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Zusammenarbeit (GIZ) GmbH



How to Compost?

Household Composting



The brochure *How to Compost* (original: *Kako do komposta. Kućno kompostiranje*) was developed as a part of a public awareness campaign within the framework of the German Development cooperation project “Municipal Waste and Water Management (IMPACT)” in Serbia, implemented by the *Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH* in cooperation with the Ministry of Agriculture and Environmental Protection of the Republic of Serbia. The materials have been translated and adapted to the Greek context in the framework of the ‘Technical support for the implementation of the National Waste Management Plan (NWMP) of Greece’ project of GIZ Greece. The project is jointly financed by the European Commission (EC), via the Structural Reform Support Programme (SRSP), and the German Federal Ministry for Environment, Nature Conservation and Nuclear Safety (BMU) and jointly implemented by *Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)* and the Hellenic Ministry of Environment and Energy (YPEN), in collaboration with the European Commission (EC). The material has been modified from its original language and country setting Serbia. The views expressed herein can in no way be taken to reflect the official opinion of the European Union.

The project addresses the improvement of municipal waste management, regulatory issues of the waste sector, and the management of specific waste categories, in line with the European Union and national legislation for the circular economy. One of the main tasks of a circular economy is the reduction of waste to be landfilled, i.e. the efficient utilisation of resources. Organic waste is biodegradable, and decomposes when disposed of in landfills, generating gases and leachate which pollute the environment. Composting waste and restoring biological materials and nutrients into the natural material cycle reduces environmental pollution, achieves financial savings and decreases use of artificial fertilisers.

This brochure contains the basic information and steps required for household composting. It is intended for all citizens who desire to compost in their own backyards. However, even if household composting is carried out throughout a municipality, this does not reduce the responsibility on the part of the competent authority to manage biodegradable waste, since not all organic waste that originates from households is suitable for composting at the household level. Composting at the municipal level calls for the engagement of professionals to determine the appropriate technology and to develop necessary technical documentation and instructions.

Having in mind that allocating land for landfills is becoming increasingly difficult from the technical and social points of view, as well as the negative effects of landfills, especially for disposing of organic waste (soil pollution, emissions into the air, climate change impacts, water pollution, impact on health, etc.), there is a global need to resolve the issue of waste disposal. Thus, waste composting has become increasingly necessary. In view of increased costs for waste disposal, composting is becoming a financially tempting alternative source of income.

Processing and utilising chemical fertilisers contributes to soil depletion, which is why compost has been recognised as an important soil conditioner, needed in large amounts to support soil fertility.

As a treatment method for biodegradable waste, composting has positive environmental impacts, as it significantly prevents the pollution of water, air and soil.

The positive effects of household composting and composting in commercial plants on a regional level are as follows:

- Greater protection of the environment and human health;
- New job positions in composting plants;
- Possible income, and
- Application of technologies based on biological processes fulfils an environmental and human need, both at a local level, aimed at waste management, and at the global level, aimed at reducing greenhouse gas emissions.

INTRODUCTION

The definition of waste management, established in the 20th century, is that of waste treatment in a manner that minimises negative impacts on human health and the environment. In the 21st century, sustainable waste management is talked about, which refers to integrated waste management. This is a system that deals with all waste streams in all stages, from waste generation to collection, selection, recycling and treatment to disposal.

According to official data published by authorities, the generated quantities of waste in Greece show that approximately 514 kg of municipal waste per person per year are generated (NWMP, 2020-2030).

The composition of the waste is such that 66.5% of municipal waste is comprised of biodegradable fractions (garden and food waste, paper), where biowaste (garden and food waste) is about 44% and garden waste makes up a 10% of the total municipal bio-waste (NWMP, 2020-2030)

In rural and suburban areas, people live in family homes, are mainly following the Mediterranean diet and are usually occupied with agriculture. Due to such activities and lifestyles, large amounts of organic waste are generated from households, gardens, fruit-growing, farming, raising livestock and other activities. In Greece, landfill remains the dominant operation of municipal waste.

Composting is the most natural and the oldest method of organic waste recycling. It can be conducted individually in gardens or yards, jointly on suitable and pre-chosen locations within a settlement, as well as in composting plants which accept deliveries of previously separated organic waste. Organic waste constitutes the ideal raw material for creating compost intended for soil conditioning. In accordance with European politics concerning waste management, European citizens are engaged with the goal of reducing the amount of waste sent to landfills. The new National Waste Management Plan 2020-2030 in Greece prescribes reductions of landfilled municipal waste in the future; it foresees that by 2030, Greece will have reached its goal of 10 % or less of total generated municipal waste to be disposed of in landfills, while the amending 2018/850 Landfill Directive to be transposed into national legislation, puts in place further restrictions by prohibiting the landfilling of municipal waste that has been separately collected for recycling, in accordance with Directive 2008/98/EC.

