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Biomass Composting and Agronomic and Environmental Effect Evaluation[#]

Kopali Albert[*], Mankolli Hysen, Abazi Uran, Shumeli Arjan

Department of Agro-environment and Ecology, Agricultural University of Tirana, Kamez, Tirana, Albania

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Abstract: The smooth functioning of the organic agricultural systems depends on the recycling of elements which might be realized through fertilizing and the behaviour of the organic matter. The fertilization strategy in the organic agriculture is intended to preserve the sustainable upgrading of fertility in land. The achievement of such an objective by using the biomass wastes accumulated on the farm (such as the stable organic matter (dung), the wastes from pruning or any other organic) through the composting process, by helping in the break-down of the organic matter. The biomass wastes created on the farm can not be used directly for fertilization since they might contain a huge quantity of seeds from wild plants and other harmful parasites to the agricultural crops, and they might reduce in a blatant way the oxygen in the land and might release quantities of toxins into the roots of plants. Hence, organic matter will have to be brought into land without causing any of the 'concerns' mentioned above. The study aims to realize composts at the farm level and to evaluate the agronomic and environmental effects of its implementation in the methods of organic cultivation which was carried out in the framework of Program of Community Initiative PAB Interreg III A- Italy-Albania through an integrated project for disseminating the technical assistance in implementation of methods in making organic produce. The application of composts was done in two demonstrative farms: at the Agricultural University of Tirana and on the "Esat Bodli" farm in Durres, Albania. The demonstrative farms were determined on the basis of several specifications: a) availability of biomass and wastes in adequate quantities given the aim and the Albanian agricultural reality and b) possibility of implementing in the field the composts produced. In preparing the heaps (stacks), the composting process has been monitored through the registration of temperature and on the basis of the temperature readings and the behaviour of rainfalls, decisions were made concerning the administration (turning and mixing) of biomass. At the end of the stage of composts, the analytical control of the final product was done in Italy, since the Albanian legislation does not foresee normative references for quality of composts. Moreover, the Albanian contributors, specialized in the control of chemical fertilizers, did not possess the equipment needed to conduct such specific analysis on biomass. The analysis have indicated that the composts produced was within the range as determined by the Italian legislation, and could be used with no obstacle for tests following fertilization.

***Key words**: composting, Progetto PAB Interreg III A Italia – Albania, organic agriculture*

Introduction

Enhancing the sustainability of agricultural systems and in particular that of organic-oriented agriculture depends heavily on the persistent behaviour of organic matter which is being realized through fertilization. But, the fertilizers should be brought in the form of composting which are arrived at through the acceleration of natural processes of biomass breakdown. The compost is prepared by using the biomass refuse which is being created on the farm (such as the manures of the cow-house, the pruned cuttings and the organic residues. The utilization of fertilizers from outside the farm should be considered as just supplementary, under the conditions when the technology of cultivation used on the

[*]*Corresponding: Email: albertkopali@yahoo.it, Tel : +355 2200892; Fax: +355 2200874.*
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farms does not guarantee adequate quantities to fertilize vast areas. Composting is a maturity process conducted over the aerobic micro-organisms (in the presence of oxygen) over the organic matter (biomass), which through high temperatures leads to the formation of a the organic matter which is homogenous and of auburn shade: compost. The compost is steady in time, rich in humus, odourless or with an odour that is acceptable, capable of releasing into the land feeding matter, to improve the land structure by helping the circulation of air; bringing useful micro-organisms for the cultivated crops and it boosts the root system of the plants. The main purpose of the experiment conducted in this study is to produce composts at the farm level and evaluating the agronomic and environmental effects that stem from the use of composts in various dosages in plants at the agricultural farm level. Through the experimentation it is intended to do an evaluation of the advantages gained by fertilizing the agricultural lands through the composts, mainly over its physical characteristics (land structure); inter-relations in the land-plan system in order to achieve the security boundaries in demonstrating composts proper at the farm level in Albania, coordinated by the project leader CIHEAM–IAM (Bari, Italy), which was administered in the 2-year period 2005–2006.

