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CHANGES IN AGRICULTURAL PRODUCTION IN THE MAŁOPOLSKIE VOIVODESHIP

ZMIANY W PRODUKCJI ROLNICZEJ NA TERENIE WOJEWÓDZTWA MAŁOPOLSKIEGO

Summary: Agriculture is one of the basic branches of the national economy, which is responsible for food production. With the rapid development of agricultural production technology, especially new techniques of animal husbandry and crop production, we are seeing changes in the amount of adverse substances entering the environment. Analysts pay great attention to biogenic compounds, mainly nitrogen and phosphorus, which infiltrate deep into the soil profile and cause surface runoff as a result of precipitation. This causes eutrophication of surface waters. In the recent decades there has been an increase in agricultural productivity. At the same time, the percentage of people employed in this sector of the economy and the economic value of products produced in agriculture are decreasing. On the basis of the data obtained from the Agency for Restructuring and Modernisation of Agriculture (in Polish: Agencja Restrukturyzacji i Modernizacji Rolnictwa, Kraków delegation) [1] and the data from the Statistics Poland (in Polish: Główny Urząd Statystyczny [2], the present study shows the trends of the changes in the agricultural sector in the Małopolskie Voivodeship in 2016-2021. Unfortunately, due to the lack or incompleteness of the data obtained, some parameters were considered over a two- or three-year period. The parameters such as livestock population, number of farms, crop area, yields and fertilization levels were analyzed. The aspect of employment in agriculture was also addressed as an element indicating the level of involvement of residents in agricultural activities, both crop and livestock production. The low rate of employment in the agricultural sector may indicate the degree of familiarity of the population with the basic processes of obtaining animal products and agricultural crops. The discussed Voivodeship is characterized by a high proportion of agricultural land – more than 60% of the area. There is a slight decline in cattle and pig populations. Sheep and goat populations are low and not very variable. Analyzing crop production, despite the declining area of total crops, there was a slight increase in the area of most crops in 2021, thanks in part to a reduction in the participation of unmarked crops compared to 2020. In addition, the analysis shows that despite the downward trend in the amount of mineral fertilizers used, yields have increased, which may confirm the development of production technologies and better management of nutrient resources contained in the soil of primary importance to plants.

Keywords: agriculture, agricultural production parameters, land use, livestock population

Streszczenie: Rolnictwo jest jedną z podstawowych gałęzi gospodarki narodowej, które odpowiada za produkcję żywności. Dynamiczny rozwój technologii produkcji rolniczej, w tym szczególnie nowych technik chowu i hodowli zwierząt oraz produkcji roślinnej możemy obserwować zmiany w ilości niekorzystnych substancji wprowadzanych do środowiska. Analitycy dużą wagę poświęcają związkowi biogennym, głównie azotowi i fosforowi, które w wyniku opadów atmosferycznych infiltrują w głąb profilu glebowego oraz powodują spływ powierzchniowy. Powoduje to eutrofizację wód powierzchniowych. W ostatnich dziesięcioleciach obserwowany jest wzrost produktywności w rolnictwie. Jednocześnie zmniejsza się procentowy udział osób zatrudnionych w tym dziale gospodarki oraz wartość ekonomiczna produktów wytwarzanych w rolnictwie. Na podstawie danych uzyskanych z Agencji Restrukturyzacji i Modernizacji Rolnictwa (delegatura w Krakowie) [1] oraz danych Głównego Urzędu Statystycznego [2], w niniejszym opracowaniu przedstawiono trendy zmian w sektorze rolniczym w województwie małopolskim w latach od 2016-2021. Niestety, ze względu na brak lub niekompletność pozyskanych danych, część parametrów była rozpatrywana w okresie dwu- lub trzyletnim. Analizie poddano parametry takie jak pogłowie zwierząt gospodarskich, liczba gospodarstw rolnych, powierzchnia upraw, plonowanie oraz poziom nawożenia. Poruszono także aspekt zatrudnienia w rolnictwie jako element wskazujący na poziom zaangażowania mieszkańców w działalność rolniczą, zarówno produkcję roślinną, jak i zwierzęcą. Niski udział zatrudnienia w sektorze rolniczym może świadczyć o stopniu zaznajomienia społeczeństwa z podstawowymi procesami uzyskiwania produktów zwierzęcych oraz płodów rolnych. Województwo małopolskie charakteryzuje się wysokim udziałem użytków rolnych – ponad 60% jego powierzchni. Obserwuje się nieznaczne zmniejszenie pogłowia bydła oraz trzody chlewnej. Pogłowie owiec i kóz jest niskie i mało zmienne. Analizując produkcję roślinną, mimo zmniejszającej się powierzchni upraw ogółem, można obserwować niewielki wzrost powierzchni większości z upraw w roku 2021, m.in. ze względu na zmniejszenie się udziału upraw nieoznaczonych względem roku 2020. Ponadto w analizie wykazano, że mimo spadkowej tendencji w ilości stosowanych nawozów mineralnych, plony wzrosły, co może potwierdzać rozwój technologii produkcji oraz lepsze gospodarowanie zasobami składników pokarmowych zawartych w glebie mających fundamentalne znaczenie dla roślin.