Due to all this, it is imperative that municipalities get organised, with support of their residents, to reach their goals and reduce the amounts of biodegradable waste sent to landfills. This goal can only be achieved with maximum commitment on the part of residents to separate biodegradable waste and apply various technologies, from household composting to urban composting facilities and other current solutions for treatment of biodegradable waste (anaerobic, aerobic digestion, incineration, etc.).

Sources:

YPEN (2018 data), National Waste Management Plan (NWMP) of Greece, 2020-2030

OP 'Environment and Sustainable Development: Guide for Source Separation Schemes & Systems for Biowaste Management, Greek Ministry of Environment (2012)

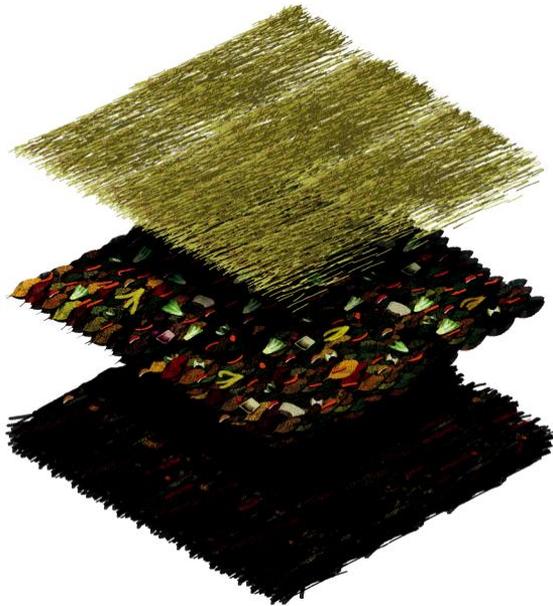
B. Lipinski, C. Hanson, J. Lomax, L. Kitinoja, R. Waite, T. Searchinger, Reducing Food Loss and Waste. Working Paper, Installment 2 of Creating a Sustainable Food Future., World Resources Institute, Washington DC, 2013

European Commission, https://ec.europa.eu/food/safety/food_waste/stop_en

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What is Composting?

Household Composting



Composting is the process of biological degradation of organic materials by microorganisms in the presence of oxygen and under controlled conditions (particular temperature and humidity) to generate compost. During composting, biodegradable waste (wet and solid organic material, food waste, garden waste, paper, cardboard, etc.) is stabilised, generating the product – compost, a material similar to humus.

Adding compost to soil has a positive impact on soil quality, allowing better permeability to water and gases as well as greater biological activity within the soil. Compost can be used to improve

the quality of degraded soils and as a fertiliser for the production of diverse plant varieties. Commercial compost must fulfil the relevant quality and environmental criteria according to the legislation in force

Composting can be conducted in your own garden or yard (independently), at suitable locations in settlements (joint composting), or at large composting sites (central composting), upon separate collection of bio-waste in separate containers and organised transport to the composting site.

Why Should I Compost?

There are many reasons why we should compost organic waste.

1 COMPOSTING SAVES MONEY



- Once payment per amount of waste is introduced, households that compost will pay a smaller waste collection fee².
 - The use of compost derived from waste will reduce the need for artificial fertilisers and improve the quality of soil.
 - Provides opportunity for organic agriculture development in households.
 - Reduces further need to purchase ready-to-use compost (or humus).
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2 PLANT HEALTH IS IMPROVED



