Composting of the Green Waste Also its Use under the Ecological Reconstruction of Waste Dumps

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Abstract: - The compost, the final result in the process of composting material it is a stable and hygienic similar to the humus in the wood that can be used as the natural fertilizer and thereby avoid the need for chemical fertilizers. It is added to the degraded land and improves the material properties of the waste dumps. The research conducted in this paper focused on composting of biodegradable vegetable waste. For achieving the compost was be considered selection of organic materials with a high content of the C / N ratio, a ratio by 30/1. The composting was conducted aerobic the hot by putting in dump piles of vegetable matter which has previously was covered with a rule of leaves and branches. With a view to launch the progress of composting piles of materials were humidified also aerated after which they were covered with tailings dump. After the successful composted experience the in field ecological reconstruction of a heap with the apple tree saplings.

Key-Words: - composting vegetable waste, animal waste, aerobic, vegetation vessels and dump.

1 Introduction

Tismana I mining area is located in the northwestern part of Rovinari coal basin, on the right bank of the river Jiu in Câlnic village Pinoasa Câlnic region and includes the center of the Tismana brook meadow and hilly areas adjacent to it to the north and south. [9, 10]

The tailing work of stockpiles is performed on the inner Tismana dump in landfill steps from 10 to 15 m height, with machines and conveyor circuits. The inner stockpile Tismana II, will have at the end 6 landfill steps 15 m high, at a slope angle of $26^{0,}$ that means a green berm of 150 m. The surface covered by Tismana I inner landfill is 30 ha. Following the deposit pattern, it has shown several phenomena of instability although, at the moment, it is stabilized. Dump has an obvious impact on the landscape, on the morphology and hydrology of the area. Also, the sterile dumps have modified the ecosystems and new ecosystems have emerged but they are poorly developed. They have a high potential to support the biotic communities and possible use of these deposits to reduce the sterile dumps impact on the landscape and help integrate them into the landscape. [10]

2 Methodologies

Studies focused on the types of laboratory analyzes that need to be performed in order to obtain compost (chemical analysis of the compost components, CN ratio, their humidity, etc.) and studies of physical-chemical analyzes of soil after organic and mineral fertilization. [3] The research was conducted near the waste dump to be rehabilitated Tismana.

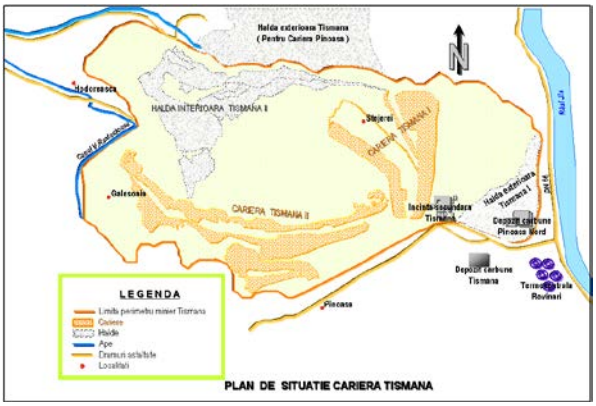

Figure 1. Tismana mining area [10]

Degradation of biodegradable substances is a natural process of decomposition. When man influences this process it is called composting. The final product of the aerobic biological treatment is the compost.

Composting is the biological decomposition of biodegradable solid waste under controlled conditions in a state that is stable enough to allow the storage and handling without problems, and that is matured sufficiently for safe use in fertilization of degraded land. [2]

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Only vegetable or animal waste can be biologically decomposed by the activity of microorganisms. [11]

- *Compost production*

Preparing quality compost as fertilizer and soil improver we took into account when choosing the raw materials aspects such as C / N ratio to be about 30/1, the collection of raw materials should have a low level of chemical pollution, the preparation of raw materials for composting, mainly consisting of shredding them into fragments of 2 to 8 cm and choice of composting technology (Table 1). The experiment and calculations were made for 2000 kg (2 t) of compost.