Słowa kluczowe: rolnictwo, parametry produkcji rolniczej, użytkowanie gruntów, pogłowie zwierząt

Introduction

The primary function of rural areas is agricultural production, which is characterized by high dependence on existing natural and economic conditions. At the same time, the pace and directions of changes in agricultural production are determined by the current socio-economic state of the country, including changes in the conjuncture of the various branches of the national economy. The new alternative uses of agricultural

production, such as the production of renewable energy are also important.

The directions of the change in agricultural production should be considered from multiple angles. In addition to changes in agrarian structure and land use, an important role is played by the effectiveness of the implementation of technical progress in the broadest sense. The assessment of agricultural transformation should therefore take into account, in addition to the changes in the level and structure of crop and livestock

production, the implementation of technical progress. From a forward-looking point of view, it is also necessary to take into account the anticipated climate changes, which, in addition to a number of positive trends, may also cause various types of risks associated with, for example, the occurrence of agrophages or negative climatic water balance. It also necessitates adaptation measures and consideration of alternative scenarios. Poland is a country with significant agricultural production potential due to its large area of agricultural land compared to other EU countries. Analysis of the conditions of Polish agriculture - those of infrastructure – is conducive to improving the competitiveness of the agricultural sector.

Among other things, branches of agriculture can be divided into extensive agriculture (called small-scale or traditional agriculture) and intensive agriculture (also called high-commodity or industrialized agriculture), depending on their characteristics: the amount of inputs, the amount of yields, as well as the average area of farms and the area of farmland in the country. Based on the mentioned parameters, it is possible to analyze the state of agriculture, its impact on the environment, as well as estimate trends in these changes.

The intense changes have taken place in agriculture in the recent decades, especially at the territory of Poland, which can be analyzed from many angles. They were caused, among other things, by the socio-political transformations after 1989 and then, after Poland's accession to the European Union in 2004. The implementation of the EU's Common Agricultural Policy program, as well as technological development, further training and professional development of people working in agriculture contributed to this. It is also related to the scientific world's interest in the continuous improvement of modern agricultural production methods, taking into account not only the volume and intensity of production, but also taking into account the sustainability of the country. Scientists analyze these changes and their impact on the environment and society. The changes in the area of farms in Poland have been studied by, among others, Elżbieta Jadwiga Szymańska and Jarosław Maj[3], while the research on the development of agriculture in rural areas has been conducted by such scientists as Prof. Józef Stanisław Zegar[4] and Barbara Kryk[5].

Purpose of research

The purpose of this study is to characterize the basic parameters related to agricultural production in the Małopolskie Voivodeship and to assess the changes taking place in it. The characteristics of agriculture were also referred to the current socio-economic and infrastructural conditions of the study area.

