# THE COMPOST – A METHOD TO RESTORE THE ORGANIC WASTE PRODUCTS IN THE NATURAL CIRCUIT

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**Cuvinte cheie:** compost, deşeuri organice, descompunere.

**ABSTRACT:**

Half of the quantity of waste products produced by the households is made of food remainders, vegetable and garden remainders and more of 50% of waste products are organic and they arrive in waste products storehouses, in cesspools or are burned, causing an important pollution. As an alternative to those, we can transform the organic material through a set of microbial, biochemical, chemical and physical processes into a valuable material with a humus appearance, named compost. To obtain a quality compost we need to lead the compost process, in accordance with the dimension, the humidity, the structure and the composition of residual materials, that these to be fast and efficient available to the micro-organisms, making up an ideal substratum rich in nutrients for their development. The decomposition agents (bacterium, fungous, mites, Collembola, wooden lice, worms, diplopoda) need the azote to build the cells and some food remainders, ripped grass and green leaves. The chips of wood, the dry leaves and the sawdust are rich in carbon and they constitute another energy source for the decomposition agents. The azote sources are designated as the „green" elements, and the carbon sources are the „brown" ones. In a pile of compost is efficient to maintain a balance between the „brown" elements (carbon) and the „green" ones (azote) – in percent of 30:1 to offer the decomposition agents a balanced nourishment and this thing can be acquired through the alternation of layers of brown and green elements. The production of compost in schools can be a way to determine the entire school community to work together for helping the environment. This means the natural recirculation of resources, community education over the benefits of the compost, the change of the cultural attitude over the garbage in a way that brings benefits to the society, the reduction of the alimentary remainders quantity from the school canteen, the implication of the students in extra- curricular activities, and, not finally, the acquirement of a fertile soil for school garden, for planting flowers and seedlings. The using of the compost as a fertilizer contributes to: the improvement of the soil structure and his resistance to erosion, the supply with nutritive elements necessary for the plants growth (because the deliver of the nutritive substances inside the soil is made gradually, the compost permanently supplies fertilizers to the soil), the development of the soil fauna (especially the dew worms that contribute to aeration), the diminution of the negative effects of toxic agents like pesticides or heavy metal because of the disuse of any chemical fertilizers, the increase of the soil capacity to retain water, the removing of some pathogenic factors from the soil, the soften of the quite clayey soils, the solving of the climate changes problem, because the compost retains the carbon dioxide at the ground level.

If the forming, the informing and the communication represent products of the educational processes, then the purpose of educational institution is to make the students aware and responsible in relation with the environment problems. The education for environment and for a sustainable development needs to be based on a solid scientific base, through the contribution of the experts who understand the complexity of the environment and the interactions between the geospheres.

In schools, the purpose intended during the activities for knowing the environment surprises the development of the knowledge and understanding capacity, the stimulation of the curiosity for its investigation, the forming and the practise of some habits of looking after and preserving the environment in order to develop a positive behaviour towards this. Through the methods used (the conversation, the explanation, the observation, the test, the problems, the case study, the learning through discovery, the role playing, the education assisted by the computer, the learning through projects) the students understand the way the environment works. In our days appear more and more vegetable waste products in different daily activities, that are worthless stuff difficult to be removed. One way that might bring a solution is the transformation of these waste products into compost. The compost, like an operation of controlled decomposition of vegetable remainders was practiced by man for centuries, with the object that the outcome humus to be restored to the soil to maintain his fruitfulness. It results a stable product, that doesn't contaminate, with a high nutritive value for plants and cereals, a very good increase to the physical and chemical state of the soils. The compost is the oldest and the most natural way to recover the waste products. If the process is controled regarding the accelaration of the decomposition, the optimisation of the efficiency and the minimize of the impact over the environment and the population, the compost can be also applied to the green waste products/ the solid municipal waste products. We can make compost from the organic waste products that result from the domestic remainders, especially cooking waste products, that are recoverable biologically speaking, the remainders from fruits, vegetables and other aliments, and the green waste products, like leaves and cut short grass.

