

# STUDIES REGARDING THE OPPORTUNITY OF ESTABLISHING SOME RURAL PLATFORMS FOR PROCESSING THE LIVESTOCK WASTE INTO ORGANIC FERTILIZERS

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## Abstract

*The paper aims to provide a series of actual and applicable contributions for the livestock producers to achieve financial savings and contribute to reducing soil, ground and water pollution. The authors conducted a research of primary data sources concerning the management of waste from livestock activities by producers of livestock and on how do the producers from the vegetable sector obtain their natural fertilizers. It was found that most of both private producers in the livestock sector and rural family owners of animals are managing in an inappropriate way the daily waste from livestock. For this reason, it was considered as an opportunity to establish of some common platforms through which the livestock waste to be converted into organic fertilizer used by the large producers or small families involved in the vegetable farm sector. Following some simulations, it was reached an estimated cost of up to 80,000 Euros for such a platform.*

**Key words:** animal waste, pollution, natural fertilizers

## INTRODUCTION

Through this paper, the authors propose the establishment of some special platforms in the rural areas for managing the waste from livestock, by composting it.

The authors made a primary data research by some interviews concerning the management of waste from livestock activities by producers of livestock and on how the producers from the vegetable sector are supplying their fertilizers. The research was conducted on three communes from Iași County and on five producers from the vegetal, livestock or mixed production fields from Iași and Suceava Counties.

By analyzing the results of the interview granted by the local authorities which were surveyed, it was demonstrated that the rural population, either from the lack of information, either of convenience, do not manage in any way the daily quantities of waste coming from livestock activities or household activities. It was found that they have no solution for managing these

quantities of waste which are produced daily which is why, in most of the households, all the waste, although organic and valuable after a certain transformation, is currently thrown or scattered randomly, in its fresh state on the outskirts of villages directly on the soil or on the edge of surface waters, ponds, etc. There are some owners of livestock which are using the resulting waste, but not in a proper way or transformed in advance. Having obtained these results from the study, in the present paper the authors made a project related to financial, technical and human resources regarding the establishment of some rural platforms for villages or communes, which to serve for transformation of the waste into valuable natural fertilizer for the vegetable farms.

## MATERIAL AND METHOD

Studies required to develop this paper were carried out during the years 2014 and 2015 and were used as information sources primary data from interviews addressed to a number of eight representatives of local communities (communes), large farms and analysis upon their opinions. It was also used

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information from secondary sources, literature existing in Romania and abroad and a number of guidelines regarding the market prices and construction equipment, for creating an estimate on the cost of setting up the rural platforms.

In estimating the resources required the authors have seen the opportunity of establishing such platforms by the Town halls, platforms which would, on one hand serve to decrease the soil and water pollution and on the other hand would be a source of natural fertilizer for the vegetable sector producers.

## RESULTS AND DISCUSSIONS

Following the interviews of local Mayors and formal and informal information obtained from them, and also from the information available in the literature, it was considered appropriate to create a financial projection for the construction of such composting platforms used at village or commune level, based on the size of the village concerned.

These platforms would represent the organized and properly managed space, according to the highest environmental standards on which the rural population could store all the organic waste from livestock and household domestic activities.

Waste management would be carried out by the Town hall staff according to some certified technologies and the output, the natural organic fertilizer would be used either by the rural population owning agricultural land, either sold to the large farms in the area which are operating in the vegetable sector.



Fig. 1 Rural platform for waste management

Building such platforms should be eligible by either accessing grants for NGOs either through public-private association (Town hall in partnership with a private operator) [1]; [2].

In this study, for example, it is proposed to build a platform either for a commune, either a larger platform which to serve 2 or 3 communes.

Since the operators in the livestock sector as legal entities are required by the law to properly manage the livestock waste from their own herd, in this study, the special platforms are designed for the rural population owning animals in their households. The studies conducted by the authors showed that the small owners of animals, namely family farms, are the main polluting factor of the air, soil and water on the outskirts of the communes. Therefore, in the present paper, the platforms are sized according to this category.

The land where the platform is proposed to be constructed will be in the ownership of operation of the Town hall and will meet the following requirements:

- a. The terrain must be flat with a maximum slope of 2 – 4%;
- b. Phreatic water layer should be at a depth greater than 5 meters;

Preferably, the platform location should be at a minimum of 700 – 1000 meters from the outskirts of the households [7]. In special situations it can be placed in strategic areas such as crossroads between the villages, outside the village, etc. This way of locating the platform requires a series of special measures to avoid any type of pollution.

