

PRODUCTION OF SELECTED CROP PLANTS IN POLAND OVER THE PERIOD OF 2010-2019

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Abstract. Plant production in Poland is growing dynamically, which is an effect of natural, economic and social factors. A measurable effect of this is a change in the area of cultivations, yields, and in the amounts of harvested crops. Based on the data published by Statistics Poland, it has been demonstrated that in the period of 2010-2019 there has been an increase of the area of wheat cultivation in Poland, while the area of cultivation of barley, triticale and oilseed rape remained at a stable level. There was a slight decrease in the area of cultivation of rye, cereal mixes and potato, and a slight increase in the case of sugar beet. In the analysed years, the yields of crop plants in Poland were at a stable level. There was only a slight increase of yields of sugar beet and oilseed rape, and a small decrease of yields of cereal mixes. In the ten-year period under analysis no distinct changes were noted in the amount of harvested crops in the country. In the case of sugar beet there was a slight increase, and in the case of cereal mixes a more pronounced decrease in the harvest volume.

Keywords: area of cultivation, yields, harvest volume, plant production, Poland

INTRODUCTION

Nowak (2013) reports that Polish agriculture ranks high in EU agriculture. Since 2004, the common agricultural policy (CAP) has been the main factor that stimulated the transformation of the Polish agricultural sector. The instruments that policy employs support the income of agricultural producers, and on the other hand impose standards that have to be met in contemporary farming. Also Halamska (2015) is of the opinion that the CAP has a major impact on the functioning and transformations of farms in Poland. However, the modernisation opportunities have been made use of mainly by large or professional farms. The data of Statistics Poland (GUS 2020) indicate that in Poland the smallest farms, with up to 5 ha of agricultural land (AL), account for more than one half of the total number of farms. The percentage of the largest farms, with areas of 50 ha and more AL, is only 2.4%. The crop structure is dominated by cereals (72.4% of the total area of cultivations), followed by industrial crops (10.8%) and fodder plant cultivations (8.9%). Jaśkiewicz and Sułek (2017) analysed Polish production of the grain of cereals and demonstrated that it



was diversified with regard to the species. There has been an expansion of the cultivation of wheat and triticale, at the cost of rye and oat. The area of cultivation of cereal mixes and barley was at a stable level. The yields of the individual cereal species indicated an increasing tendency, and the basic direction of their use was animal feed and industrial applications. Matyka (2014) reports that Polish agriculture does not fully utilise the biological, technological and organisational progress, which results in a notably lower dynamics of increase of yields relative to e.g. Germany or generally to EU-27. Bobrecka-Jamro *et al.* (2013) demonstrated large disproportions of yields between field experiments and field production. Łukiewska and Chrobocińska (2015) point out that the production potential of Polish agriculture is spatially diversified. This follows, among other things, from natural conditions, the kind of agricultural activity, agricultural structure, or from the level of economic development of a given region. Therefore, actions aimed at reducing the disproportions observed in the country in the area of agriculture development should be preceded by an analysis of the situation of the specific region. Haman *et al.* (2012) emphasise that Polish agriculture is affected by the progress and development of agricultural sciences. However, it is absurd to employ the criteria of parameteric assessment, oriented at scientific journals with high impact factor points, which can be accepted as appropriate for fundamental studies, but not for applied sciences such as agricultural sciences. For this reason, Chyłek (2011) and Kozera (2013) conclude that what is needed is an increase of awareness that the development of agricultural and associated sciences unquestionably has affected, affects and will affect all branches of the economy, food safety, consumer health and the political and economic stability of both Poland and of the European Union.

MATERIAL AND METHOD

The basic source of information used in the study was Statistics Poland, Warsaw (<https://bdl.stat.gov.pl/BDL/dane/podgrup/wymiary>). The results obtained were analysed statistically for the area of cultivations, yields, and harvest volumes of selected crops in Poland. Statistical computations were made for the period of 2010-2019, using Microsoft Excel. Based on the data from the ten-year period, the trend equation was determined and the value of the coefficient of determination R^2 was given. In the case of analyses for oilseed rape, it should be noted that GUS provides data combined with those for common agrimony. In the study we left out the analysis of the cultivation of legumes for seeds (GUS or ARMA give the notation of legumes for grain), known from the literature of the subject.