Table 1 The proportion of raw materials in the mixture (%) and quantities required

Name the group and raw material	**Participation% in the mixture**	**Required quantity (Kg)**
Raw vegetable materials, of which:	*60*	*1200*
- wheat straw	30	600
- corn stalks	30	600
Animal raw material, of which:	*40*	*800*
- cattle manure	30	600
- poultry manure	10	200
Total amount	*100*	*2000*

As a method of composting it has been selected the warm aerobic composting, in heaps directly on the ground after it had been uncovered about. 10 cm and then sunk. [4] The materials were arranged in horizontal layers alternating with those of vegetable with those of animal waste. After wetting, the pile was covered with the soil that resulted from the uncovering and had the role of initiator of the composting process. (Figure 2) [3]

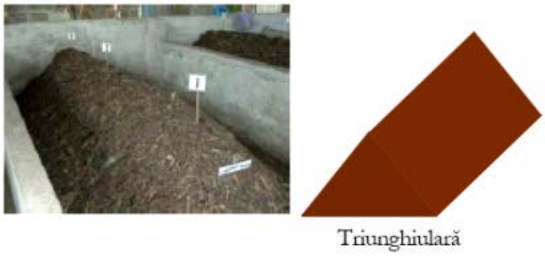

Figure 2. Passive stack ventilation system

Passive aeration is primarily natural aeration. During composting, the concentration of carbon dioxide increases and oxygen concentration decreases in the piles. [14]

Carbon dioxide concentration is greater than the atmosphere surrounding the pile. Because of this difference and the higher temperature of the pile, oxygen can enter it. It is therefore possible for oxygen to enter the pile penetrating up to 80 cm in thickness.

In addition, the method used known as the Chinese method, with aeration by tubes, is still considered to be part of a passive ventilation system. The force that puts things in motion is the chimney effect. [5]

Temperature was monitored so that during the first three phases to be between 45-75^{o}C and the last phase it was below 45^{o}C (diagram 1.). They made three reshuffles. Quality indices of compost are shown in table 2.

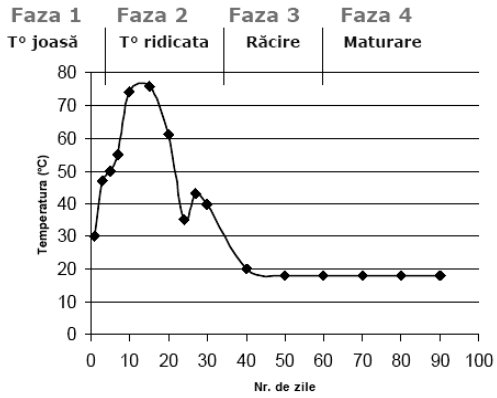

Chart 1 Temperature variation in producing compost

Table 2. Quality indices of compost

Quality indicator	Rating unit	Average values	Comments
Size:			
> 1 cm	%	26	medium coarse texture, good
1 – 5 cm	%	52	
1 - 0,5 cm	%	22	
Apparent density(AD)	g/cm^3	1,08	Very good
Humidity (U)	%	34	Good
Solubility in water	% of dry substance	0,56	Middle
C/N ratio		13,5:1,0	Very good
pH-in water solution		8,1	Normal
The content of mineral nitrogen(N)	%	0,67	Very good
Available phosphorus content (P_2O_5)	%	0,48	Good
Available potassium content (K_2O)	%	0,62	Very good

The turning over of the material is a possibility to increase the oxygen level. Turning over the material can be done manually or with the help of machines (figure 3.). [12]

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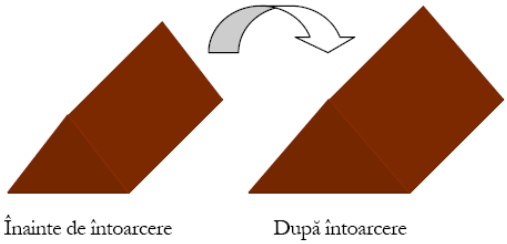

Figure 3. Turning over the material in piles

3 Results and discussions

- Soil analysis results

It has been observed the influence of internal fertilization Tismana II landfill material for a period of four years on *apple-walnut-raspberry-currant* on the following soils: V1 - unfertilized, V2 - fertilized chemically $N_{150}P_{75}K_{75}$, V3 - compost 10 t / ha, V4 - compost 20 t/ha, V5 - compost 30 t/ha.

