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MANAGEMENT OF NATURAL FERTILIZERS IN POLAND¹

Key words: management, natural fertilizers, fertilized area, manure, liquid manure, slurry

ABSTRACT. The study discusses the results of the analysis of changes in the management of natural fertilizers in Poland and voivodships. Analysis included changes in: the number and percentage of individual farms using natural fertilizer, fertilized area, and level of consumption of particular fertilizer types. The comparative analysis at a voivodship level concerned the years 2007 and 2016. The current situation with regard to fertilized area and natural fertilizer rates was also assessed on the basis of Statistics Poland data from the years 2018-2019. The results of analyses indicated that the number of farms using natural fertilizers in Poland has clearly decreased. Despite observing an increase in the interest in slurry application, the most popular natural fertilizer applied is still manure, which, in the years 2018-2019, was applied on 18% of utilized agricultural area. In Poland, the average annual rates of applied manure, liquid manure and slurry are, respectively 17 t/ha, 22 m³/ha and 26 m³/ha. An analysis of the organization and intensity of natural fertiliser management in the Podlaskie Voivodeship shows that this is the leading region in this aspect, which confirms its dominant position in livestock production in Poland.

INTRODUCTION

Taking into account the assumptions of sustainable development of agriculture, including the need to maintain the production potential of soil, the basic problem is to maintain its fertility and ensure appropriate production and economic effects of economic activity [Wrzaszcz, Kopiński 2019]. Due to a significant interference of agricultural activity in the natural nutrient cycle and environmental effects resulting from the progressive intensification of production and specialization of farms, it is necessary to conduct rational fertilizer management [Kopiński 2018b, 2018c]. According to Tadeusz Filipek [2002], rational fertilizer management must take three aspects into account, i.e., obtaining (production) fertilizers, flows in the process of plant production and, also more broadly in agriculture, taking care of the natural environment. To a fairly large extent, rational fertilizer management takes the management of natural fertilizer resources into account, which, after mineral fertilization, are the main source of inflows of fertilizer components (nutrients) in the agricultural production cycle [Kopiński 2017].

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In Poland, livestock production is the dominant sector in the commodity structure of agricultural production and an important element of the system guaranteeing the food security of the country [Kopiński 2018b]. In recent years, according to the data of Statistics Poland (SP)² [2016-2019], it constituted 60% of total commodity production. The proper management of natural fertilizers, in a way a by-product of livestock production, are in fact a secondary resource [Chyłek (ed.) 2017], important for production and environmental reasons. Unfortunately, it is often forgotten that the main advantage of natural fertilizers, unlike mineral fertilizers, is that they contain almost all nutrients necessary for proper crop growth and development. Therefore, their elimination or reduction may lead to a decrease in soil fertility and productivity by disturbing the ionic balance and processes taking place in the soil environment [Gonet 2006, Kopiński 2017]. The value of natural fertilizers (content of ingredients) depends on many factors, and mainly on their type (form). In agriculture, they are used in the form of manure, liquid manure and slurry.

The aim of the study was the assessment of changes in natural fertilizer management in Poland, with a regional aspect perspective.

MATERIAL AND METHODS OF RESEARCH

Research covered fertilizer management in the agricultural sector in Poland. Results of own research constituted the basic source of information [Wrzaszcz, Kopiński 2019], carried out on the basis of statistical data collected by the Statistical Office (SO) in Olsztyn, collected as part of the Farm Structure Survey in 2007 and 2016³ as well as current statistical data collected by Statistics Poland [GUS 2019-2020].

Generally, the analysis of changes in fertilizer organization in individual agriculture concerned the period between 2007 and 2016, while the assessment of the current situation concerned the last years, i.e. 2018-2019. A comparative analysis by spatial arrangement was conducted at a voivodship level (NUTS-2), where the reference point was the average size for Poland. Analysis included changes in: the number and percentage of farms using natural fertilizer, fertilized area and level of consumption of particular types of fertilizers.

RESEARCH RESULTS AND DISCUSSION

Although the volume of natural fertilizer production, including fertilizer components, is influenced by the number of livestock and conditions of livestock production, it does not yet undisputedly mean the use of manure. In Poland, the number of farms using natural fertilizers decreased in the examined period by almost 40% (from 1,107 thousand in 2007 to 672 thousand in 2016) (Table 1). These changes are, to a large extent, a result of a dynamic decrease in the number of farms in Poland, which has been going on for several years, usually as a result of resignation from their operation and a decrease in the number of many livestock species [Kopiński 2018a]. As a result, in 2016, only 47% of

² SP (in Polish language: GUS) – Statistics Poland.

