TERRASOL compost from sheep manure

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Summary

The Karcag Research Institute of University of Debrecen Centre of Agricultural Sciences and Engineering and the Research Institute for Soil Sciences and Agricultural Chemistry of the Hungarian Academy of Sciences worked out a new compost product named TERRASOL from sheep manure between 2005 and 2007. Our goal was to work out a new technology of compost making that can be used in organic farming and meets the environmental protection rules of the European Union. During the project we produce compost from sheep-manure of deep litter and by-products of organic farming. We utilized the results of an earlier developed composting technology of the Karcag Research Institute to create a new technology suitable for the recent environmental expectations. The improvement of the circumstances of livestock was considered too by using of absorbing agents for cleaning the air of the shed and reducing the number of the pathogens.

Different additives were used to improve the nutritive value of the compost and the hygienic circumstances of the shed.

In the development of the technology the new EU food safety rules were considered as well. During composting process the transformation of raw manure, the number of pathogen microbes and the quality of the compost were controlled. The chance of the elimination of pathogens was tested as well.

The produced compost can be used in both traditional and organic farming in greenhouses and on arable lands to supply the nutrient demands of plants.

In the paper the main elements of the elaborated composting process and the application possibilities of the new compost product are summarised.

Introduction

The Karcag Research Institute of University of Debrecen Centre of Agricultural Sciences and Engineering already produced compost from sheep manure called „Supercompost" at the end of the 1980ies. We finished the composting in the middle of the 1990ies because of the increasing production costs. At the end of the 1990ies the demand for ~~of~~ different composts and flour-pot mould increased again. Our Institute permanently examined the effects of composted sheep manure on the yield of grassland and crops (Csízi and Monori, 2005).

We decided to work out a new compost making technology that meets the environmental rules of the European Union. We considered the improvement of the circumstances of livestock through cleaning the air of the shed and reducing the number of the pathogens. We also considered the economical efficiency of the technology and the possibility of its utilization in organic farming.

Our work with the purpose of development different compositions of composts started in 2003. We chose six composts of good perspective for the examinations in order to decide which is the best to achieve our goals. We intend to utilize the compost in horticulture, green-houses, grassland management and crop production.

We won a project proposal entitled „Sheep-manure and bio-waste compost technology development from point of view of animal healthcare and cater security" which was sponsored partly (80%) by the European Union and partly (20%) from national sources. This project was a pull demand innovation project. The main goal was to create a new type of composts. The project period was 36 months between 2005 and 2007.

Methods

We started to produce six different compositions of composts (Table 1.) that were turned, mixed and chopped by a T-088 manure spreader three times during the process of our opened pile (Kocsis, 1998) compost technology among semi-operating size that means 5 tons per compost pile. There was a 5-week-long period between two turns. We examined the agent composition of the different composts, regularly checked the temperature of the compost piles and examined the consistence of the different composts and fraction sizes.

Table 1. Composition of the different composts

Compost code	Composition
1	Control, deep litter sheep manure (SM)
2	SM + bacterial culture (EM 1)
3	SM 98% + Zeolite 2%
4	SM 98% + Zeolite 2% + bacterial culture (EM 1)
5	SM 96% + Zeolite 2% + mineral phosphate 2%
6	SM 96% + Zeolite 2% + mineral phosphate 2% + bacterial culture (EM 1)

One of the most important dynamic indications of the compost status is its temperature. The compost temperature can indicate the biological activity in the compost pile. Low biological activity can be caused by low compost moisture content or the end of composting process which is also indicated by the decreasing temperature. A fast increase of the average pile temperature (up to 65 C°) was expected in the first two weeks after the turning. The temperature was thought to be permanently lower than 50 C° between the end of the 2^{nd} and the 5^{th} weeks.

If the temperature decreased faster then it was expected or the temperature increase was low, we increased the moisture content of the compost by watering-

Kocsis (2005) established that the optimal moisture content rate is between 40 and 60%, and the optimal carbon/nitrogen rate for composting is between 25 and 35%. So, we tried to keep the moister content between 60-65% during the composting process, but we did not have to set the carbon/nitrogen ratio, because the deep litter sheep manure could sure the optimal carbon/nitrogen rate according to the findings of Alexa (2001).