Material and Method

The first implementation stage was finalized with the familiarity towards the agricultural reality with the view to determining the organic residues useful for composting on the farm. From a close observation in various spots and places, it was possible to define the farms with organic matter potentially capable of being composted: manures of various sources, straw, card box and fodder residues. The wastes of pruned cuttings have not resulted easily available and in the presence of all other trees such as olives, orchards and other fruit trees. The reasons behind this inadequacy are to be sought within these facts: i) in several cases the pruned cuttings have not been yearly organized, hence its availability is easily fluctuating; ii) shredders are not easily found, wood would be of no use as a source of composting if such shredding machines were not available; iii) the cuttings are incinerated in the field or are reserved as burning fuel in the form of firewood. Farms have been determined on the basis of the availability, with adequate quantities of biomass with its representative wastes, and in particular a demonstrative field has been selected within the Agricultural University of Albania along with the Shijak-based “Esat Bodli” farm. Two heaps of composts have been prepared with various contents, placed in the function of the quality and quantity of the wastes present in the selected demonstrated farms. In particular, in the case of the farm at Agricultural University of Tirana there have been available manure from cattle, swine, goats and sheep, shavings, wheat stubble, while in the case of the “Esat Bodli” farm the starting matter has been manure from cattle, straw, foddered maize refuse and cardboards. The size of the heaps has been as follows: length 15-20 m, width 1.5 -2 m, height 1.5-2.5 meters.

The composting process has been monitored closely through daily monitoring of temperatures of heaps/stacks and on the basis of these observations and the quantities of rainfalls and the return and moisture of the biomass has been established. At the end of the composting process several agronomic and environmental parameters have been established which have been a gained, in particular, the extent of reaction (pH), humidity, electricity conduct (EC), the content of inert, content of organic carbon, total content of N.P.K and heavy metals Cd, Cr, Cu, Hg, Ni, Pb, and Zn.

The compost samples were collected and analyzed in the laboratory of Chemistry and Bio-chemistry section of DiBCA, University of Bari, based on the methods of the analysis and the fertilizer behavior from the Italian legislation (Trinchera *et al*., 2006). The analyses were conducted in Italy, since the Albanian legislation was lacking in the contemporary analytical methodology on the quality of composts, and, since the Albanian laboratories are not specialized in administering analysis of fertilizers since they are not equipped with the proper instruments to allow for such analysis to go ahead. Since the implementation protocol allowed for the analysis to be shifted elsewhere, the experimentation comes with the demonstrative part as well in the field, that is, a variety of a plant pertaining to spring-summer period has been used and more precisely a variety of maize *Gold fox 120* . The testing in the field was done next to the Experimental Didactic Farm at Agricultural University of Tirana in Valias Tirana,

based on the randomized parcelling scheme by applying various dosages of composts produced at the Agricultural University. 15 experimental plots of land have been divided, from 25 square meters each, divided up as follows below:

- 3 T plots, no quantity of composts used ;
- 6 plots C_1, 20 t composts per acre-1, equivalent to 2 kg m-2;
- 6 plots C_2, 40 t compost per acres-1, equivalent to 4 kg m-2.

The randomized parcelling scheme is brought to figure no.1. The compost has been applied to the land and has been overturned at a depth of 15-20 cm prior to sowing, which has been done a few days afterwards at a frequency of 7 plants/square meters (sowing distance at 70 x 20 cm). Each plot of land has been analyzed in connection with the average yield of cobs (kg/plot), the average yield of complex biomass (kg/plot), the average height of plants in relation to the number of rows of grains per cob , in relation to the number of grains per row and the weight of some 1000 grains.

