

DYNAMICS OF PROTECTION AND USE OF MANURE IN THE REPUBLIC OF MOLDOVA AGRICULTURE

A. RUSU, V. PLĂMĂDEALĂ

“Nicolae Dimo” Institute of Soil Science, Agrochemistry and Soil Protection of Chisinau

Keywords: *manure, livestock, livestock units, statistics, waste recovery*

Abstract

Based on the information provided by the Moldovan statistics yearbooks, a justifiable analysis of the dynamics of manure production and usage is presented for the period 1950-2010. The largest amount of manure amounting to 15.6-16.6 million tons per year, was produced within 1981-1990. The highest level of usage totalling to 58-82 percent of the total quantity produced was registered during the same period. During those years about 4.4-6.0 tons of garbage was distributed per arable hectare annually. In 2006-2010, the smallest amount of manure was produced, about 3.4-4.5 million tons per year, and even less was used, about 0.1-0.2 percent of the amount produced. Even if for 1 invested dollar 1.6-3.6 lei are recovered by the production increase over the following four years, the main reason of the allegedly ignored attitude towards the usage of manure lies in the lack of financial and technical resources necessary to prepare and apply manure. These costs can vary between 160 and 360 lei per ton (10 to 23 euros/t).

INTRODUCTION

Since ancient times, manure is known as a fertilizer having multilateral fertilizing action on soil and plants. It enriches the soil with organic matter, restores its structure, thus the soil becoming mellower and less resistant at plowing, increasing soil permeability and capacity for water and air. During the process of manure decomposition in the soil, that lasts several years, soil is significantly enriched with all nutrients almost in the necessary proportions for plants. Simultaneously, manure indirectly increases the content of soluble minerals in soil reserves, by the dissolving action of acids formed in the process of organic matter decomposition.

Manure use is sustained and argued not only from an agronomic, ameliorative and ecological point of view but also from an economic one. A comprehensive recent study accomplished in the "N. Dimo" Institute demonstrates that the use of different types of manure, prepared according to different technologies and applied to various crops, provides a specific income between 90 and 930 lei/tonne. One leu invested in the use of manure is recovered by 1.55 to 3.64 lei. The expenses for manure preparation, transportation (3 km), distribution and incorporation into the soil is fully recovered with production gains in a year for vegetable and horticultural crops and for field crops in three years maximum. Despite all listed

benefits and increasingly stringent need for vegetal production, nowadays, manure is practically not used, left to chance, causing mess, dirt and danger to health.

The purpose of this paper is to present a sound analysis of manure production dynamics from the main species of domestic animals existing in the Republic of Moldova, as well as the degree of its use as fertilizer during the period 1950-2010.

MATERIAL AND METHODS

As materials, we used statistical data for the given period recording the use of natural organic fertilizers, the absolute majority of which was manure and also the information about livestock per years. The latter was converted using the factors presented in table 1 and offered the opportunity of assessing the amount of produced manure depending on animal breed and breeding regime, as well as the methods of manure cleaning in stables.

Table 1

Calculation factors of manure quantity from an animal depending on the breed and breeding regime, tones/year

| Animal breed | Population farms | Livestock and poultry farms with mechanical cleaning | Livestock and poultry complexes with water cleaning |
|---------------------|-------------------------|---|--|
| Cattle | 8.1 | 11.0 | 9.8 |
| Pigs | 1.4 | 1.2 | 1.1 |
| Poultry | 0.0023 | 0.0046 | 0.0021 |
| Sheep | 0.5 | 0.5 | - |
| Horses | 5.1 | - | - |

In the case of large livestock and poultry farms the notion of manure was given to the mud with the humidity below 84%. On the basis of all mentioned and obtained statistical data we analyzed and generalized the information according to the methods and rules of logics in order to achieve the established purpose.

RESULTS AND DISCUSSION

During the investigated period, 1950-2010, the mass of manure produced in the Republic of Moldova consisted mainly of cattle manure, which made up 68% of the arithmetic average of that period (Table 2). Pigs manure had an average rate of 14%. Sheep, horses and poultry manure was produced in roughly equal quantities, each about 5-7% of the total. Both the types of manure and total quantity presented rather large quantitative oscillations.

During the investigated period, when we recorded the maximum amount of manure accumulated in the period 1981-1990 - years recording an extreme intensification of agriculture, including animal husbandry, our country registered an increase of livestock units up to 2.475 thout heads. The smallest manure quantity, 3.4 million tones, was produced in 2010. The livestock in that year was only 822 thout livestock units. Mathematical analysis of the accumulated manure mass per years showed that the arithmetic average in the mentioned period was of 9.585 thout tones/year and had a very great deviation from the standard - 4.88 thout tones - and an impressive variation coefficient of 51%. In such a sample of numbers, for approximately 95% of cases the arithmetic average of annual manure mass could amount from 5499 to 13.671 thout tones/year.