Results and discussion

We observed that the compost types treated with EM 1 bacterial culture suspension coded 2, 4, 6 (Table 1.) after the second compost turning were consistent and their homogeneity met the expectations. The average length of straw and hay vestiges was shorter than 20 mm in the composts treated by EM 1 bacterial culture suspension and their colour was smoothly deep brown, close to black. The new composts had no manure odorł but they had smell similar to one of resh spring fields. Other compost types coded 1, 3, 5 (Table 1.) reached the expected consistence, homogeneity and smell only after the third turn.

The effect of the EM 1 bacterial culture suspension on the technology costs and the length of the composting period is very important. We made the composting period shorter by 25% by using EM 1 comparing to the length of composting process of compost types without EM 1. Practically we could save 33% of the costs of turning. During the composting process, the cost of the turning of the compost is one of the most significant economical factors. This was a very important result from the point of view of technology development.

The nutrient contents of the different composts were examined as well. We had minimum expectations for the nutrient contents (Table 2.) based on the earlier results achieved in our Institute. Our former compost (called 'Supercompost') was very successful in the market, so we took its nutrient contents as our basic expectations for the new compost products. The results of chemical analyses of the new compost types (Table 3.) were surprising because they were statistically different from the earlier results.

Table 2. Minimum expectation of nutrient content of Supercompost

pH	7.5-8.0
Dry matter content (%)	55-60
Organic material content (%)	25
Total N content (%)	0.7
Total P_2O_5 content (%)	1.3
Total K_2O content (%)	1.1

Table 3. Our new results of different composts

Compost code	pH(H_2O)	pH(KCl)	$CaCO_3$ (%)	OM content (%)	N (%)	Total P_2O_5 (%)	Total K_2O (%)	Ca (g/kg)	Mg g/kg)
1	8.65	8.17	0.36	14.25	1.01	0.84	2.62	8.84	1.85
2	8.44	8.06	1.16	9.79	0.81	0.70	2.33	8.07	1.54
3	8.66	8.17	1.32	10.02	0.82	0.57	1.98	8.67	1.53
4	8.69	8.24	1.00	13.83	1.14	0.71	2.86	10.58	2.21
5	8.48	8.01	1.02	13.00	0.96	0.74	2.49	10.32	1.82
6	8.64	8.21	1.16	15.02	0.92	0.78	2.62	9.94	1.96

Comparing the most important nutrient contents of the new composts we established that there were no significant differences among them. Unfortunately we observed high pH values. The other nutrient values were reassuring.

The expected and the measured nutrient contents were compared too. We established that the new compost types had significantly higher pH values, N and K_2O contents than they were expected, but the total phosphorus content of the new compost types was lower than expected.

Because of the favourable effect of the EM 1 on the composting technology, we built the EM 1 treatment in the composting technology.

After that we tested the compost production technology of the compost coded 6 (sheep manure 96% + zeolite 2% + mineral phosphate 2% + bacterial culture EM 1) with different operating sizes. During this activity we produced more than 200 tons of this kind of compost.

The nutrient composition of the compost was more stable and the consistence was more homogenous under the circumstances of operating size than in the case of semi operating size. We were satisfied with the features of our new compost product called TERRASOL whose trading permission was got in 2008. The nutrient contents of the TERRASOL measured due to the related standards are shown in the Table 4.

Table 4. Chemical features of TERRASOL compost

pH		8.5
Dry matter content	(m/m%)	60
Organic matter content	(m/m%)	50
Fraction rate under 25 mm size	(m/m%)	100
N content	(m/m%).	2.5
P_2O_5 content	(m/m%)	1.9
K_2O content	(m/m%)	5
Ca content	(m/m%)	1.8
Mg content	(m/m%)	0.7
As content	(mg/kg)	max. 10
Cd content	(mg/kg)	max. 2
Co content	(mg/kg)	max. 50
Cr content	(mg/kg)	max. 100
Cu content	(mg/kg)	max. 100
Hg content	(mg/kg)	max. 1
Ni content	(mg/kg)	max. 50
Pb content	(mg/kg)	max. 100
Se content	(mg/kg)	max. 5

The final result of the project was a new compost production technology of TERRASOL compost. Its features meet our basic expectations: low technology cost, stable and homogenous product texture and last but not least high nutrient contents.

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