³ The studies concerned individual agricultural farms with at least 1 ha of utilized agricultural area maintained in good agricultural conditions (UAA).

individual farms applied manure fertilization, while in 2007 they accounted for 62% of all individual farms (Table 1). In the compared period, there was an increase in the number and relative number of farms using slurry. Nevertheless, the presented results confirm the dominance of the bedding system in Poland.

In Poland, in 2016, the majority of farms, namely over 50%, applied natural fertilizers in such voivodships as: the Podlaskie, Małopolskie, Wielkopolskie, Mazowieckie and Kujawsko-Pomorskie (Table 1). On the other hand, in the Dolnośląskie or Zachodniopomorskie voivodships, these fertilizers are only applied by every fifth farm. The processes in progress indicate that, on many farms, the enrichment of soils with organic matter in the form of natural fertilizers has been abandoned. The discussed phenomena, despite existing differences, were visible in all voivodships of Poland (Table 1). In the compared years, the largest decrease in the number of farms applying natural fertilization was observed in the following voivodships: the Dolnośląskie, Lubuskie, Opolskie, Podkarpackie, Śląskie, Świętokrzyskie and Zachodniopomorskie.

Figure 1 shows that natural fertilizers are most often used on farms with an area in the range of 25-49.99 ha of UAA (72.4% of all farms in the area group). While in the case of the smallest farms (1-5 ha) and the largest farms in terms of area (100 and more ha), natural fertilizers were applied least frequently (36% and 42%, respectively). Farms from these two area groups are located in the southern and western regions of Poland [Wrzaszcz, Kopiński 2019].

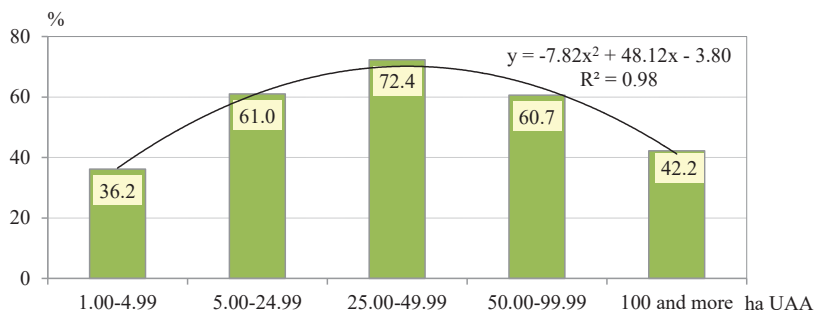


Figure 1. Share of farms using natural fertilizers in relation to the total farm number (with 1 ha UAA and more) in area groups in 2016

Source: Source: own study based on 2007 and 2016 data of the Statistical Office in Olsztyn [IERiGŻ-PIB 2018]

In the years 2018-2019, the area of utilized agricultural land on which natural fertilizers were applied in Poland, amounted to about 3.5 million ha and did not exceed 1/4 of the total UAA (Figure 2). The area fertilized with manure in the studied years was 2.7 million ha (18% of UAA), while only 6% of the area was fertilized with liquid manure and slurry. The presented data confirm the need, visible in the first years of the 21st century, to undertake actions to counteract the soil impoverishment of soil organic matter on a significant area of agricultural land in Poland, mainly on arable land [Kuś, Kopiński 2011]. Additionally, the management of natural fertilizers is significantly diversified in spatial layout (visible even at a voivodship – NUTS-2 level).