Research methodology

Within the framework of this study, the analysis carried out is presented in several key elements. The

basic factors determining the volume and nature of agricultural production are summarized below. Based on the data obtained from the Agency for Restructuring and Modernisation of Agriculture) (Polish: Agencja Restrukturyzacji i Modernizacji Rolnictwa) in Kraków [1], the changes over 2019–2021 in the agricultural sector were exposed, except for crops, where, due to lack of data, the analysis was carried out for 2020 and 2021. The parameters analyzed include the structure of use, percentage of employment in the agricultural sector relative to other sectors of the economy, livestock population, number of farms, crop structure, yields and level of mineral fertilization.

Characteristics of the research area

The research area covers Małopolskie Voivodeship, including the following districts: Bocheński, Brzeski, Chrzanowski, Dąbrowski, Gorlicki, Krakowski, Limanowski, Miechowski, Myślenicki, Nowosądecki, nowotarski, Olkuski, Oświęcimski, proszowicki, suski, Tarnowski, Tatrzański, Wadowicki, Wielicki, and cities: Kraków, Nowy Sącz and Tarnów [2] (Fig. 1). The analyzed area borders on three provinces, i.e. Śląskie, Świętokrzyskie and Podkarpackie. The decision to select the aforementioned study area resulted primarily from a methodical approach to the analysis. This is because the Małopolska province is, from a structural and environmental point of view – a catchment area, characterized by a great similarity to the orography of the Central Polish Carpathians.

Upland and mountainous areas predominate. The province is located in three climatic regions: the mountain and foothills climate, the foothills climate of the lowlands and basins, and the central highlands climate. During the year, the average air temperature reaches 5–8°C, while the average annual precipitation is 550–1400 mm. The main watercourse flowing through the study area is the Vistula (Polish: Wisła) River [6].



Fig. 1. Study area – administrative division of the Małopolska Voivodeship [7]

Table 1. Structure of land use data 2021 [2]

Land use form	Surface area [km ²]	Percentage [% of total area]
Agricultural land	9148.46	60.25
Forest land. wooded and shrub land	4605.65	30.33
Land under surface water	224.96	1.48
Developed and urbanized land	1036.83	6.83
Ecological uses	6.71	0.04
Wastelands	113.06	0.74
Miscellaneous areas	47.13	0.31

The total area of the province is 15182.79 km², which is less than 4.9% of the national area. According to the Statistics

Poland (Polish: Główny Urząd Statystyczny), the mentioned Voivodeship is dominated by agricultural land, which in 2021 accounted for 9148.46 km² (60.3%) of the voivodeship area, including wooded and shrub land on agricultural land, until 2016 included in "forest land, wooded and shrub land", followed by forest land and wooded and shrub land – 4605.65 km² (30.3% of the voivodeship area) [2].

Results of the research

The level of employment in the agricultural sector in Małopolska province is low and has recently been less than about 10%. Residents find employment mainly in the service sector (about 60%), and less than a third of people work in industry. Employment in agriculture declined slightly from 2016 to 2017, and then increased by 0.2–0.4% from 2019. The figure is 9.6% on average for Poland in 2020 (Figure 2).

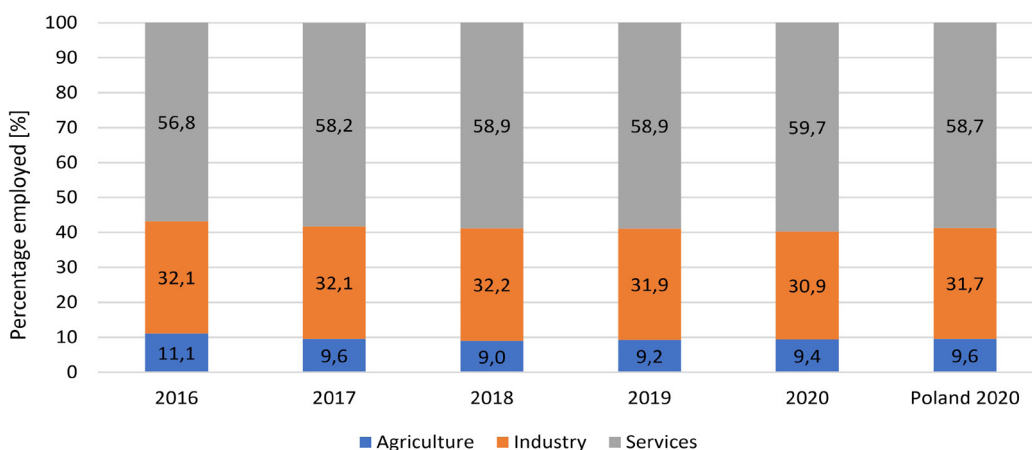


Fig. 2. Percentage of employees by economic sector [2] [%]