The study has been placed on an uninvolved type of landfill soil, moderately eroded, mainly clay, very deep, formed on loess, Am-A/EB-Bv morphological sequence. The landfill soil has a slightly acid reaction (pH = 5.2 ÷ 5.6). Humus content is medium (2.5 g %), average total nitrogen, 0.11%, good supply of mobile phosphorus (4.5 mg %), medium supplied in mobile potassium (12.6).

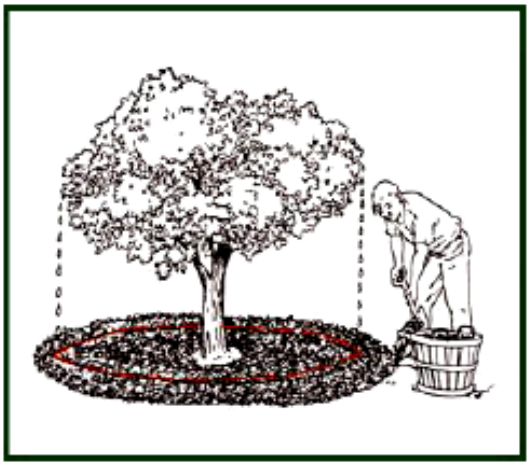

Figure 4. Managing compost around trees

- Management of chemical and organic fertilizers

As is vas given by the experimental protocol complex fertilizers NPK were used to prepare the seedbed and the rest of the nitrogen was administered on vegetation, during a second breeding.

Compost, given that it was produced later was applied before the seedbed preparation, being incorporated around the circumference of the crown (Figure 4).

Covering the soil around trees with a protective layer of compost to provides:

- Protection from extreme temperatures,
- Slow loss of moisture from the soil,
- Provides specific nutrients that are released slowly.

- Planting, care and observations on vegetation

It has been sown in experimental plot of the inner Tismana stockpile the early hybrid MM106, 740 plants / ha. Apple seedlings were sown in pots of vegetation, which were subsequently transplanted on the experimental plot (figure 5.)

Figure 5. Experimenting in vegetation pots on apple trees with seedling material variants

Maintenance work consisted two manual weeding in the rows and two mechanical weeding between rows.

Phenological observations were made, aiming sprouting time, the appearance of fruit buds at rest, leafy buds of fruit, pollination and different stages of maturation. Also, biometric measurements were made of components and productivity in adulthood.

- Plant and soil sampling

They collected samples of plants in 3 rounds on a surface of 100 m^2 which consisted of counting and weighing of their fruits and then productive and qualitative analyzes were performed.

They were collected with metallic cylinders 5x5 cm for measurements of physical features and with agro-chemical probe for the chemical determinations, on the diagonal of the plots, in three rounds.

- Chemical and physical analysis of plant and soil

It is stated that the application of compost the bulk density values decreases with increasing dose, both because of direct influence on soil by

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increasing the quantity organic material and the rise of stronger root system of plants (Table 3).

With chemical fertilization there is a decrease in the bulk density values due to indirect action on root system development, the values are similar to the version - compost 10 t/ha. The stability of water retention of aggregates, which increases with increasing doses of compost but the highest values are found where chemical fertilizers were applied.