Table 1. Individual farms in total and using natural fertilizers in 2016 and changes between 2007-2016

Specification	Number of total individual farms with an area ≥ 1 ha UAA		Number of farms using natural fertilizers		Number of farms using manure		Number of farms using liquid manure		Number of farms using slurry		Share of farms using natural fertilizers in relation to total individual farms	
	2016 thousand	change* %	2016 thousand	change* %	2016 thousand	change* %	2016 thousand	change* %	2016 thousand	change* %	2007	2016
Dolnośląskie	55.2	-24.0	12.1	-47.6	12.0	-48.3	0.9	-84.8	0.4	-66.4	32.0	22.0
Kujawsko-pomorskie	632.1	-13.3	31.7	-33.4	31.2	-34.4	6.9	-48.5	2.6	61.8	65.3	50.2
Lubelskie	179.6	-18.8	77.6	-42.2	77.3	-42.3	3.3	-69.5	1.5	-39.5	60.8	43.2
Lubuskie	19.7	-39.3	6.2	-52.3	6.2	-52.7	0.3	-72.8	0.2	-54.0	40.3	31.6
Łódzkie	123.2	-18.9	60.7	-39.6	59.2	-40.9	7.6	-62.3	3.9	27.0	66.1	49.3
Małopolskie	139.3	-26.1	81.1	-40.4	80.3	-40.7	25.9	-66.8	5.2	205.1	72.1	58.2
Mazowieckie	211.9	-20.4	109.2	-35.4	106.4	-37.0	16.6	-22.4	8.8	32.5	63.6	51.6
Opolskie	26.4	-27.9	9.9	-49.7	9.5	-51.0	3.7	-66.3	1.0	1.5	53.5	37.3
Podkarpackie	132.1	-27.4	62.1	-46.6	61.6	-46.8	12.8	-76.6	2.1	-30.5	63.9	47.0
Podlaskie	80.9	-12.4	51.8	-22.7	49.7	-25.0	8.2	-36.1	9.7	46.2	72.5	64.0
Pomorskie	38.3	-13.8	16.3	-35.9	16.1	-36.6	3.8	-63.7	1.7	2.9	57.3	42.6
Śląskie	53.4	-33.9	22.8	-47.5	22.3	-47.5	4.5	-68.8	1.5	-37.2	53.8	42.7
Świętokrzyskie	84.7	-21.4	36.5	-49.8	36.3	-50.0	4.2	-59.0	1.7	-41.3	67.5	43.1
Warmińsko-mazurskie	42.5	-8.2	19.7	-34.5	19.1	-35.9	4.0	-48.0	2.3	26.2	64.9	46.3
Wielkopolskie	118.7	-12.5	68.5	-28.2	67.5	-29.2	12.8	-68.2	4.8	16.2	70.4	57.7
Zachodniopomorskie	28.8	-19.8	5.4	-58.2	5.3	-58.5	0.5	-79.2	0.3	-50.6	35.8	18.7
Poland	1,398.1	-20.9	672	-39.3	660.1	-40.1	115.9	-63.2	47.6	15.8	62.6	48.1

* change in % in relation to 2007, values below 0 mean a decrease

Source: own study based on 2007 and 2016 data of the Statistical Office in Olsztyn [IERIGŻ-PIB 2018]

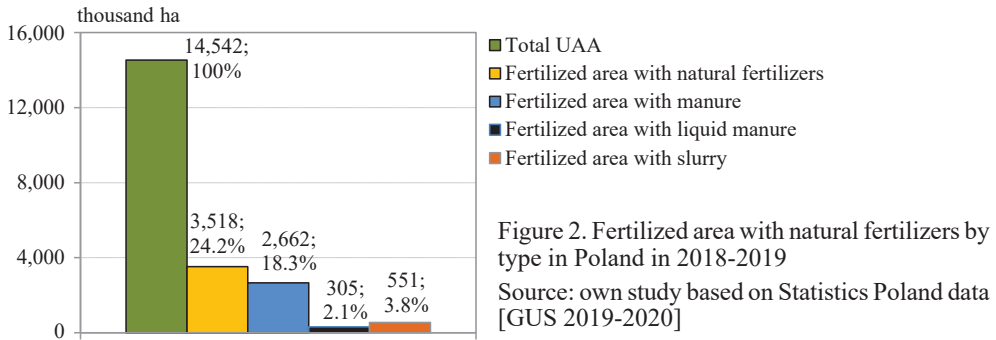


Figure 2. Fertilized area with natural fertilizers by type in Poland in 2018-2019
Source: own study based on Statistics Poland data [GUS 2019-2020]

In Poland, the relatively largest amount of UAA is fertilized with natural fertilizers in the Podlaskie, Wielkopolskie, Łódzkie and Mazowieckie voivodships (Figure 3). The total area with natural fertilizers in these four regions constitutes 56% of total fertilized area in Poland. In the remaining voivodships, the fertilized area with manure, liquid manure and/or slurry generally does not exceed 30% of UAA in these voivodships. While, in the Dolnośląskie and Zachodniopomorskie voivodships, only 9% of agricultural area is treated with natural fertilization.