It is proposed that the platform has a built area of 3,500 square meters and holds the following sections:

- a. Section of waste reception from the rural population, with an area of 500 sqm: upon it the waste will be delivered from the rural population in its raw form and non-homogenized. On the surface of this reception platform will take place the homogenizing of the waste and the shredding of it using a tractor equipped with front loader;
- b. Composting section with an area of 2,500 sqm: after mixing the waste, the tractor

equipped with a front bucket will form stacks of livestock waste for the composting process to take place;

c. Section of the compost storage, with an area of 400 sqm: this section will be used for the storage of the composting prepared for situations where it will not be taken back by the rural population immediately after the composting process;

d. Hall section, with an area of 100 sqm: this section will consist of a hall or a simple roof and will be used exclusively for parking and handling the equipment for the waste handling, and the potential tools required (hose to wet the platforms, shovels, sieves, tape and other tools and/or equipment).

The entire surface of 3,500 sqm of the platform will be covered by concrete and will meet the following requirements:

- a. Structure of reinforced concrete – lower case;
- b. Concrete slab;
- c. Waterproof seal of the perimeter and of the bottom diaphragms;
- d. A layer of sand and slag having a thickness of about 10 cm;

e. A layer of gravel of about 20 – 30 cm.

The entire structure will also have a source of water for wetting the mix of compost when necessary. For this regard, there would be a drilled bore in order to avoid additional expenses related to adduction of the water network.

Regarding the technical resources required for the waste management within the platform, these are:

- a. Agricultural tractor, with an approximate of 50 – 70 horsepower;
- b. Front bucket loader of 1-2 cubic meters as an equipment for the tractor;
- c. Shredder for branches and wood waste, also as an equipment for the tractor;
- d. Pressure hose for wetting the compost and pressure cleaning the concrete platforms;
- e. Water pump for pumping water from the drilled bore;

Regarding the staff needed for the functioning of such a platform, it was estimated that a number of two employees can ensure a smooth functioning of it. The two employees will be paid by the Town hall and will have the following structure:

Table 1 Required employee for the waste platform

Qualification	Required studies	Responsibilities
Technician / tractor operator	- High school with agriculture profile - Tractor driving school category	- reception of the waste - waste handling and building the stacks - supervision of the composting process
Unqualified worker	- Vocational school	- working with the wood waste shredder - wetting the compost heaps with low humidity - fulfill tasks set by the technician

The costs for constructing and setting up of such a platform may differ significantly from one community to another, depending on the actual situation of the specific area. For the present simulation the authors had in mind a pessimistic variant, i.e. it was considered that the platform will be built from the ground, on a vacant land, without any previous planning. However, many communes in the rural areas still have former farmhouse, platforms and other old and

disused structures whose potential existing concrete structures might be used after a minimum, consolidation or modernization. Their use would entail a total cost of setting up a platform significantly lower than building one from the ground. In addition, there are numerous rural municipalities which already own in their property a tractor which would mean important savings involving the purchase of a new tractor, as we can see in the following table:

Table 2 Detailed costs of establishing the platform for waste management

No	Operation	Value in Euro (without VAT)
1	Land purchase	0
2	Filling and leveling the area	1,000
3	Field studies	200
4	Obtaining approvals, permits	400
5	Projection	400
6	Technical assistance	300
7	Training courses for the technician	300
8	Concrete platform	35,000
9	Steel structure	1,500
10	Insulation	1,500
11	Drill execution	200
12	Other expenses	500
13	Tractor with front loader	38,000
14	Wood waste shredder	3,000
15	Hose nozzle	35
16	Water pump	150
TOTAL I (without VAT)		78,785
VAT (24%)		18,908.40
TOTAL (VAT included)		97,693.40

Widely, there are four main methods of composting. After studying the peculiarities of each method, given the advantages and disadvantages of all the composting processes, the authors took into account the method of reshuffle the strings or piles.

This method is the most suitable in terms of the cost-benefit at the conditions of Iasi County and the North-East Region.

First, the rural population is delivering the waste to the dedicated reception platform. The waste is took and placed in rows with the front loader of the tractor, on the composting platform.