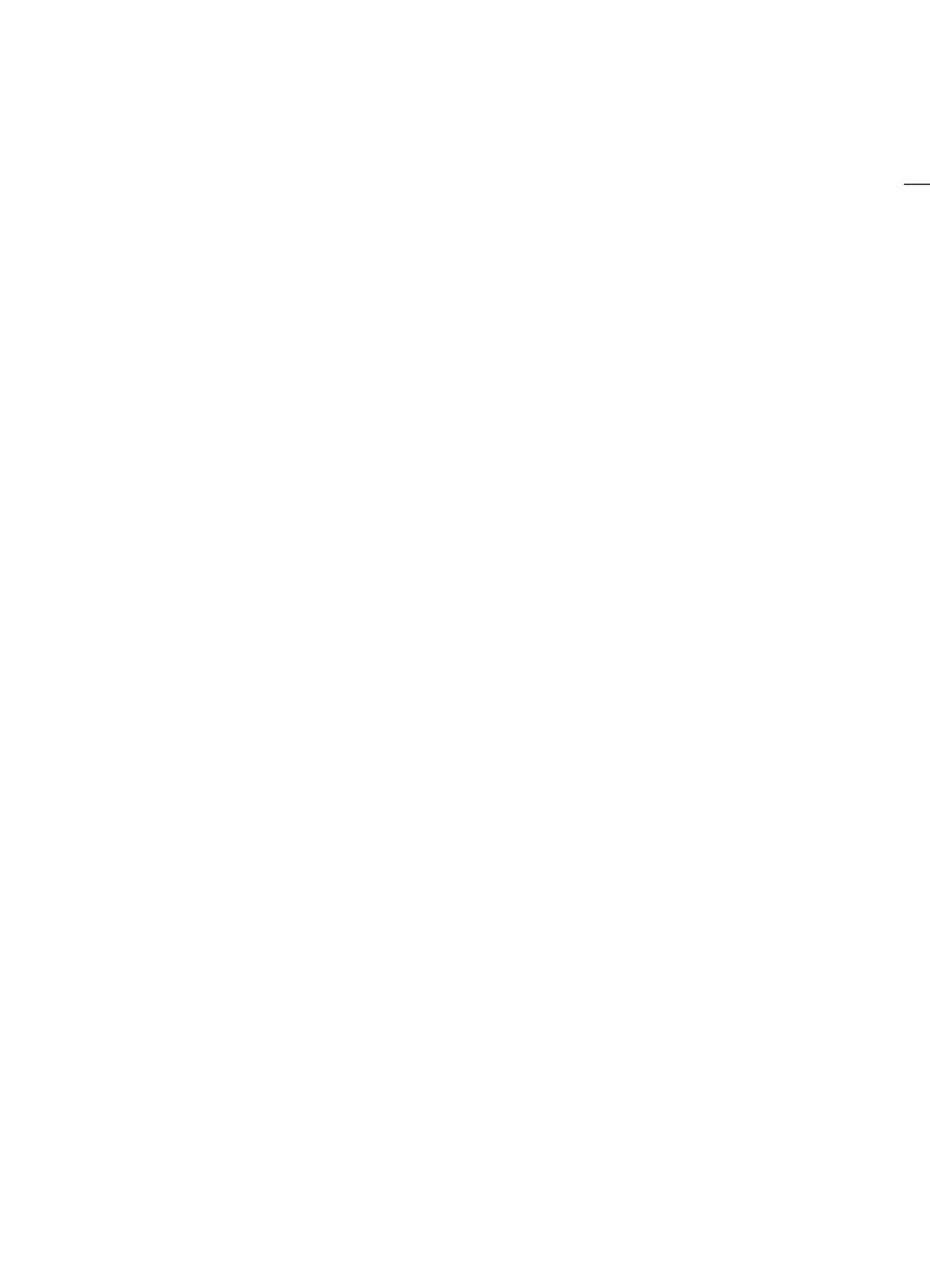
- With the reduced use of artificial fertilisers, plants feed on organic materials; this makes them healthier and less prone to disease, as compost improves soil texture, structure and capacity so that it retains moisture and nutrient content.
 - Soil structure is improved, drainage and aeration are accelerated.
 - Through compost, nutrients such as nitrogen and phosphorous make their way back to the soil, as do trace minerals, which are released slowly over a period of 1-2 years.
 - When used alongside straw and manure in coverage, compost helps conserve water and prevent weeds.
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3 ENVIRONMENTAL PROTECTION IS IMPROVED



- Contamination of soils is reduced as a result of non-landfilling of biodegradable waste.
 - Water pollution is reduced
 - Generation of harmful landfill gases (methane) is reduced. Landfilled organic waste, when deprived of oxygen during degradation, produces methane, a greenhouse gas which has a negative impact on climate change.
-

It is expected that, applying pay as you throw principle, the fees for waste disposal will be defined according to the amount of waste disposed (NWMP 2020-2030).



When Can Composting be Conducted?