Livestock population in Małopolskie Voivodeship

Over the period of 2019–2021, the Małopolska region has seen a reduction in livestock numbers. In the case of cattle, the value decreased by about 8% during this period. A similar,

although more intensive, trend was observed in the case of the pig population (a decrease of about 13%). In the case of sheep numbers, the decrease in stocking rates concerned only 4%. An increase in the stocking rates was noted only for goats, from 3,123 head in 2019 to 3,964 head in 2021 (about 26%) (Fig. 3).

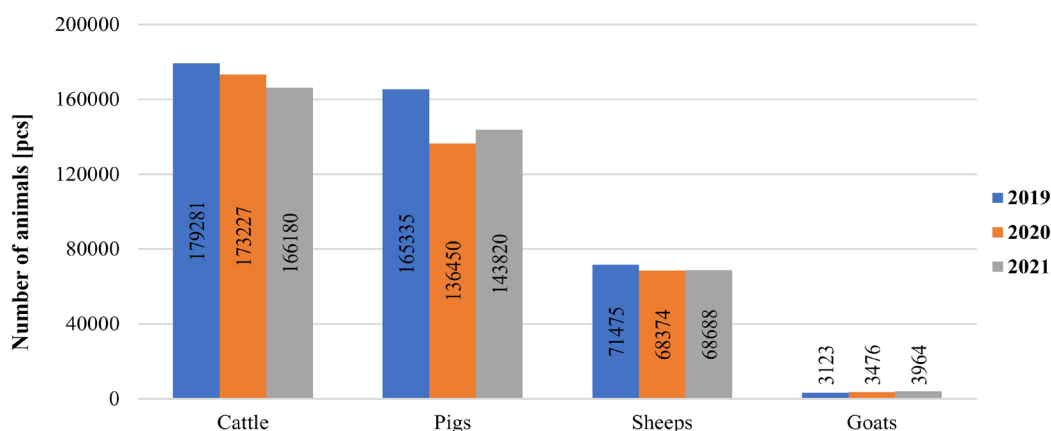


Fig. 3. Changes in livestock production in Małopolska Voivodeship from 2019 to 2021 [1] [pcs]

Number of farms engaged in livestock production

In the chart below (Figure 4), it can be observed that the number of farms in the period of 2019–2021 decreased similarly

to the cattle and pig population. The largest reduction was found in the number of farms oriented to cattle and pig breeding. In 2021, their number accounted for only 56.6% of the value of two years ago (9705 pcs in 2019, 5393 pcs in 2021).