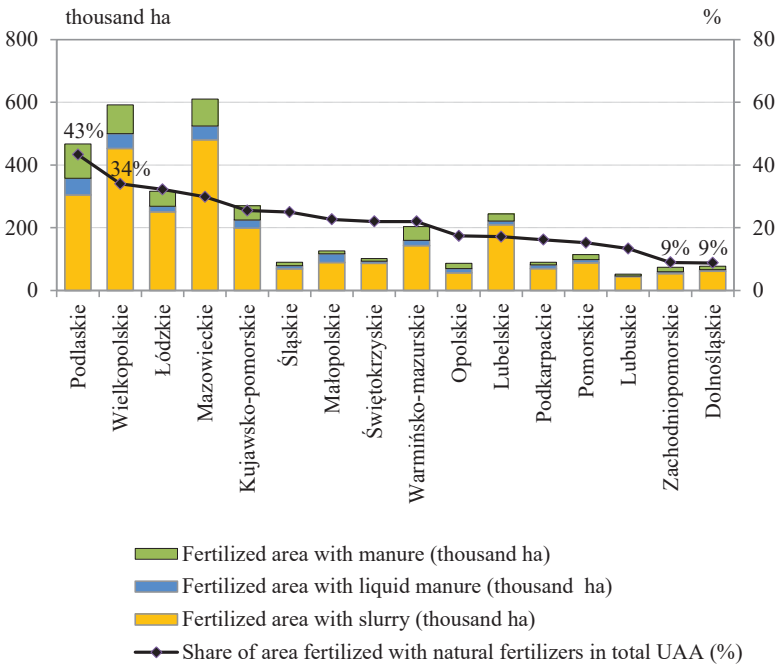


Figure 3. Territorial differentiation of fertilized area with different types of natural fertilizers in Poland in 2018-2019
Source: own study based on Statistics Poland data [GUS 2019-2020]

One of the indicators for assessing the intensity of management is the level of input incurred in terms of value and in terms of quantity. The intensity of management of natural fertilizers is measured by the level of applied doses of particular fertilizer types. In recent years, 2018-2019, the highest doses of natural fertilizers were applied in the Podlaskie, Warmińsko-mazurskie, Lubelskie, Lubuskie and Pomorskie voivodships (Figure 4). In

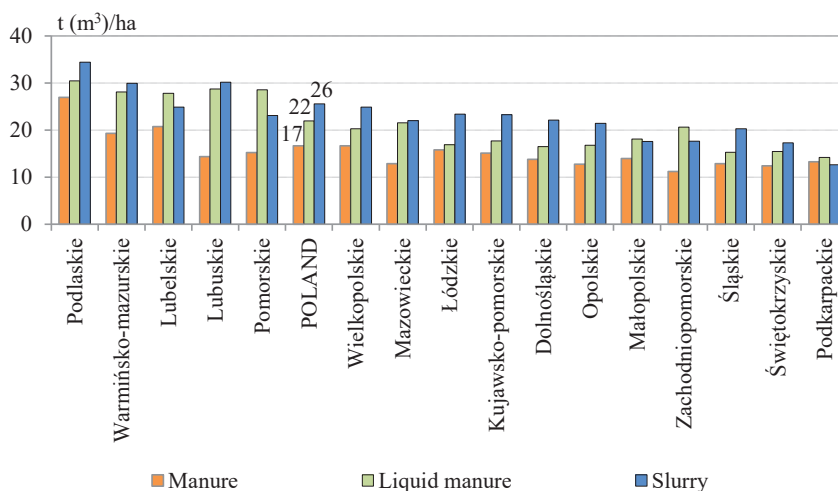


Figure 4. Level application doses of different types of natural fertilizers (on fertilized area) in voivodships in 2018-2019

Source: own study based on Statistics Poland data [GUS 2019-2020]

these voivodships, annual average doses of applied manure, liquid manure and slurry were higher than the national average, which, respectively, for particular types of natural fertilizers, amounted to 17 t/ha, 22 m³/ha, 26 m³/ha. The situation was different in the Podkarpackie and Świętokrzyskie voivodships, where the lowest natural fertilizer doses were applied at a level of 15 t (m³)/ha, on average. Therefore, if we also use this indicator (Figure 4) to determine the range of impact and scale of natural fertilizer application (Figure 3), the Podlaskie Voivodship is the leading one in Poland in terms of organization and intensity of manure management.