Composting can be carried out throughout the year. During the composting process, the temperature in the composted material rises due to heat caused by microorganism activity; thus, low outside temperatures do not stop, but only slow down the composting process.



Composting can and should be continued during the winter period:

- Even when outside temperatures are low, organic kitchen waste can still be composted especially if composting has already been started.
- Lag your compost. Keep a store of wood chips and dried autumn leaves. Mix this with kitchen organic waste, then spread the mix on top of the compost heap.
- Processes in the compost heap are slower during the winter period. The activity of microorganisms (bacteria and fungi) generates heat; thus, even if outside temperatures are below zero, the temperature within the compost heap can still be between 40-50 °C. Only during long periods of low temperatures will the decomposition processes within the heap come to a stop.
- Decomposition processes will start up again once the outside temperature is above 0 °C. “Helpers” in the compost (various insects, centipedes, and other “decomposers”) likewise rest during winter, and composting worms retreat to the middle of the compost heap or deeper into the ground. With the beginning of spring, the rich activity within the heap will return, thus continuing the process that was started in autumn.



40—50°C

— ADVICE —

Inoculation of compost. If you already compost and have some old, ripe compost, add it into the new heap so that the decomposition process starts sooner. It is also advisable to mix in some larger pieces when sieving compost into the new heap.

What Can Be Composted?

Organic materials, including those in municipal waste, can be composted. Organic waste is separated into green (fresh) and brown (dry) waste according to its place of origin and moisture content.

- **GREEN WASTE** (organic waste rich in nitrogen (50%)): fruit and vegetable residue, fruit and vegetable peelings and skins, coffee grounds, tea leaves, cut grass, weeds, garden plants, withered flowers, grass waste, garden waste, animal waste, noodles, bread. Green materials provide nitrogen, moisture, and food for organisms which transform the organic material in the compost;
- **BROWN WASTE** (organic waste rich in carbon (50%)): leaves, dry wood chips from unprocessed wood, straw, hay, pruning residue from orchards and vineyards, sawdust, needles from coniferous trees, paper napkins, paper towels, egg cartons. Brown materials provide the necessary amount of carbon for organisms, adsorb moisture, and aid in increasing the amount of air in the heap.

GREEN WASTE



Ratio 1 : 1

BROWN WASTE



How to Compost?

In the mass that is being composted, the ratio of green to brown waste should be 1:1. The best C (carbon) to N (nitrogen) ratio to get quality compost is between 25 and 30. If the carbon content is increased (C:N ratio is too high), the decomposition process is very slow; if the nitrogen content is increased, the decomposition process changes into anaerobic and odours occur.

TABLE 1. Types of organic waste which can be used for composting

TYPES OF WASTE SUITABLE FOR COMPOSTING

CUT GRASS



Be cautious when composting cut grass. Grasses mostly consume nitrogen from the ground. This means that if a lot of fertiliser is applied, the nitrogen content in the grass is high. The cells of grasses also accumulate water, which in combination with nitrogen can lead to significant heat generation. The generated heat can even result in self-ignition of heaps of grass. Due to the fine structure and high nitrogen content of grass, the process of decomposition can become anaerobic, resulting in odours. This is when methane can be generated; it is released into the atmosphere and has a negative impact on climate (a gas with a greenhouse effect). To avoid such decomposition processes, add cut grass to the compost heap only when it has withered to an extent, and only in a thin layer, or mixed with other materials, such as fallen leaves, hedge trimming residue, or waste from maintenance of greenery.

FALLEN LEAVES



One of the most important materials for household compost. Some leaves decompose more slowly, such as leaves from:

- oak
- chestnut
- poplar
- plane
- beech
- juniper
- locust tree

Composting of such types of fallen leaves, especially juniper, generates tannic acid, which results in acidic compost; thus, it makes sense to add some lime or mineral clay. In contrast, leaves of the following plant species decompose more rapidly:

- nut trees
- maple
- linden
- willow
- ash
- rowan tree
- alder
- hazelnut.

TREE AND HEDGE TRIMMING RESIDUE



Shred such material using garden scissors or a shredder and add to compost for better aeration.

KITCHEN WASTE



- Fresh fruit and vegetable residue
- Coffee and tea filters
- Egg shells.

TYPES OF WASTE SUITABLE FOR COMPOSTING IN MODERATE AMOUNTS

TROPICAL FRUIT PEELINGS



To facilitate long-distance transport, tropical fruits are treated with fungicides. These chemicals are biodegradable and when present in small amounts do not threaten the process of composting. Thus, small amounts are not an issue for household composting.