The compost experiment as a method for reintroducing the organic waste products in the natural circuit can be made in school with the students, especially in the schools that have canteen and garden, orchard or park. The compost offers responsability to the schools and involves the students in extra – curricular activities. It provides the recirculation in the natural way of the resources, it changes the cultural attitude over the garbage in a way that bring benefits to the society, reduces the quantity of alimentary remainders from the school canteen and creates a useful product: a fertile soil for school garden, to plant flowers or seeds. During the classes, the scientific notions connected with the production process of the compost, can be easy incorporated in the schools' curricula of Natural sciences, and a circle of ecology can make from the production of the compost a mixt project that combines the school curriculum with practical lessons in the service of the community, that later can be adopted as an official school program. The equipments and the tools necessary to the production of the compost are: the compost boxes, rake and/ or shovel, spear of hay or spear garden, work gloves, thermometer for compost, wheels, buckets, a sufficient quantity of material for stuffing like leaves, chips of wood, sawdust, drums for food debris or containers with labelled wheels, sieve. The construction of the boxes for

compost can be achieved by different members of the school community or by the school administrative staff. Another alternative is the construction of the boxes for compost as a project for students during the groups after classes, of some practical training hours, or as a tehnical project of the school.

The best method to obtain compost in school is making it in wooden crates of $1m^3$, with slits aeration and a detachable front side. These must be located in a convenient location, on a straight surface of grass or soil, to assure the drainage and to facilitate the access of the administrative staff. The ideal location would be a place with shadow, easily accessible because the material inside the box must remain warm, moist and with oxygen. It must be established a place where will be gathered materials from the garden or from the orchard, like grass, leaves and remainders from the vegetation care. This will allow to be aded in the compost box immediately after they were obtained and, on the other side, to be easy to reach to mix them in many stages with the food scraps. First, we gather in piles the vegetable remainders from the vegetation care, broken branches or other vegetable scraps until we obtain a layer, thick of 10 – 15 cm. This is in fact a base layer for the rest of waste products from the compost process. We can add finished compost, earth, manure or a little of each. Once the „bed" made by remainders from the garden is finished, we can add organic waste products from the kitchen mixed with garden waste products. The purpose of the compost box is double. On one hand, we avoid that a big part of the waste products to arrive at the waste products storehouses or to be burned, and, on the other hand, to obtained a natural fertilizer of high quality. Because of this is very important that the waste products inside the compost box to be organic ones carefully selected , that don't contain plastic elements, cans, batteries or any other product that might contaminate the fertilizer that we will produce. Regarding the paper, we can put inside the compost box only paper in wich was packed food, paper that doesn't present traces of ink. In the compost box we can add food remainders (untreated chemical), leaves, grass (but not very much because it is rich with azote), remainders from preparing the coffee, eggs shells, etc. (table 1).

**Table 1.** The content of the compost box.

| **Recommended materials** | **Not recommended materials** |
|---|---|
| Remainders from vegetables and fruits (onion, carrot, cabbage) | Cooked food |
| Tea envelopes | Bread |
| Cardboard | Fats |
| Towels and paper bags | Sauce, oil, mustard |
| Cardboards for eggs and egg shells | Waste from dogs and cats |
| Citrus peels | One use diapers |
| Coffee grounds | Ashes |
| Flowers | Mud |
| Cut grass | Soil |
| Human hair | Plastic products |
| Hedge | Stones |
| Home plants | Metal |
| Water | Aluminium containers |
| Sawdust | Weeds with seeds |
| | Bones |
| | Meat |
| | Fish |
| | Glass |
| | Tetra paks |
| | Dairy products |
| | Sand |

There must be assured the optimal quantities of food, moisture (water) and oxygen for that the decomposition agents to grow and to reproduce continuously (fig. 1). The decomposition agents (bacteria, fungous, mites, Collembola, wooden lice, warms, diplopoda) need azote to build their cells; and the food remainders, the cut grass and the manure are excellent azote sources. The wood chips, the dry leaves and the sawdust are rich in carbon, a source of energy for the decomposition agents. In the specialty jargon, the sources of azote are designated as „green" elements, and the sources of carbon are the „brown" ones.