SUMMARY

The analysis of changes in the organization and intensity of natural fertilizer management in the spatial order makes it possible to determine the scale of regional differences in Poland, also in terms of the strength of its potential environmental impact. The state of natural fertilizer management indicates the scope of needs for soil organic matter enrichment through various forms of crop material. This is an important issue in Poland because, in 2016, less than half of individual farms used manure, which is a dominant type of natural fertilizer and a significant source of soil organic matter. Currently (in 2018-2019),

manure was applied on only 1/5 of UAA. The least popular natural fertilizer in Poland is slurry, although a gradual increase in the percentage of farms using this type of fertilizer is observed. Liquid natural fertilizers (in the form of liquid manure and slurry) are only applied on 6% of UAA in Poland.

Natural fertilizers are most often used in farms of medium size (25-50 ha of UAA). Reluctance to use such practices often takes place on farms belonging to extreme area groups, i.e. the smallest farms (1-5 ha) and the largest ones (from 100 ha).

In 2016, the majority of farms in the Podlaskie, Małopolskie, Wielkopolskie, Mazowieckie and Kujawsko-Pomorskie voivodships used natural fertilizers, in contrast to the Dolnośląskie or Zachodniopomorskie voivodship (only one in five farms). From a territorial perspective, in the case of most voivodships (excluding the Podlaskie, Wielkopolskie, Łódzkie and Mazowieckie voivodships), the area of fertilized area with natural fertilizers did not exceed 30% of total UAA.

In terms of the intensity of farming, measured by the amount of applied doses of particular types of natural fertilizers, the leading voivodships are the following: the Podlaskie, Warmińsko-mazurskie, Lubelskie, Lubuskie and Pomorskie. The doses of manure, liquid manure and slurry applied in these voivodships are, on average, higher than the national mean, amounting to, respectively 17 t/ha, 22 m³/ha, 26 m³/ha. At the other side of the spectrum are the Podkarpackie and Świętokrzyskie voivodships, where natural fertilizer rates do not generally exceed 15 t (m³)/ha of fertilized area. Analysis of the organization and intensity of manure management shows that the Podlaskie Voivodship is the leading one in terms of the organization and intensity of manure management, which confirms its dominant position in livestock production in Poland.

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GOSPODAROWANIE NAWOZAMI NATURALNYMI W POLSCE

Słowa kluczowe: gospodarowanie, nawozy naturalne, powierzchnia nawożona, obornik, gnojówka, gnojowica

ABSTRAKT

W artykule omówiono zmiany gospodarowania nawozami naturalnymi w Polsce i w poszczególnych województwach kraju. Analiza dotyczyła zmian liczby i udziału gospodarstw indywidualnych stosujących nawożenie naturalne, powierzchni nawożonej i poziomu zużycia poszczególnych rodzajów nawozów naturalnych. Analiza porównawcza na poziomie województw dotyczyła lat 2007 i 2016. Oceniono także aktualną sytuację w zakresie nawożonej powierzchni oraz dawek nawozów naturalnych na podstawie danych za lata 2018-2019. Na podstawie wyników analiz wykazano, że w Polsce wyraźnie zmniejszyła się liczba gospodarstw stosujących nawozy naturalne. Mimo wzrostu zainteresowania stosowaniem gnojowicy, nadal najbardziej popularnym nawozem naturalnym był obornik, który w latach 2018-2019 stosowano na 18% użytkowanej rolniczo powierzchni. W Polsce średnioroczne dawki stosowanego obornika, gnojówki i gnojowicy wynosiły odpowiednio: 17 t/ha, 22 m³/ha i 26 m³/ha. Z przeprowadzonej analizy organizacji i intensywności gospodarowania nawozami naturalnymi wynika, że najbardziej wiodącym pod tym względem było województwo podlaskie, co potwierdza jego dominującą pozycję w produkcji zwierzęcej w Polsce.

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