PAPER AND CARDBOARD



Small amounts of kitchen paper or newspapers can be composted. Generally, paper and cardboard are biodegradable and decompose in household composting. However, they frequently contain components and additives which are not suitable for composting. Larger amounts of paper, printed paper such as newspapers and cardboard, egg cartons, as well as fruit and vegetable packaging could be better used by being recycled.

BEDDING FOR SMALL ANIMALS



For hygienic reasons, only bedding for small, herbivorous animals should be used for composting, provided the bedding comprises wood residue or hay. Bedding based on granulate, which is purchased as in shops, cannot be used for composting.

If bedding for small animals is not explicitly marked as biodegradable, it must be disposed of in the bin with other waste.

Mix the bedding and faeces well with other materials in the compost. Pet faeces should be added to composting materials based on straw and wood, to add nitrogen.

Dog and cat bedding and faeces, as well as bedding and faeces from other carnivorous animals, should not be added to household compost.

ASH FROM WOOD



Ash from combustion of non-treated wood can be added to compost in small amounts as a mineral ingredient. Mix ash well with other ingredients. Larger ash particles are not suitable for compost, as larger concentrations of heavy metals in ash can contribute a significant content of heavy metals to the compost.

YOUR COMPOST SHOULD BE FREE OF THE FOLLOWING MATERIALS

Newspaper or colour magazine paper

Ash from coal

Plastic, metal, glass

Dog or cat excrement

Pharmaceuticals

Bones, meat, fat, food leftovers containing meat or fish

Vacuum bags

Inseminated weeds

Disposable diapers

Diseased plants⁴

Walnut leaves

Coloured or painted wood and plywood

Tobacco

Organic waste that was in contact with petroleum, petrol, oil or protective paint/colours, and pesticides