In a pile of compost is effective the maintenace of a balance between the „brown" components (carbon) and the

„green" ones (azote) – in a percentage of 30:1 to offer to the decomposition agents a balanced nourishment. The alternation of layers of brown and green components helps in maintaining this balance. The „brown" components are also called „materials for stuffing".

The reason is that beeing more dry, they don't allow the pile of compost to be burden, it remains easy and loose and assures a free circultion to the air. A pile of compost that is too moist and compact will start to smell as a result of the anaerobic bacteria action (bacteria that doesn't need oxygen to grow). It needs to be wet, but not flooded with water. The food has a high content of water and usually is wet enough to maintain the moisture of the pile of compost. By the regular turn, the pile gets aerated and the brown and green waste products are mixed. The water content is essential for all living organisms. Most micro- organisms are very sensitive at the existence of this factor in their environment. When the moisture from an active blend from a pile of compost falls under 35 – 40% (in the conditions under which water content represents 34 – 40% of the total weight), the decomposition speed is reduced significantlly as the micro – organisms aren't capable to continue their metabolic activities; at a moisture lower than 30% they cease permanently their activity. On the other hand, too much moisture creates the ideal conditions and leads to the rapid appearance of anaerobic micro – organisms, as the water fills the tiny spaces from the blend. This situation leads to the disappearance of spaces for air, situation that doesn't favour the existence of micro –organisms that consume oxygen(aerobic micro – organisms), but the anaerobic ones appear. When the quantity of oxygen is insufficient, the conditions favorise the anaerobic micro – organisms, and these lead to the appearance of a processless effective and nasty smells. In this way, the moisture content and the oxygen availability are tied together :while the micro – organisms need moisture, the material that is too wet and too heavy will not have spaces between particules for the air to circulate. The ideal status is the one in which the material is moist, but not wet, that means when it is serried in hand, the moisture should make itself felt, but the water mustn't flow. If the material in the hand is friable after it was serried, than it needs water. If, on the contrary, the material has too much water, we can add dry material in the box (sawdust, dry leaves) and drain/ monitor the box trickling. The fresh alimentary remainders are always stored in the first box. When this one is full, its content is transferred in the second one. Meanwhile, in the first box there is started again the collection of fresh alimentary remainders. When the first box is full again, the content of the second one is transferred in the third box, and the content of the first box in the second one. The process is restarted in the first box and the sequence continues, according to how many boxes we have. We reserve the first box for the fresh waste products from the kitchen and garden. The more carefully we will mix in the appropriate proportions the green and the brown waste products, the better quality compost we will get from the beginning. After each time we add new material, the volume will decrease again.

In practice, the best blend isn't always possible. In the summer there is always a grass excess, in the autumn there are always more leaves. We need to keep the brown waste products nearby, so every time we add in the first box remainders from the kitchen we need to mixed them with materials for stuffing.

The second box is kept for what will result after the first turn. With a pitchfork we put out the material from the first box. We get everything out and we clean it very well, we mix, aerate, then we introduce it in the second box. The process of producing the compost reaches the maximum point with the strong heating of the compost. It is expected an increase of the temperature to $50^0$C or even more. This thing is important especially when the process of turning into compost is somehow evolved and when it rains regularly. The compost mustn't be directly covered with wood or plastic. It is important that the air to circulate between the compost and the roof. The third box must be covered. It is the stage where the molds are responsible for continuing the process, and these ones, unlike the bacteria that operated in the initial stage, work much better in conditions of more reduced moisture. The maturity and the nitrification that accompany the process (transforming the ammonia into nitrate) are improved if the material is somehow drier. The pH of the dry compost is also neutral. Finally, a compost somehow drier is easier to be manipulated: the drier compost is easier and it is much simple to take it with the shovel, to sieve it and to spread it on the groundside.

