete the composting process. Seasonal temperatures also influence composting process: cold weather will slow microorganism activity and reduce the roles of worms and insects as well.

Compost material should be chopped to increase surface area exposed to microbial life and should be adequately wet and exposed to air circulation (aeration). A squeezed handful of composting material should feel wet, but not dripping. If the heap is too dry, add water and/or watery material. If the heap is too wet, add dry material.

Manure: Although manure is a great addition to a compost heap, good compost can be made without it. Composting is a safe, effective way to process fresh and dry manure. Composted manure has a higher concentration of nutrients than fresh manure. Nitrogen is fixed by the microorganisms, and phosphorous and potassium are more readily available for plant uptake. Composted manure is safe to use for vegetable production. Hot composting methods will eliminate pathogens as well as weed seeds.

Compost structures come in many shapes. They can be enclosed (wood, bricks, metal wire), in one or more bin system, or in a free heap. If using a wooden structure, do not use treated lumber. Free heaps or piles have many advantages because they do not require any initial investment, and they are

Compost is the aerobically decomposed product of mixed organic matter.

Have students discuss the meaning of the definition:

- “Aerobically decomposed product” means that compost needs air or oxygen, that the decomposition involved is of the aerobic type.
- “Mixed organic matter” means compost is made with a mixture of different components. The more variety, the better!

easier to mix and to move. Building a compost pile or bin on a wooden pallet allows for aeration; however, it is not a good idea to start composting on a cement/concrete surface. The best solution is to have the compost heap directly on the soil surface, providing a first layer of loose branches and sticks or a plastic pipe with holes in it for aeration.

Care of the compost pile: Let the heap remain uncovered in good weather but protect it from excessive rain with a plastic loose cover. A cover is also helpful in the summer when the heap can dry easily. If plastic is not available, other materials can be used to cover the pile, such as carpet remnants, cardboard, straw or dry weeds.

Exposing the pile to air reduces the composting time. It is important to turn the compost regularly using a pitchfork or large stick. The ideal compost pile is 1 meter by 1 meter by 1 meter. If it is larger, the center does not get enough oxygen; if it is smaller it doesn't reach a hot enough temperature. Positioning several sticks or rods in the pile and moving them periodically promotes aeration and facilitates watering.

Using a **ventilating stack** is a possible *no-turn method*. Stick a 10-cm plastic pipe with holes drilled in it or a cylinder of wire mesh into the center of the pile with one end sticking out. This allows air to move in and out of the pipe causing more rapid decomposition. The stack can also be used to add water to the heap as needed. If a cylinder is not available, one can use a bunch of twigs loosely tied together.

Remember, nothing assures a good and even composting process as a good manual mix, especially with larger heaps.

When there is well activated and sustained microbial activity, heat will be produced in the pile. It is easy to check by inserting a hand in the middle or leaving a plastic or metal rod inserted in the pile. The size of the heap has an influence on the final product and on the ability of the heap to heat thoroughly (with the help of few turnings). Smaller heaps will not heat up as much. An ideal sized heap is about 1 cubic meter in volume.

Fast speed compost	C/N ratio between 20/1 and 40/1 Heats up quickly Generally two turnings total Ready in 2 to 3 months
Medium speed compost	C/N ratio closer to 100/1 Takes longer to mature (about 3 months in warm weather, 9 months in cold weather). Turning is optional, but beneficial
Slow speed compost	C/N ratio around 200/1 or higher It generally needs to be mixed later with another pile

Compost Pile variations:

Wandering compost pile:

- The new materials are added at one end while the finished compost is removed from the other end
- The compost moves closer to its final destination each time that it is turned, leaving a fertile footprint

Trench and Hole composting (spot methods):

Narrow trenches or small holes are prepared in the garden weeks or months ahead of planting, then filled with fresh materials and covered again with soil. Plants are planted directly into these holes. It is a fast way to improve poor soils, and it might be useful for very small gardens. Gardeners who are hesitant to start composting may be willing to try this method out first.

When is the compost ready? It depends on the factors mentioned above, but fast compost is generally ready in 2-3 months. If some components are not yet decomposed, it is easy to sift them out and put them back on another compost heap. The fine sifted material resulting from a good composting process will look dark, feel moist and be rich in microbial life and nutrients.

Using compost (many possibilities!)

- incorporate liberally in the soil at the beginning of the growing season when preparing the soil for planting
- incorporate only in the beds at the beginning of the growing season
- incorporate only along the rows where seed and seedlings are going to be positioned

- mix with the soil only where the seedlings are going to be transplanted
- use as side dressing when plants are established
- use to prepare compost teas during the growing season
- use to prepare potting/container/tray, nursery bed soil mix

Discuss ways to make composting easier and more acceptable for new gardeners:

- Consider access to water and distance from the kitchen, etc. to reduce labor
- Use materials that are available or easy to obtain from neighbors or nearby markets
- Help decomposers do their job by monitoring the pile, mixing it for aeration and providing water as needed
- Reuse and recycle materials
- Use a varied mix of materials
- Compost to suit individual needs

Summary of Composting Tips:

The composting process is a mixture of science and art to which you can add techniques that work for you. No two compost piles are exactly the same and there is no single “correct” set of composting techniques that gardeners should follow. Select your methods based on your circumstances. That said, some tips may help you compost more effectively:

- Mix materials thoroughly; it’s usually not helpful to layer materials.
- To speed up the process add an extra nitrogen (e.g., cottonseed meal, blood meal, urine) source at each turning.
- Keep your compost pile moist (but not soggy) for efficient decomposition. Excess moisture

causes anaerobic decomposition and offensive odors. During dry weather it may be necessary to add water at weekly intervals.

- Branches and other woody materials will decompose very slowly unless they are chopped into small pieces. When in a coarse form, they do provide aeration to the composting pile and can be easily removed at the end.
- In dry weather, cover the pile to prevent excess moisture loss and to aid decomposition. A tarp or other cover also protects the pile from becoming too wet during periods of heavy rainfall and helps prevent nutrient leaching.
- Turn or mix the pile regularly. If dry leaves make up the bulk of the pile, turn the pile in before freezing occurs. Do not turn the pile in winter because this allows too much heat to escape and slows decomposition.
- Whenever kitchen scraps are collected or composted it is helpful to mix in a dry, high-carbon material, such as leaves, sawdust, or shredded paper.

Follow up activities

- (1) Tour a demonstration farm or a plot with a composting site and observe the different examples and stages of composts. Have the students touch different compost piles, check the temperature of the heap (inside and outside), and check the moisture level.
- (2) As a group, **build a compost heap** from the beginning, alternating layers of dry and more water rich material, more coarse material with more fine material. Add some soil in the mix and some manure if available. Wet the mass thoroughly. A good heap is not too compacted; it should move slightly if pressured and poked.

Check the heap periodically in the following weeks.

- (3) **Discuss:** The farm is a different situation from the one people have in their gardens. Generally people have limited material available when starting and can keep adding something to their heap every day. At times there will be more of a specific material available; there will be times of plenty and times of scarcity. This either means there will be several small heaps, or one heap continuously going. The top will be fresh while the bottom will be darker and more decomposed.

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Assessment questions

- 1) What is compost?
- 2) Can you describe how to start compost in a garden? What materials will you use?
- 3) What is needed for a good composting process?
- 4) How will compost improve the garden?
- 5) How do you know if the compost is ready to use?

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