Table 3 Influence of different doses of fertilizer on some physical properties of soil

Variant	Depth- (cm)	Apparent density		Hydro-stable Structural aggregates	
		(g/cm^3)	(%)	(%)	(%)
Unfertilized (M_t)	10-20	1,34	100,0	38,2	100,0
$N_{150}P_{75}K_{75}$		1,31	0,98	43,5	114,9
Compost 10 t/ha		1,31	0,98	42,0	110,8
Compost 20 t/ha		1,27	0,95	42,6	111,5
Compost 30 t/ha		1,20	0,90	43,0	112,6

- *Chemical analysis of soil land plant*

Applying compost contributed to the change of the aero-hydric regime and increased pH when used the 30 t/ha compost variant and on the chemical fertilized variant because of the acid produced, these values decreased (Table 4).

The amount of humus in all fertilized variants increased, the maximum values were recorded in the version - compost 30 t/ha.

Organic C content and total nitrogen increased in all the fertilized variants by bringing additional organic matter and nitrogen and for chemical fertilization by additional input of nitrogen and indirectly through better plant root system development. A similar trend was also found for phosphorus and potassium.

Table 4. Influence of different doses of fertilizer on some chemical properties of the soil

Variant	Depth (cm)	pH	Humus (%)	Organic C	N_t (%)	C/N	P ppm	K ppm
Unfertilized (M_t)	10-20	7,0	2,7	1,92	0,18	10,3	51	354
$N_{150}P_{75}K_{75}$		6,9	2,8	2,14	0,28	7,51	71	467
Compost 10 t/ha		7,0	2,9	2,33	0,24	9,64	65	407
Compost 20 t/ha		7,0	2,9	2,82	0,28	9,84	71	462
Compost 30 t/ha		7,0	3,0	3,46	0,31	11,0	75	495

Analyzing the chemical composition of apple fruit we notice that increased doses of compost and chemical fertilization increase the percentage of their nitrogen, phosphorus and potassium levels (Table 5).

It also increases the dry matter content, the highest values being found in the version - compost 30 t/ha.

In version - compost 20 t/ha and in the chemically fertilized soil values are relatively close, that makes us opt for organic fertilizer.

Regarding the influence of fertilization on the production of apple fruit, compared with the unfertilized sample, all variants produced very significant increases (from 39.5 to 66.9%). Compared to the chemically fertilized, values are close with the one occurred in the variant fertilized with 20 t/ha compost. Increasing the dose of compost 10 t/ha only caused an increase of 2.5% (not significant). In other variants there are very significant negative differences.

We ca conclude that the use of compost fertilizers in the apple crop can replace chemical

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fertilizers, from 20 t/ha compost variant and in terms of agriculture 2010/2011 fertilization with compost 20 t/ha is the most advantageous in every aspect.

Table 5 The chemical composition of apple fruit under the action of fertilization

Variant	Depth (cm)	N	P	K	S.U.
Unfertilized (M_t)	10-20	13,0	2,0	3,7	17,1
$N_{150}P_{75}K_{75}$		13,9	2,5	4,2	20,2
Compost 10 t/ha		13,4	2,2	4,1	18,0
Compost 20 t/ha		13,8	2,4	4,2	19,9
Compost 30 t/ha		14,2	2,8	4,5	21,6

4. Conclusions

Mining in the Tismana - Rovinari river bank area, has seriously affected the environmental components of the area analyzed.

As a measure of ecological restoration, we studied the possibility to integrate into the natural flow of the area, namely the creation of an orchard with apple trees and shrubs, this being advantageous as favoured by its location in a hilly area surrounded by farmland and orchards and the physical-chemical and biological it disposes.

Laboratory findings were complemented by field observations thus achieving a much more detailed view on the site. In addition combining the quantitative with qualitative results allowed establishing the need of natural and organic fertilizer to improve the quality of the landfill material and to obtain good production.

In the future, we will continue the investigations by increasing the number of data and information on soil quality (further samples and soil analysis) and detailed analysis and evaluation of environmental components.

We hope that the results obtained from analysis and assessment can provide integrated local land use. It must focus on the reconstruction of sterile deposits and on preserving life on the newly formed land and, if possible, transforming the site into a productive area for the local community.

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