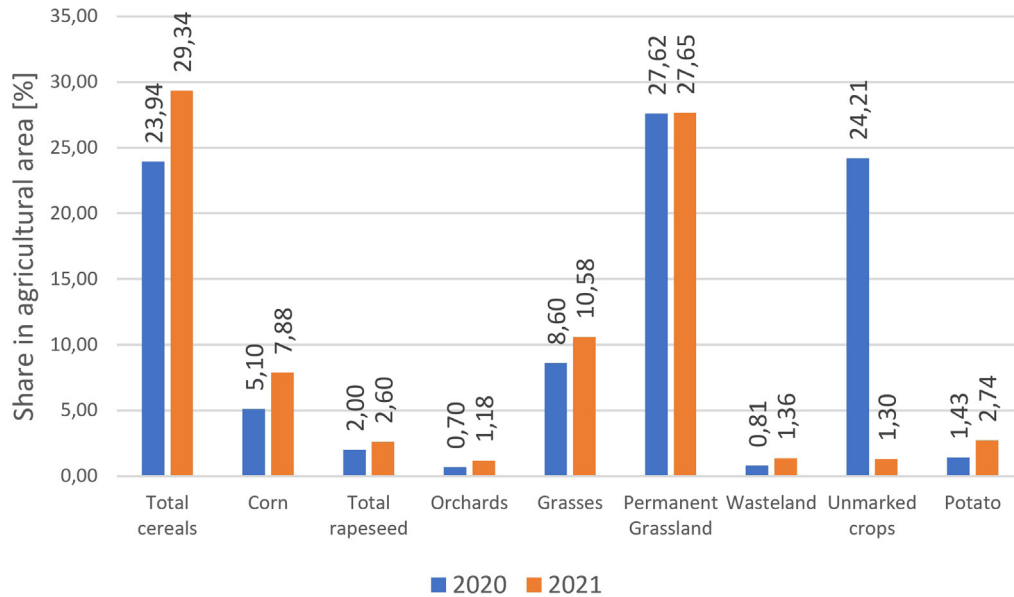


Fig. 4. Changes in the number of livestock production farms Małopolskie Voivodeship from 2019 to 2021 [1] [pcs]

Crops

Based on Figure 5, it can be seen that the area of arable land in Małopolska province has decreased slightly. According to ARiMR[1] data, the total area of agricultural land (understood as areas occupied by arable land, permanent grassland and permanent pasture or permanent crops) is decreasing. In 2021,

it was 481302.48 hectares, to decrease to 477819.81 hectares the following year. Thus, there was a loss of 3482.7 hectares of agricultural land, which is only about 1% of all agricultural land in the province. It can be assumed that this is related to the allocation of land for residential or other non-agricultural developments.

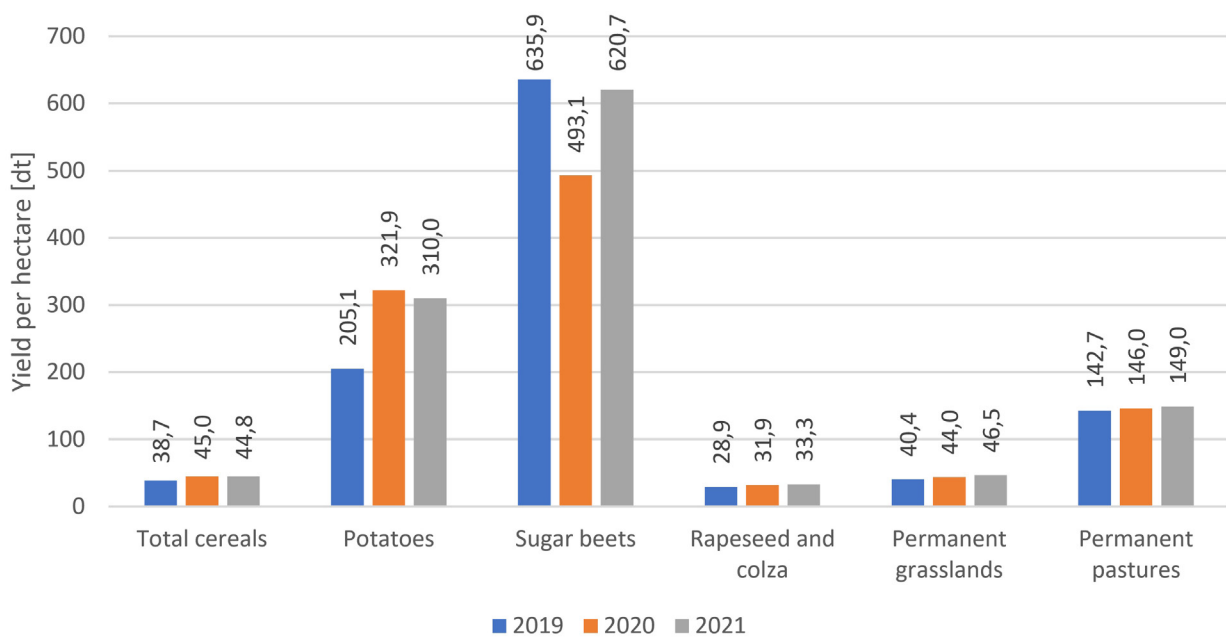


Fig. 5. Crop structure of selected plants in Małopolskie Voivodeship in 2020–2021 [1] [%]