Table 2

Annual dynamics of manure production depending on animal breed in the Republic of Moldova

| Annually | Cattle | | Pigs | | Sheep | | Horses | | Poultry | | Total, thout t |
|----------|---------|----|---------|----|---------|----|---------|----|---------|----|----------------|
| | thout t | % | thout t | % | thout t | % | thout t | % | thout t | % | |
| 1941 | 4259 | 59 | 468 | 6 | 732 | 10 | 1709 | 24 | 102 | 1 | 7270 |
| 1950 | 5174 | 74 | 441 | 6 | 511 | 7 | 734 | 11 | 129 | 2 | 6989 |
| 1961 | 6926 | 68 | 1462 | 14 | 869 | 9 | 704 | 7 | 239 | 2 | 10200 |
| 1971 | 9406 | 73 | 1910 | 15 | 710 | 6 | 444 | 3 | 356 | 3 | 12826 |
| 1981 | 11971 | 76 | 2324 | 15 | 590 | 4 | 260 | 1 | 585 | 4 | 15730 |
| 1986 | 12746 | 77 | 2280 | 14 | 627 | 4 | 250 | 1 | 715 | 4 | 16618 |
| 1990 | 11451 | 74 | 2403 | 15 | 669 | 4 | 235 | 2 | 800 | 5 | 15558 |
| 1996 | 6034 | 71 | 1172 | 14 | 697 | 8 | 291 | 3 | 296 | 4 | 8490 |
| 2000 | 3586 | 63 | 929 | 17 | 515 | 9 | 342 | 6 | 293 | 5 | 5665 |
| 2003 | 3414 | 64 | 697 | 13 | 478 | 9 | 398 | 7 | 381 | 7 | 5368 |
| 2007 | 2477 | 54 | 731 | 16 | 474 | 10 | 342 | 7 | 577 | 13 | 4601 |
| 2010 | 1792 | 53 | 629 | 19 | 211 | 6 | 289 | 8 | 468 | 14 | 3389 |

Arithmetic average of the period 1950-2010

| | | | | | | | | | | | |
|---|------|----|------|----|-----|---|-----|---|-----|---|------|
| - | 6816 | 68 | 1362 | 14 | 577 | 7 | 390 | 5 | 440 | 6 | 9585 |
|---|------|----|------|----|-----|---|-----|---|-----|---|------|

We can suppose that such quantitative fluctuations in the livestock and, respectively manure, were caused primarily by radical changes in the socio-

economic sector of our country in the early 90's of the last century. Until then, especially during the period of intensification, the state invested much in agriculture, which had the effect of increasing the number of animals. In the period after the land reform, the investment in animal husbandry became insignificant and since 1992 the livestock reduced sharply and continued to decrease uninterruptedly until today. Manure quantity reduces concomitantly with the livestock, similar to an arithmetic progression, having the mathematical ratio of manure mass reduction of about 640,000 tones/year.

The second factor causing quite large variations in the number of animals and manure mass is due to oscillations in forage crops productivity, which directly determines the size of livestock, reducing it when the year is dry and the harvest is poor or redressing it during a year rich in rainfall. In this regard, it should be mentioned that the unexpected reduction of livestock in the early 90's is not only the result of land reform but also of a very dry period in the Republic of Moldova during 1989-1994 [1]. It's obvious that during such a period and in the following years the livestock reduces sharply.

In this period, both quantitative and qualitative radical changes have occurred in the number of livestock and, respectively, in manure quantity. At the peak of animal husbandry development, in 1986, there was a total of 16.618 thout tones of manure, where cattle manure, being of low technological quality and poor in nutrients, had a dominant share of 77% (Table 3). The share of poultry manure, which recorded the highest fertilizing effect, made up only 4%. By 2009, the share of cattle manure was reduced to 53%, while that of poultry has increased, making up 14% of the total manure mass. It has been registered an increase in the share of pigs, sheep and horses manure up to 2-7% which contains more nutrients and better technological features than that of cattle. Therefore, nowadays the produced manure mass is less than in the intensification of animal husbandry development, but it is of a higher agronomic quality.

The investigations concerning manure use showed that since 1970 the usage rate has exceeded 2 million tones/year, increasing till 1998 with an annual derivative of 200-775 thout tones. The largest amount of manure, 10.8 million tones, was incorporated in 1988, and constituted 82% of the produced quantity. In that year, on the average, 6 tones of manure were incorporated in each hectare of crops. But since 1991, the amount of used manure continuously decreases and in 2000 it reaches the level of 22,000 tones/year making up only 0.4% of the produced manure mass. And in the period 2006-2010, there have been incorporated only 6-8 thout tones/year or 0.1-0.2% of the produced manure quantity. At present, an annual average of a ridiculous manure amount – 10 kg – is incorporated per one hectare of crops.