Cut grass from lawns treated with herbicides

Introduced species such as wild wormwood, ambrosia and giant pig weed

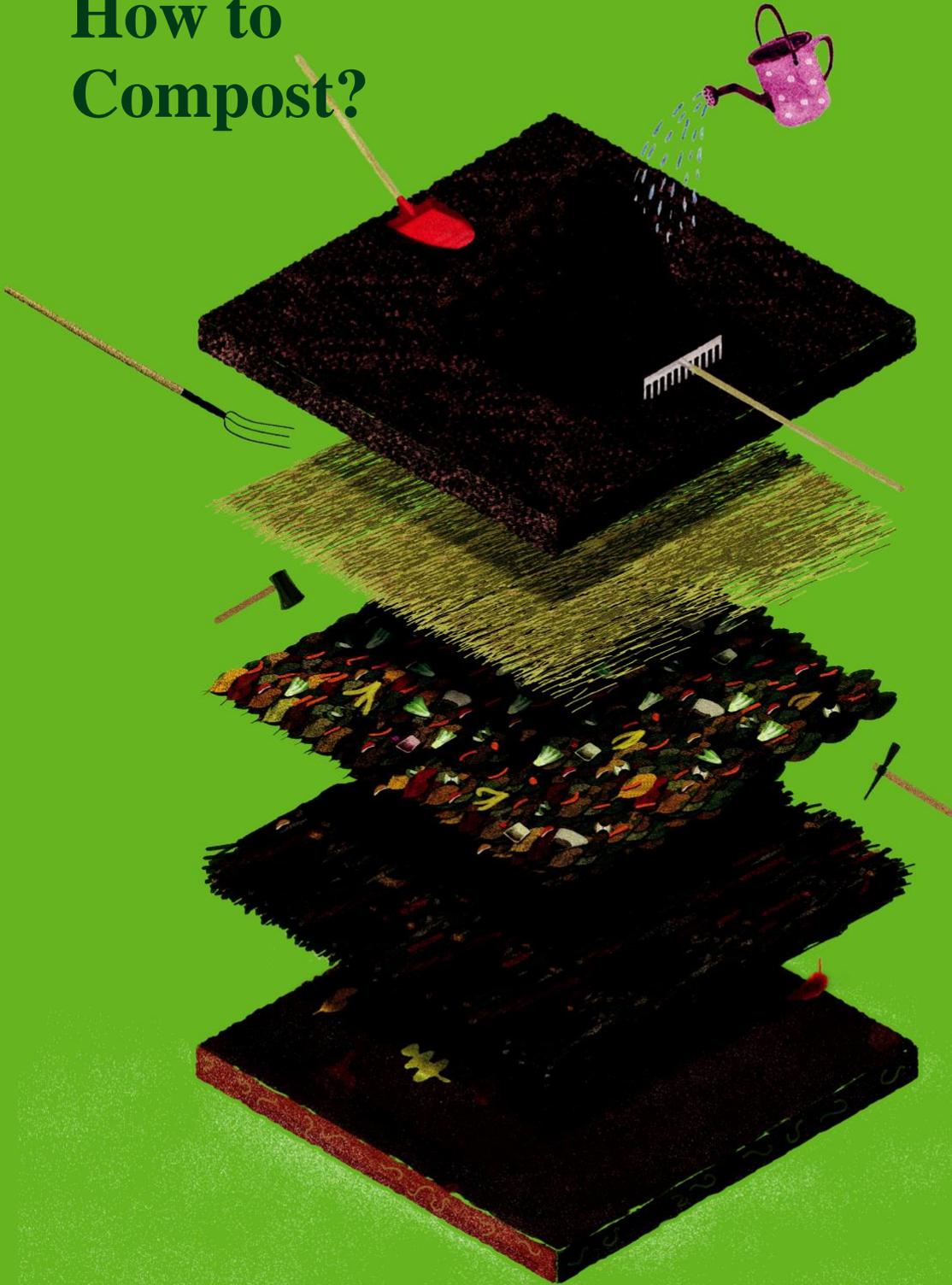
Sludge from the gutter

Construction material and rubble

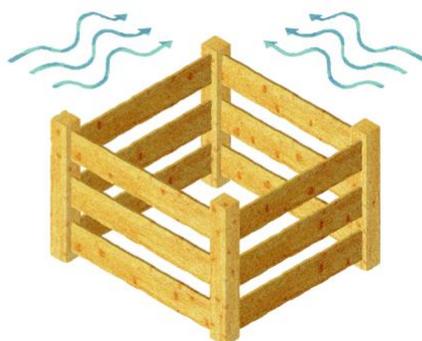
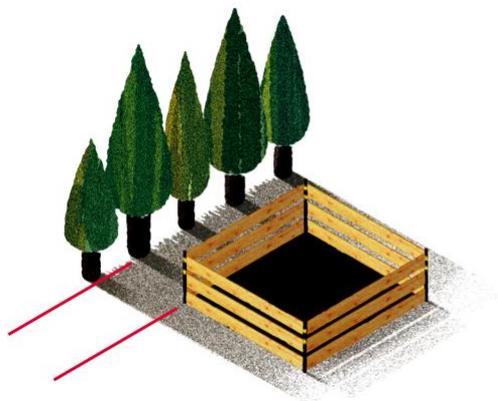
Food waste which is not of plant origin (meat, sausages, fish, bones, etc.) is not suitable for household composting since the process cannot achieve the temperatures necessary to eliminate pathogenic microorganisms. In addition, cooked food waste should also be avoided so as to prevent attracting various animals (rodents and the like).

⁴Diseased plants or plants affected by pests, either from the garden or indoor facilities, should not be composted. Animal pests such as lice, red spiders, or fly larvae will die only if compost reaches very high temperatures. Fungi and their spores, such as, for instance, fungi of the family Erysiphaceae (powdery mildew) on cucumbers and pumpkins, Peronospora on lettuce and spinach, blight on geraniums and black spot on roses are not likely to be destroyed

How to Compost?



How to Compost?



PREPARATION OF SPACE FOR COMPOSTING

The compost bin or heap should be located in the backyard or garden, in a convenient place for emptying the food waste bin. If possible, place the compost bin or heap on soil (on concrete surfaces, use only compost bins with a sealed bottom) as this will allow leachate to drain into the soil and enrich it with nutrients.

It is important that the compost heap is kept in semi-shade, protected from wind, and that it has enough airflow. The heap should not be placed in the shade, as this would make it cool too quickly.

The compost heap should not be placed near trees or vines since the roots of these plants “steal” nutrients from the compost.

One of the methods of composting at home is by piling waste in a heap on the ground, rather than in a compost bin. The composting process will still occur, but will be less controlled and less protected from outside impact (wind, rain, etc.).

HOW TO MAKE A COMPOST BIN

Compost is most often prepared on soil, in a suitably enclosed space. If the compost bin is on a solid surface (e.g., concrete), it must have a sealed bottom.