Results and Discussions

The analysis of the major parameters of the compost gained from the Albanian representative farms are brought as such in table 1. The analytical findings have displayed the differences of the starting matter in setting up the various stacks. In particular the compost produced by the university has displayed an index of content of P and Zn and a value of CEE in lien with what was expected of the use of fertilization of various origins through the closest matter, while the compost of "Bodli" farm has displayed a higher level of K, closely connected with the highest variability of the plant material in the course of creating the heap. The two heaps are characterized from the value of inert materials, since even though the heap of university proved to be "far heavier polluted' , thus it was possible to indicate the content because of the lack of the final material. Even in such a case the difference between the two composts are registered in the content of the starting matter, from the moment that the origin of the inert is connected with all of the fertilizers being used.

With the exception of humidity content and inert, all of the parameters analyzed were able to respect the Italian norms in connection to the trading indicators, thus it was critical to proceed with the demonstrative testing in the field, whose findings are brought to table 2.

Table 1. Results from the main chemical-physical analysis of the composts.

Parameters	Measuring unit	University compost	Esat Bodli compost
Inert	% s.s.	9.8	3.8
Humidity	% t.q.	69.6	64.3
pH (in H_2O, 1:10)	-	8.5	7.9
EC (extract, 1:10)	dS m-1	2.49	0.75
Ash	% s.s.	54.6	52.1
Organic carbon	g kg-1 s.s	259.6	276.1
Organic matter	g kg-1 s.s	519,2	552,2
Total nitrogen	g kg-1 s.s	16	16.7
C/N	-	16.2	16.5
Total Phosphorous pentoxide (P_2O_5)	g kg-1 s.s	22	16.1
Total potassium (as K)	g kg-1 s.s	2.3	13.1
Total Cadmium	mg kg-1 s.s	1.1	0.6
Total Nickel	mg kg-1 s.s	60.5	58.4
Total copper	mg kg-1 s.s	52.3	81.4
Total chrome	mg kg-1 s.s	77.3	65
Heczovalent chrome	mg kg-1 s.s	<0.4	<0.4
Total mercury	mg kg-1 s.s	<0.5	<0.5
Total lead	mg kg-1 s.s	28.7	40.9
Total Zinc	mg kg-1 s.s	217.6	129.7

Table 2. Results of demonstrative testing on compost implementation, years 2005 and 2006

Varieties	B	P	B-P	H	R	C	Average P
T (2005)	49.84,00	36.00,00	13.84,00	202.6,00	14.4,00	610.56,00	371.7,00
C1 (2005)	54.83,00	37.33,00	17.50,00	204.2,00	15.1,00	608.53,00	346.7,00
C2 (2005)	52.95,00	34.05,00	18.90,00	205.5,00	15.2,00	655.76,00	330.0,00
T (2006)	48.90,00	35. 0,00	13.70,00	227.5,00	16.4,00	724.88,00	358.3,00
C1 (2006)	53.50,00	37.00,00	16.00,00	237.5,00	15.9,00	683.70,00	353.7,00
C2 (2006)	52.60,00	33.90,00	18.70,00	231.5,00	15.7,00	763.02,00	333.9,00

B: average yield of total biomass (kg plot-1);
P: average yield of cobs (kg plot-1);
H: average height of plants (m);
R: average length of cob-1;
C: average number of grains per cob-1;
Average P: weight of 1000 grains (gr).

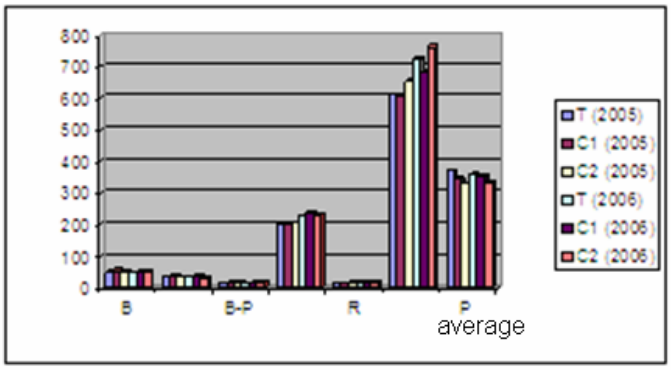

Figure 1. Results of the demonstrative testing of the compost implementation, years 2005 and 2006**.**