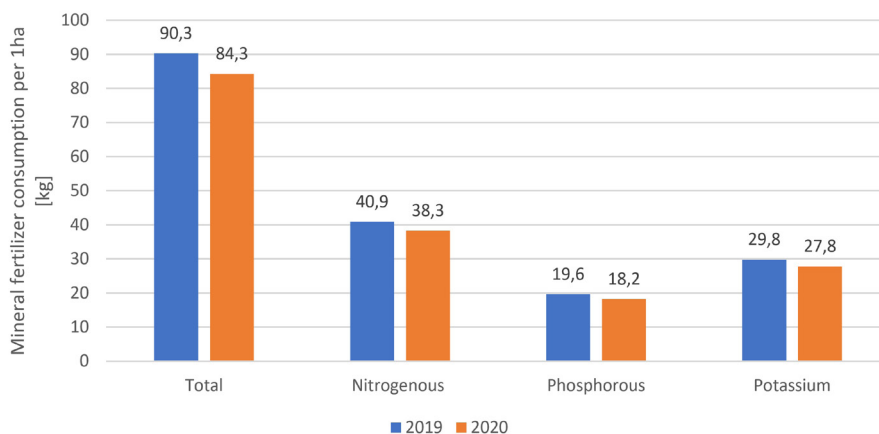


Fig. 6. Yield per hectare of staple crops in Malopolska in 2019–2021 [2] [dt]

It can be noted that despite the decreasing area of land devoted to cultivation, the share in the area of staple crops is increasing. In the case of cereals, the province in 2021 cultivated more than 5% more relative to the area of agricultural land than in the case of 2020. Increases can also be seen in the popularity of cultivation of, among others, corn (about 2.78%), grass (about 1.98%), rape (about 0.60%) or the establishment of orchards (about 0.48%). At the same time, it is shown that the area of fallow land, i.e. areas temporarily excluded from agricultural use, is increasing (by about 0.5% per year). Special attention can be paid to potato crops, which, despite their small share of the total crop area, almost doubled (by about 1.31%) during the period under review. There was a significant decrease in the area of undesignated crops (almost 23%), suggesting that the crops were more accurately classified or previously unused land was put under cultivation. There was a slight decrease in the area occupied by TUZ (permanent grassland) – by about 0.03%.

Based on the data from the Local Data Bank (Polish: Bank Danych Lokalnych) of GUS [8], it is possible to verify the obtained yields of basic crops grown in the province (Figure 6) and the applied fertilization in 2019–2021 (Figure 7).

In the case of total cereal crops, despite the decreasing area of crops from 226532 hectares in 2019 to 199927 hectares (according to ARiMR Krakow [1]) in 2021, there has been a total increase for the entire area of the crops in the province in cereal yields from 8762659 dt to 8948764 dt [2]. Digging deeper into the analysis of changes in the production of individual types of cereals, it can be seen that regardless of the increasing yields of all types, the area of staple cereals is decreasing in favour of cereal mixtures. A similar pattern can be observed in the case of the other major crops, where, despite the decreasing area, yields are increasing. These data may indicate improvements in technique and technology in cultivation, the support measures used and fertilizer doses.

A special attention can be paid to potato production, where the yield per hectare increased significantly from 205 kg per hectare of crop in 2019 to 310 kg in 2021. Sugar beet yield, on the other hand, despite a significant decline in 2020 compared to the previous year (by about, 142.8 kg/ha), rose to 620.7 kg/ha the following year. This may suggest that the province has experienced changes in climatic conditions to which this crop was sensitive in 2020.

