

Lesson 7

Infrastructure and efficient time management

Learning outcomes

- The trainee explains the importance of mechanization in vermicompost production.
- The trainee explains the effects of substrate particle size on vermicompost yield.
- The trainee knows the machines and equipment used in reducing the substrate particle size.
- The trainee explains the necessity of mixing organic wastes in appropriate proportions and in sufficient variety to produce quality vermicompost.
- The trainee knows the appropriate tools and equipment for successful stack (pile) management.
- The trainee explains the requirements for controlling temperature, moisture and pH in the pile.
- The trainee explains the consequences of anaerobic and aerobic conditions.
- The trainee explains the functional role of the sifting process.
- The trainee knows the equipment used in the sifting.
- The trainee explains the requirements for packaging in vermicompost.
- The trainee knows the moisture content that vermicompost should have in the package.
- The trainee knows the approximate cost of vermicompost packaging equipment.
- The trainee knows the tools to be used in the packaging process.

Instructions for the trainer

The trainer shares theoretical knowledge through presentation.

Basic requirements: Projector, computer.

7. Infrastructure and efficient time management

Vermicomposting and composting production processes require a certain level of mechanization for effective time and cost management. Equipment that can be used in some basic processes to ensure that the production process results in high-quality outputs by consuming less labor and time is given below.

7.1. Crushing, Shredding, Size Reduction

Most materials used in farm composting do not require crushing or shredding. Newspapers, cardboard and other garden waste are crushed and shredded. Tree bark and other large objects are also reduced in size before composting. Thanks to shredding, materials such as newspapers can be shredded and used as bedding material before composting. However, crushing/shredding operations may create noise and dust problems. Equipment that can be used in this process are paper shredders, large garden shredders, lawn mowers and straw clippers. Some size reduction mechanisms can be used with auxiliary equipment such as balers, dust separators, conveyors and screens. Actual capacities depend on materials used, loading rate and other conditions. The cost varies depending on the power needed and the equipment used. If a crusher or shredder is only needed for a few weeks a year, it is more profitable to rent this equipment. The primary types of crushing/shredding equipment used in composting systems are surface shredders, hammer axes, trough shredders and chippers [53].

7.2. Mixing and Batching

The most necessary step in the composting process is mixing the substances in appropriate proportions and then forming stacks with this mixture in a closed reactor. In most closed reactor methods, mixing is done within the system. Substances are loaded into the silo or hopper with

conveyors, augers and/or bucket loaders. In windrow and aerated pile methods, mixing and stacking occur in separate steps. Initial mixing is especially important in aerated static pile systems. Once mixing is done, the quality of this mix lasts throughout the entire composting process. In the windrow method, in the first mixing step, the raw materials are proportioned and mixed until they reach a certain density. With subsequent mixing, the substance is completely mixed. Mixing and windrowing can be done in different ways depending on the compost method, the equipment available and the method of manure processing on the farm. For mixing materials and creating stacks, loaders, manure spreaders and other equipment on the farm are usually suitable. However, mixing and windrowing require more labor than other compost operations [53].

7.3. Maturation, Storage and Processing

Anaerobic conditions may be caused by excess moisture or water accumulating at the bottom of the pile. In mature compost, not enough heat is generated to evaporate moisture. Surface runoff in the maturation area is drained by directing it away from the piles. The height of the pile should be parallel to the base. The most effective way to prevent wet or anaerobic conditions in a compost pile is to mix the pile and spread the compost on an open field. This allows oxygen into the pile and aids in the aerobic decomposition or evaporation of anaerobic compounds. After aeration for a day or two, the compost is piled again, the pile warms up again and is composted in a short time. It takes a few days to a few weeks for the pH to return to its normal level. The use and sale of compost is generally seasonal. Microbial activity remains at a low level in finished compost that has been properly composted and matured. The height and width of the pile is determined by the use of bucket loaders, conveyors or other equipment. However, the height of storage piles should not exceed 3.6 m. As the size of the pile increases, the risk of compost deterioration and spontaneous combustion increases. Piles with a height of more than 2.4 m have low moisture, but due to poor drainage conditions, the bottom of the storage piles becomes wet. It is usually safe to stack large storage piles into smaller piles for a few weeks before using or selling. This allows natural aeration of the stored compost and removal of any phytotoxic compounds present. If

the produced compost is applied to a field, maturation and/or storage piles are placed in a suitable part of the field. Poor drainage and steep land slopes should be avoided to reduce anaerobic conditions, compost loss, and nutrient loss from runoff [53].

7.4. Sifting

Sifting is done to separate substances of different sizes and/or shapes. By sifting;

- Most of the unwanted materials such as stones, metal, bottles and other garbage are removed,
- Composted materials are separated from non-composted ones,
- Compost residues and completely uncomposted materials are separated and brought to a quality suitable for sale or use,
- The bulking agent in the compost is recovered and reused.

The use of screening in on-farm composting systems allows the quality of the compost to be improved or the bulking agent to be recovered. The most important characteristics to consider when choosing a sieve are; The sieve's mouth opening, capacity, efficiency, cost and resistance to clogging.

Clogging is the blocking of sieve openings with particles. Most sieves use equipment such as brushes or spheres to prevent this. The sieve opening to be used in composting should be between 0.60 - 1.30 cm, depending on the substances to be separated and the final use of the compost. Although small openings provide better separation, they reduce the capacity of the screen and cause clogging. The efficiency of the sieve is determined by its ability to separate particles in the desired distribution. If the size of the particles passing through the sieve is larger than desired or if the particles planned to pass through the sieve are retained in the sieve, the efficiency decreases.

Efficiency and capacity are affected by the material fed as well as the sieve opening. The sieve works better with desiccant. It is generally preferred to sieve the substances after ripening and drying. To sift the compost without clogging and material buildup, the moisture content must be less than 50% or 45%. In practice, the maximum moisture content depends on the specific sieve opening. There are also sieves that can shred and mix. Such screens

use abrasive belts or hammers to break up material residues before sifting. There are various types of sieves. These are rotary drum sieve, shaking sieve, shaker sieve, flexible belt sieve, disc sieve, augers and trough sieve, rotary sieves [53].

7.5. Packaging

Packaged compost is more expensive than openly sold compost. Compost customers can also be increased with packaging. It is not necessary to use special equipment for packaging small volumes. Although it is laborious, compost can be packed using a shovel. Work can be done faster by using package holders, package binders or closers. Metered valves, scales, package closers and conveyors are used in high-volume packaging operations. A packaging machine may also be required since most vendors package the package. An automatic package line costs a total of fifty thousand euros. This does not include labor and product storage. In a plastic package, the moisture content of the packaged compost must be at least 35%. Otherwise, the compost decomposed in the airtight package may turn sour. In compost labeling, the producer company/person, the properties of the compost, storage conditions, production code, date, intended use, instructions for use, and details about public health should be stated on the package [53].