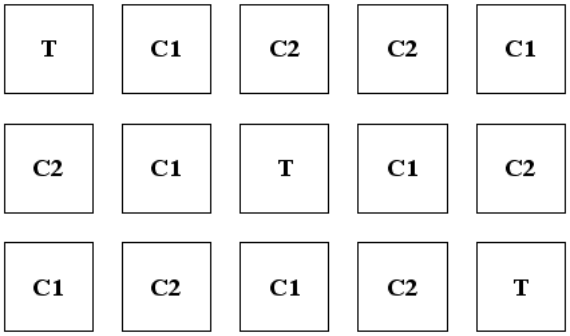

Figure 2. Scheme of experimental plots. C1: 2 kg compost m-2; C2: 4 kg compost m-2; T: 0 kg compost -2.

Testing C1 has indicated the highest yield of the cobs and the complex biomass in the tow years of testing, while testing C2, at the same period of time, has yielded the highest produce only in the biomass of maize (b-P). This evidence might be attributed to the surplus nutritious availability in plot C2 which has resulted in a small reduction of the production of cobs at the vegetative stage. The compost-free testing (T) has yielded a higher weight of grain production and this implies a much lower frequency of cobs per plot. On the other hand, the C2 testing has displayed a weight of 1000 grains lower and a higher number of grains per cob that indicates a production of grains much smaller and lighter, by attesting a far more vegetative development rather than reproductive ones. At last, the C1 testing has

yielded a weight of 1000 average grains and a number of grains per cob much lower that along with the higher production of cobs, imply a much more balanced ratio between the number of grains and their weight and a higher frequency of cobs per plot of land

Conclusions

The PAB project Interreg III-A Italia - Albania, through an experimentation already administered in the Albanian farms, has demonstrated that composting is a process easy to achieve in agriculture. Huge efforts have been underway to improve the quality of near matter with the view to reducing the content of inert in fertilizers in sufficient quantities in the Albanian agriculture. The parameters of composts analyzed have proven within the confines of CEE with the exception of several metals, which, compared with (Reg. CEE 2092/91), are above the borderline. Based on the findings it is easy to demonstrate that, regardless of the agricultural origin of the matter at the source, the respect of the above borders proves to be difficult in production of composts. The experiments realized so far have demonstrated the advantages of using composts in fertilization of maize and through the upgrading test the C1 has resulted in such a way (20 t compost per acre-1). The study might serve as a reference point for the production of biomass at the farm level from companies or various ventures.

References

Altieri MA, (1991)Agroecology. The scientific basis of alternative agriculture,pp..210 - 275.Berkley

Biopuglia, (2003) Studio preleminare sull'agricoltura biologica in Puglia, IAM Bari.

IAM (Bari) Manual per kompostimin ne bujqesine biologjike. pp.140. Itali.

Isufi, E. (2004). Kompostimi i mbetjeve organike për plehërimin e bimëve, pp.14.Tirana

Peçuli, V, Kopali A, (2005) Bujqesia biologjike, pp. 362, Tirana

Regolamento (CEE) n. 2092/91. Relativo al metodo di produzione biologico di prodotti agricoli e alla indicazione di tale metodo sui prodotti agricoli e sulle derrate alimentary. Brussels

Trinchera A., Leita L, e Sequi P, (2006) Metodi di Analisi per i Fertilizzanti. Consiglio per la Ricerca e la Sperimentazione in Agricoltura, Istituto Sperimentale per la Nutrizione delle Piante per conto del Ministero delle politiche agricole alimentari e forestali, pp:384 Roma, Italy,