RESULTS AND DISCUSSION

Over the period of 2010-2019 there was an increase in the area of wheat cultivation in Poland. On average, in the analysed period that area was 2305.4 thousand ha. Stable sowing areas were shown for barley, oat, triticale and oilseed rape. In the case of rye and cereal mixes, due to the low values of the coefficient of determination (R^2), one can speak of only a slight decrease of cultivation. In the case of sugar beet – a slight increase of sowing area. The area under potato cultivation decreased, but at a low value of the coefficient of determination (Tab. 1). Jaśkiewicz and Sułek (2017), in a study covering a longer period of time, demonstrated that in Poland the cultivation of wheat and triticale expanded at the expense of rye and oat. The area of cultivation of cereal mixes and barley was at a stable level. Rachoń and Kawczyńska (2018) report that in Poland the contribution of cereals with higher productivity (wheat, triticale, barley, maize) increased successively, while that of cereals of low productivity – rye and oat – decreased. Hara and Stanek (2018) demonstrated that in Poland the area of potato cultivation decreased, and consequently also the position of potato in the sowing structure. Nowacki (2015) reports that in view of the progressing concentration, specialisation and professionalisation of potato production, the fact that the area of its production has been decreasing for decades does not mean that the level of potato production does not fully satisfy the needs of the Polish market and of export, in all of its sectors. In an earlier analysis, Jarecki and Kipa (2019) demonstrated that in Poland the production of oilseed rape remains at a stable level, with a slight increasing tendency. The variations in the area of cultivation, yields or harvested amounts of oilseed rape over years resulted primarily from variable weather conditions and from fluctuations on the agricultural market.

In the analysed period, the yields of the major crop plants were at fairly stable levels. In view of the low values of the coefficient of determination, one can only take note of a slight increase of yields of sugar beet and oilseed rape, and a decrease in the yields of cereal mixes. The average yields of the intensive cereals: wheat, barley, triticale, were 4.45 t ha^{-1} , 3.58 t ha^{-1} and 3.56 t ha^{-1} , respectively. The yields of the extensive cereals: rye, oat and cereal mixes, were at the levels of 2.77 t ha^{-1} , 2.71 t ha^{-1} and 2.94 t ha^{-1} , respectively (Tab. 2). Jaśkiewicz and Sułek (2017) observed that the yields of the individual cereal species grown in Poland displayed only an increasing tendency. Rachoń and Kawczyńska (2018) analysed a longer period of time and demonstrated that an increasing tendency was characteristic only of the yields of wheat in Poland. On the other hand, Hara and Stanek (2018) report an increase in the yields of potato in Poland. Dzwonkowski (2017) is of the opinion that the consequence of the high fragmentation of potato cultivation in Poland is a lower level of yields, compared to West European countries, though over the analysed period those disproportions have decreased noticeably.

Table 1. Area of cultivation in Poland (thousands of ha)

Year	Wheat	Rye	Barley	Oat	Triticale	Cereal mixes	Potato	Sugar beet	Oilseed rape
2010	2141.5	1063.2	974.5	577.3	1329.9	1100.3	400.7	206.4	946.2
2011	2258.7	1085.5	1018.0	546.2	1269.3	1199.2	406.4	203.5	830.2
2012	2077.2	1042.1	1160.6	513.8	991.8	1278.3	373.0	212.0	720.3
2013	2137.9	1172.7	820.0	433.8	1176.7	1012.4	346.1	193.7	920.7
2014	2338.8	886.4	808.3	478.6	1306.0	880.8	276.9	197.6	951.1
2015	2395.5	725.3	839.3	460.7	1516.2	812.9	300.4	180.1	947.1
2016	2384.0	761.0	926.2	477.9	1403.5	805.6	311.6	205.6	827.0
2017	2391.9	873.2	953.8	491.2	1352.0	880.4	329.3	231.7	914.3
2018	2417.2	894.0	975.7	497.2	1288.0	992.5	297.5	238.9	845.1
2019	2511.3	903.8	975.3	495.5	1314.8	931.9	308.2	240.8	875.2
Mean	2305.4	940.7	945.2	497.2	1294.8	989.4	335.0	211.0	877.7
Equation	$y = 41.25x$	$y = -30.399x$	$y = -5.8988x$	$y = -6.5321x$	$y = 16.282x$	$y = -34.184x$	$y = -11.475x$	$y = 4.0855x$	$y = 0.9103x$
of trend	$+ 2078.5$	$+ 1107.9$	$+ 977.61$	$+ 533.15$	$+ 1205.3$	$+ 1177.4$	$+ 398.12$	$+ 188.56$	$+ 872.71$
R ²	0.75	0.40	0.03	0.23	0.13	0.42	0.60	0.38	0.001