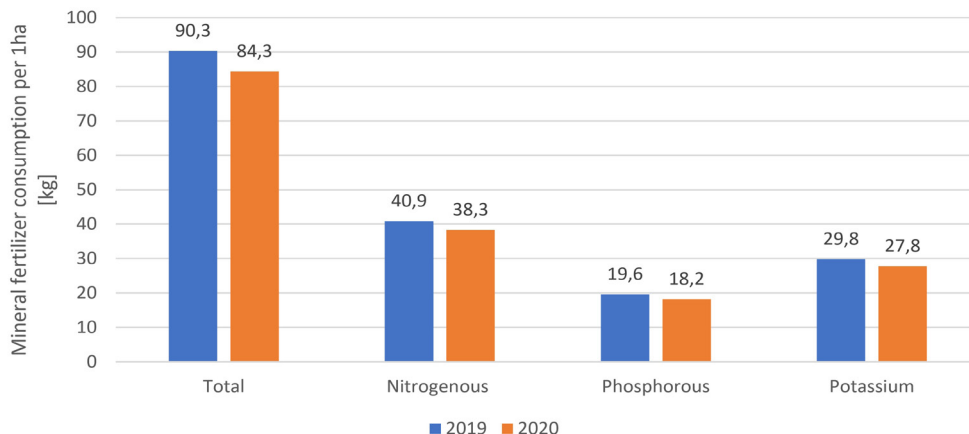


Fig. 7. Mineral fertilizer consumption per hectare on the territory of Malopolska Voivodeship in 2020–2021 [2] [kg/ha]

Analyzing the data of the CSO Local Data Bank, one can observe a decrease in the amount of mineral fertilizers applied per hectare of crops. For fertilization in the province in question, 51568 tons of total mineral fertilizers were applied in 2019, where in 2020 it was 46982 tons. Thus, the decrease over the year was nearly 10%. The reason for this trend may be the increase in fertilizer prices and the development of farmers' awareness, who more rationally select the dosage of treatments to meet the needs of each crop.

Summary and conclusions

Based on the above analysis, it is possible to observe significant changes in the agricultural sector in Lesser Poland province, over a period of just 3 years. A significant reduction in agricultural production was observed in each of the production elements. There have been reductions in livestock production, i.e. in the size of cattle and pig breeding. Minimal equilibrium was observed in the sheep population, and a slight increase was recorded for the goat population. An interesting case, and an exception in the overall analysis, appears to be the pig population, where the number of heads in 2020 decreased compared to the previous year, and increased in the following year, 2021. On the other hand, the number of farms engaged in pig production has drastically decreased (down about 45% in 2021 compared to 2019). This indicates a significant concentration of production in a smaller number of farms that have specialized in pork production. The total agricultural area in the province also decreased from 481302.48 hectares in 2020 to 477819.81 hectares in 2021[1]. Thus, it can be seen that agricultural activities, including both crop and livestock production, are losing strength and are less popular. This situation can be attributed to a number of factors, including a decline in the profitability of small farms through rising fertilizer, fuel and machinery prices. In the recent years there has also been declining rainfall, which adversely affects the yield of crops grown.

As a positive aspect, a reduction in the amount of mineral fertilizers used per hectare of crops can be observed, which does not translate significantly into a drastic reduction in yields, which in most cases are increasing. This may be due to a more rational and conscious use of fertilizers by food producers, as well as to the development of technology and improvement of crop production. This is, of course, a positive phenomenon from the point of view of environmental protection, especially water resources.

The data presented can be used to prepare a broader analysis and study of the impact of agriculture on environmental changes in the Małopolska province. The structure of agricultural production, livestock or crops will allow determining, *inter alia*, the balance of NPK or biogenic compounds, and then, estimating the impact on eutrophication processes. It can also allow an up-to-date assessment of the state of the environment, and thus plan to supply crops with the right amount of components to ensure better yields without excessive fertilization.

To sum up – the level of agricultural production in Lesser Poland Voivodeship – against the background of the volume of this production in the country – is at an average level. This is due, among other things, to the fact that the voivodeship can be territorially divided into a northern part (intensive agriculture – mainly vegetable farming) and a southern part, where the level of agricultural production (mountains and foothills) is characterized by extensive farming. There are mainly grasslands and traditional herding of sheep and partly cattle.

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