The causes of such outdated and vicious situations of non-use of manure, mostly manifested in recent times, may be different. But, in fact, they are based on two

reasons: farmers lack the necessary money resources and secondly, they lack the knowledge about the necessity and advantages of using manure. Insufficiency of funds makes it impossible to rent the service of manure preparation and application. According to the price level of 2010, this work is estimated at 160-360 lei per tone or 3000-9000 lei to fertilize one hectare. Closely related to the deficiency of money resources, the non-use of manure can often be caused by the lack of necessary equipment for its reshuffling, loading, transportation and distribution, operations that will imply incomparably heavy expenditures.

Table 3

Composition of livestock in the Republic of Moldova and of produced manure in 1986 and 2010

| Animal breed | Calculation factor, in livestock units (lu) | 1986 | | | | | 2010 | | | | |
|--------------|---|-----------------------|-------------------------|-----|--------|-----|-----------------------|-------------------------|-----|--------|-----|
| | | Living eads, thousand | Conventional heads (lu) | | Manure | | Living eads, thousand | Conventional heads (lu) | | Manure | |
| | | | thout | % | thout | % | | thout | % | thout | % |
| Cattle | 1,0 | 1259 | 1259 | 68 | 12746 | 77 | 218 | 218 | 50 | 1792 | 53 |
| Pigs | 0,2 | 1962 | 392 | 21 | 2280 | 14 | 459 | 92 | 21 | 629 | 19 |
| Sheep | 0,1 | 1253 | 125 | 7 | 627 | 4 | 421 | 42 | 10 | 211 | 6 |
| Horses | 0,9 | 49 | 44 | 2 | 250 | 2 | 56 | 50 | 11 | 289 | 9 |
| Poultry | 0,002 | 22631 | 45 | 2 | 715 | 4 | 18328 | 37 | 8 | 468 | 14 |
| TOTAL | - | - | 1865 | 100 | 16618 | 100 | - | 439 | 100 | 3389 | 100 |

We are tempted to believe that one of the reasons that influence the formation of an indifferent attitude towards this resource may be the lack of knowledge. Manure is practically not used more than 20 years - a period when a new generation of farmers emerged, who may be unaware about the methods of manure use, don't have the skills to manage this material, are not documented about the benefits of its use and damage caused by its continuous accumulation.

CONCLUSIONS

1. Manure produced in the Republic of Moldova during the period 1950-2010 consisted on average 68% of cattle manure, 14% of swine manure and horses, sheep and poultry manure have almost equal shares between 5 and 7% of the total mass. Both within each type of manure and the total mass, there were found rather large quantitative and qualitative oscillations.

2. In the Republic of Moldova, the largest amount of manure - 15.6-16.6 million tones per year - was recorded in 1981-1990, period characterized by maximal intensification of agriculture, when there have been recorded 2.475 thout heads of livestock units and 103 livestock units corresponded to 100 hectares of agricultural land. That period was highlighted by the highest degree of manure use, when about 7.9-10.8 million tones/year or 58-82% of the total manure mass were incorporated into the soil, thus about 4.4-6.0 tones of manure were incorporated per one plowed hectare.
3. The period 2006-2010 recorded the smallest amount of manure produced in the last 50 years - 3.4-4.5 million tones/year. In 2010, our country registered 822,000 livestock units. 37 livestock units corresponded to 100 hectares of agricultural land. The mentioned period was highlighted by the lowest mass of manure use, about 6-8 thousand tones/year or 0.1-0.2% of the produced quantity.
4. We suppose that the main reasons of not using manure are the lack of necessary money resources and lack of knowledge about the necessity and advantages of using manure. According to the price level of 2010, the expenses for manure preparation and application can vary between 160 and 360 lei per tone (10-23 euros/t). One lei invested in the use of manure is recovered by production increases in about 4-6 years, with about 1.60-3.60 lei.
5. Currently produced manure is distinguished by a more superior fertilizing and technological quality than the one produced in the period before the land reform, by reducing in the annual mass the share of cattle manure from 77 to 53% and increasing poultry manure from 4 to 14%, by increasing the share of manure with litter mass from 20% annually in 1986 to 91% in 2010.

REFERENCES

1. Constantinov Tatiana, V. Sofroni, I. Mangul, 2000. *Particularitățile climei în Republica Moldova*. În: *Degradarea solurilor și deșertificarea*, SNMSS, Chișinău (pp. 28-35).
2. ****Anuarele statistice ale Republicii Moldova din anii 1950...2010*. Departamentul de Statistică, Chișinău.