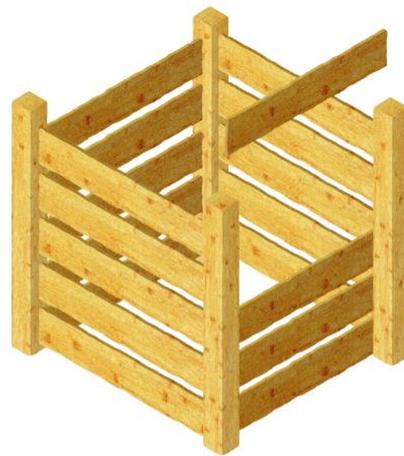
It is important that the compost bin is airy, covered, and that it allows the composting mass to be mixed. There are many ways to make a compost bin. The bin can be made out of any kind of durable and solid, but well-insulated material to assist the composting process. The selected material, along with the size, shape, and design of the bin will have an impact on the composting process, which is why it is important to seriously consider these factors.

Speaking of materials, wood is the first choice, primarily because it is easy to process. It is advisable to use recycled wood, such as desks, drawers, laths, stakes, and wooden pallets for construction. Other materials could be: bricks or blocks, chicken wire, sheet metal and plastic.

It is also possible to buy plastic compost bins. These are frequently circular in shape. Rectangular bins use up more space, but are similar in volume to circular bins. If the bin is too small, the composting process will be slow. The smallest capacity of a compost bin is 1m³, which is big enough that the composting process proceeds properly. In ideal conditions, if there is sufficient space, the compost bin could have two chambers to enable the compost to be aerated by shoveling it between chambers.

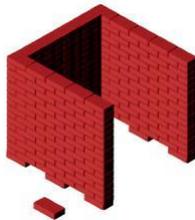
The steps in making a compost bin are as follows:

- 1 Chose materials for the compost bin
- 2 Determine the volume the bin (minimum 1 m³)
- 3 Assemble and fasten three sides
- 4 Make the fourth side removable
- 5 Make the lid (or cover it with a piece of an old rug or sheet metal) so as to prevent rain infiltration.

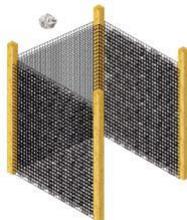




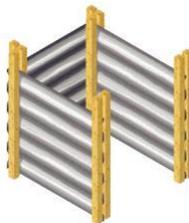
Wooden laths:
Nail the laths, leaving some space between the laths on all four pillars



Bricks or blocks:
For ventilation, remove several bricks at the bottom of the compost bin for ventilation



Chicken wire and newspapers:
Make two "wraps" of wire and fill the space between them with newspapers.



Corrugated sheet metal or plastic:
Support such walls with firmly and deeply-rooted pillars.

WHAT TO PUT INTO A COMPOST HEAP

Keep a separate organic waste bin in the kitchen to collect waste for composting. Fragment all organic material destined for composting to approximately thumb size (5 cm).

It is good practice to keep aside spare brown material, such as fallen leaves, in bags, for covering the compost heap.

- Larger cut pieces of brown waste should be placed at the very bottom to assist ventilation and drainage of unnecessary water; a thin layer of kitchen (or green) waste is added on top of this. Then, add alternate brown and green waste layers until the heap is full.
- Cover the compost. Water should only be added if necessary. Check to see whether the heap has enough moisture if it is covered with textile covers, e.g., blankets. When adding new waste, maintain the alternate layering of brown and green waste.
- Large quantities that are added at once will disintegrate faster than small quantities that are added several times. When the heap reaches a height of 1 meter, it would be good to mix it every two weeks to keep it aerated.
- Compost is ripe when it turns dark brown or black colour and develops a sweet smell like forest soil.



All biological-organic residues from kitchens (apart from cooked food), gardens, lawns, and orchards can be composted

All kitchen waste is collected in a separate bin. Bring plant residues from the garden to the pile near the area where the compost bin will be set up. Spread cut grass in a thin layer so that it can dry. Pile branches, woody residue, and dry leaves are separately. Chop branches into small chips.

To stack the compost heap, use an equal proportion of hard woody and soft watery ingredients. The amount of organic waste rich in nitrogen and organic waste rich in carbon needs to be equal.

Fragment all waste to pieces not larger than 5cm in size (length of thumb), but succulent green garden waste (e.g., grass) should be withered before being placed on the compost heap.