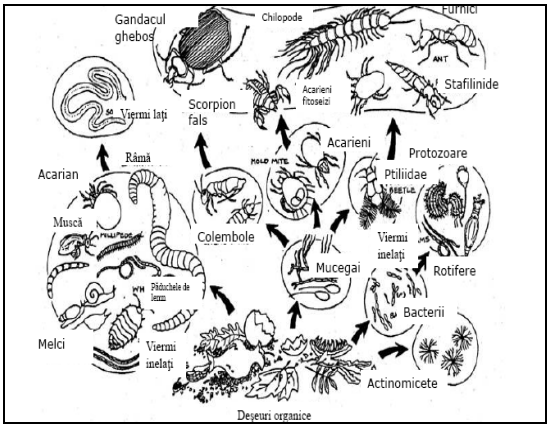


**Fig.1.** The food chain in the pile of compost.

**Fig. 2.** The temperature variation in the compost box.

We identified three main phases of the compost process (fig. 2):

I. **phase 1**, *the stage of mezofil fermentation*, that is characterized by the growth of bacteria and temperatures between 25 and $40^0$C;

II. **phase 2**, *the termofil stage* in which are presented the bacteria, the fugus and the actinomicete (the first level of the consumers) at a temperature of 50-$60^0$C, decomposing the cellulose, the lignite and other resistant materials; the

superior limit of the termofil stage can be $70^0$C and it is necessary to maintain the temperature high for at least a day to assure the destruction of the pathogens and contaminants;

III. **phase 3** is *the maturation stage*, where the temperatures decrease and grow stable. Some fermentations continue, converting the degraded material in humus by reactions of condensation and polymerisation; the last objective is to produce a material that is stable and can be judged regarding the report C:N. The materials well composted have a reduced report C:N. The C:N report can decrease from 30 at the beginning of the compost process to 15 at the mature compost.

The volunteers among the students and administrative staff will have to be trained regarding the daily activities related to the processing of the alimentary remainders. The programming of these tasks depends on the school lunchtime, on the availability of the volunteers and on the elements that are mostly agreed by the staff of the kitchen and the caretaker involved in the programme. A team of two or three students, watched by an adult, can hold the next daily tasks in about 15 minutes.

Task 1: The food scraps collecting
Task 2: The food scraps weighing
Task 3: The transportation of the food scraps to the boxes
Task 4: The compost temperature measuring.

This activity must be made daily for a while(for example, before and after the turn). The long probe of the compost thermometer is pushed carefully in the center of the compost pile, where it is the warmest. The temperature is read and registered in the table. Measuring the temperature in the pile of compost is a way to measure the progress of the transformation process of the alimentary remainders in compost. A pile of compost in work take certain phases, becoming warmer as the decomposition agents work and reproduce themselves, after that getting cold. If the compost is getting cold before most of the decomposition having taken place, this is a sign that the report between the alimentary remainders, air and materials for stuffing must be adjusted. Usually, a decreasing in temperature indicates the fact that it is time to turn the pile by transfering it in the joined compartment for compost.

Task 5: The foodscraps spreading.
Task 6*:* The applying of the layer with the material for stuffing.
Task 7: Cleaning.

The final compost can be otained after approximately 5 months and it has the following qualities: it smells and it looks like the soil from the woods, the finished material is uniform, the colour is dark (black or dark brown), it doesn't contain easily identifiable materials, it contains a limited number of seeds with the capacity of germination, the pile decreased until 1/3 of its initial volume and it doesn't reheat itself.

The use of the compost as a fertilizer contributes to: the improvement of the soil structure and of its resistance to erosion, the supply of nutrients necessary for the development of the plants, because the release of the nutrients in the soil is made gradually, the compost permanently provides fertilizers to the soil; the increasing of the soil fauna, especiallly with the earthworms, that contributes to the aeration; the reducing of the adverse effects of the toxic agents like pesticides or heavy metals, because of the disuse of any chemical fertilizers; the increase of the soil capacity of retaining the water; the removal of some pathogen factors from the soil; the soak of

the quite clayey soils; the solving of the climate changes problem, because the compost retains the carbon dioxide at the ground level.

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