To actively manage the process, the strings and piles are reshuffled regularly using the front loader of the tractor. The whole process is made in order to avoid compacting of piles, improves air exchange and brings to the surface the material which is inside and introduces the material from the surface of the pile.

By this composting process, the weed seeds, pathogens and insect larva are being destroyed by reaching the middle of the strings where the temperature is very high and being destroyed. Turning and mixing again during reshuffles, the material subject of composting fragments into smaller particles and increases their biological active contact surface. However, excess reshuffle may reduce the

porosity of the pile if the particle size becomes too small. The size of the pile or string is given by the characteristics of the equipment that carries out the operation, a pile reshuffle or a front loader. For this method of composting, it is preferred that the composting platform is surrounded by a ditch to collect leakages. The fluid collected may be used to moisten the pile to reshuffle if necessary or it can be applied to agricultural land as liquid fertilizer.

In the work of reshuffle, as a machine it can be used either a tractor with a front loader or other front or rear cup machine that can handle piles. There is machinery dedicated to this work, but the current proposal recommends a tractor with front loader or a Vola because it can be multifunctional (can be used in winter for cleaning the snow etc).

Advantages to this method of composting consist primarily of:

- Obtaining an evenly quality compost and in less time;
- A method without risks and generally used in composting.
- Lower costs to build the platform, but higher compared to other methods (for example the passive open composting) given the need to reshuffle the piles.

The primary drawback to this method is given by the existence of the composting costs, respectively in appointing a composting

machine operator and the acquisition of this machine.

For a quick transformation of livestock waste into natural fertilizer, it is recommended the use of bio products, which shortens the composting process from 6-8 months to 3-4 months in the warm season and to 4-5 in the cold season.

After composting, where, for various reasons, the product is not picked up by rural population or by large farms to fertilize the land, there is the possibility to store the fertilizer. Compost piles should be stored in large and covered areas to protect from humidity or excessive dryness.

The storage is necessary to harmonize the time between the moment of completion of the composting process and the time of use.

In order to prevent the ignition of the mix, height of piles storage should not exceed 3.5 m in height.

For packaging and marketing of compost in bags, the expenses were not provided in the present estimate because it is assumed that all of the compost produced will be taken over by the rural population as bulk, without being packed.

However if the packaging is desired, for this approach there will be some distinct expenses, with packaging equipment and plastic bags with the capacity of 20-50 kg.

The packaging requires very stable compost, with a water content of 40-45%. The sieving will be made through a screen smaller for the compost that is packed. Because compost is breathing, packaging should be done just before delivery, in a breathable packaging.



Fig. 2 Packed natural fertilizer

For an easier storage, it is recommended the building compost bags on box pallets.

A compost as an end product, of a high quality should have the following features:

- ✓ to appear as a homogeneous dark brown or black product;
- ✓ smell must be one of moist ground, with no odor;
- ✓ has a pH value between 6.0 – 7.8.
- ✓ it should have a stable smell (can be stored for a reasonable period of time without losing its effectiveness as a soil amendment);
- ✓ does not contain viable weed seeds;
- ✓ does not contain visible contaminants [5], [8], [9];

Trading may be carried out either in bags of 20 kg up to 50 kg or in bulk. However, the compost to be marketed in bags should submit a finer texture than the one sold as bulk. The compost will be accompanied by a label or certificate will contain the following information:

- ✓ Humidity that the product has (it should be less than 50%);
- ✓ Total nitrogen content (it must be greater than 1.5%);
- ✓ C: N ratio 10:18;
- ✓ Humidity (below 50%);
- ✓ Total nitrogen content (over 1.5% in the active substance);
- ✓ pH (6.0 -7.8) [5];
- ✓ Recommendations for use.

## CONCLUSIONS

The method of reshuffling and rising stacks and including bio preparations can shorten the waste to organic fertilizer to a minimum of 3 months;

Total estimated costs for the creation of such a platform rises to a value of about 78,000 euros, provided the involvement of the Town Hall with financial, land, and probably technical resources. Thus, if the Town Hall implementing this platform already possesses a tractor with front loader, there could be savings of 38,000-50,000 Euro as the tractor is not required to be purchased.

The implementation of such platforms and in particular the determination of the rural population owning livestock to actually centralize waste would eliminate pollution by

improper placement on the outskirts of towns or streams.

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