Soft, wet and hard, woody parts should always be mixed in equal amounts

Small pieces of wood ensure that the compost heap gets the necessary ventilation and looseness, while soft plant waste provides food for organisms. Add water gradually, as needed.

A well-stacked compost heap with optimum moisture content will reach 50 °C very quickly, which speeds up composting and, at the same time, leads to a hygienic treatment of the compost.

Regardless of the season, the compost heap needs to have optimum moisture content and be well-aired. This can be tested: squeeze the material in your palm; as water should not leak out from the squeezed material, the shape of the material should not change, and the material should not rustle.

HYGIENE

Biological waste and compost heaps are generally not harmful for human health, provided some basic rules are observed: people allergic to mildew and immunocompromised people should be cautious and eliminate bio-waste from their kitchen as soon as possible, and ideally should not place waste in the bio-waste bin or in compost bin themselves. For healthy people, composting in your own garden is absolutely safe. Scientific research indicates that use of compost suppresses plant diseases transmitted through soil on the one hand (phyto-sanitary effect), while on the other, it can transfer human and plant pathogens into the soil, as well as weed seeds.

In commercial composting, pathogens and weed seeds are destroyed primarily by the heat generated in the decomposition process. Sufficiently high temperatures over a longer period of time, in combination with, among other factors, appropriate moisture content, can help to eliminate pathogens and weed seeds.

In household composting, such temperatures are rarely achieved and they do not occur constantly over the necessary period of time, because the relatively small heaps do not generate sufficient heat due to their unfavourable surface/volume ratios. Numerous human, animal and plant pathogens, weeds with seeds, and weed roots might not be destroyed with absolute certainty in household composting.

This is why certain plants and plant parts are best disposed of in the municipal bio-waste collection system.

THE PRODUCT OF COMPOSTING

The product of composting is compost, dark brown to black in colour, similar to humus, lumpy, with a pleasant smell. Compost contains simple organic substances that are accessible to plants, and that are formed when microorganisms degrade the complex organic structures in composting materials. Depending on the level of composting and the intended purpose, there are several different types of compost:

- Stable compost — is achieved after 4-6 months, ready for application, stable and clean, and contains less nitrogen than in the preceding months. This type of compost can be used on fields.
- Mature compost — compost is mature after 12 months and is beneficial for sensitive crop cultivation, as a long-term fertiliser, as an agent for improving soil quality, as an additional nutrient for indoor plants, and in the preparation of substrates for seedlings.

Compost maturity can be evaluated by planting fast-germinating seeds. Place compost in small containers, followed by seeds. If seeds sprout after 2-3 days and grow into healthy plants 10 days thereafter, the compost is ready for use. If the seed does not sprout or if weak plants grow, the substrate needs to be returned to the compost heap until the compost reaches maturity. When the process is complete, sift the compost, and use the small-sized substrate, while returning large pieces back into the heap.

PROBLEMS THAT COULD ARISE WHILE COMPOSTING

The following table presents potential issues that could arise and their possible solutions.

ISSUE	SOLUTION
Insects swarm the compost	Add only fresh bio-waste to the compost heap. Bury it in the already existing heap, then sprinkle a small amount of slaked lime or stone dust on top of it, or apply a thin layer of soil or mature compost. Do not add cooked food left-overs to the compost heap.
The compost heap is not heating up	Heating can be stimulated by shaking or turning over the composting materials. Adding soft, fresh material or cut grass will have a positive effect on increasing temperatures. Cover the heap to retain heat.
Unpleasant odours are noticed	The compost heap can release an unpleasant smell only if the material is too moist. In that case, mix the heap to ventilate the material, and mix in a small amount of larger pieces of wood, paper, sawdust or leaves.
Bio-waste is not decomposing	Check the ratio of green and brown material. There is probably a shortage of green material, or the pieces of brown material are too large. Add green material and cover the heap to speed up decomposition. If the heap is dry, add water.
The compost is too moist	Turn over the entire compost heap, and add dry matter to enhance ventilation and help dry out the material.

PLANT REQUIREMENTS FOR COMPOST

Different plants have different needs for compost. The following table illustrates the recommended quantity of compost for selected plant types.

PLANT TYPE	QUANTITY (l/m ²)
Vegetables (per cultivation season)	
with a high nutrient need	Around 3
with a medium nutrient need	Around 2
with a small nutrient need	Around 1
Trees (annually)	Around 1
Shrub vegetation (annually)	
large growth	Around 2
small growth	Around 1
Lawn	Around 2

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