Table 2. Yields of crop plants in Poland (t ha⁻¹)

Year	Wheat	Rye	Barley	Oat	Triticale	Cereal mixes	Potato	Sugar beet	Oilseed rape
2010	4.39	2.68	3.49	2.63	3.44	3.03	21.10	48.30	2.36
2011	4.13	2.40	3.27	2.53	3.34	2.81	23.00	57.40	2.24
2012	4.14	2.77	3.60	2.86	3.38	3.07	24.20	58.20	2.59
2013	4.44	2.86	3.58	2.74	3.63	2.98	21.00	58.00	2.91
2014	4.97	3.15	4.05	3.05	4.02	3.32	27.80	68.30	3.44
2015	4.57	2.78	3.53	2.65	3.52	2.77	21.00	52.00	2.85
2016	4.54	2.89	3.72	2.84	3.64	3.00	28.50	65.80	2.68
2017	4.88	3.06	3.98	2.98	3.93	3.23	27.85	67.90	2.95
2018	4.06	2.42	3.12	2.35	3.17	2.52	25.14	59.86	2.61
2019	4.39	2.72	3.46	2.49	3.49	2.65	21.41	57.47	2.71
Mean	4.45	2.77	3.58	2.71	3.56	2.94	24.10	59.32	2.73
Equation	$y = 0.0188x$	$y = 0.0101x$	$y = 0.0029x$	$y = -0.0122x$	$y = 0.0093x$	$y = -0.0312x$	$y = 0.3135x$	$y = 0.9415x$	$y = 0.0379x$
of trend	$+ 4.3473$	$+ 2.7173$	$+ 3.564$	$+ 2.7793$	$+ 3.5047$	$+ 3.1093$	22.376	$+ 54.145$	$+ 2.5253$
R ²	0.04	0.02	0.001	0.03	0.01	0.14	0.096	0.19	0.12

Table 3. Harvested amounts of crops in Poland (thousands of tons)

Year	Wheat	Rye	Barley	Oat	Triticale	Cereal mixes	Potato	Sugar beet	Oilsed rape
2010	9408.1	2851.7	3397.2	1516.5	4575.8	3338.7	8448.2	9972.6	2228.7
2011	9339.2	2600.7	3325.9	1381.6	4235.3	3372.7	9361.9	11674.2	1861.8
2012	8607.6	2888.1	4180.2	1467.9	3349.2	3919.6	9041.3	12349.6	1865.6
2013	9485.2	3359.3	2933.6	1190.0	4273.0	3021.1	7290.4	11234.2	2677.7
2014	11628.7	2792.6	3274.8	1458.6	5246.7	2922.4	7689.2	13488.9	3275.8
2015	10957.8	2013.2	2960.7	1219.6	5339.4	2250.0	6313.7	9364.5	2700.8
2016	10827.9	2199.6	3441.1	1358.1	5102.5	2415.2	8872.5	13523.8	2219.3
2017	11665.7	2673.6	3793.0	1464.6	5312.1	2847.4	9171.7	15733.0	2697.3
2018	9820.3	2166.9	3048.3	1166.1	4085.7	2505.5	7478.2	14302.9	2202.4
2019	11012.4	2461.4	3374.4	1232.5	4583.5	2472.4	6599.2	13836.6	2373.2
Mean	10275.3	2600.7	3372.9	1345.6	4610.3	2906.5	8026.6	12548.0	2410.3
Equation of trend	$y = 220.93x + 9060.2$	$y = -72.002x + 2996.7$	$y = -17.43x + 3468.8$	$y = -23.125x + 1472.7$	$y = 69.199x + 4229.7$	$y = -131.63x + 3630.4$	$y = -156.39x + 8886.8$	$y = 441.44x + 10120$	$y = 35.715x + 2213.8$
R ²	0.39	0.29	0.02	0.28	0.10	0.58	0.18	0.45	0.06

In the analysed ten-year period no big changes were noted in the total volumes of crop plants cultivated in Poland. Due to the low values of the coefficient of determination, one can only speak about a slight increase in the harvested amounts of sugar beet and wheat, and a more pronounced decrease of harvested amounts in the case of cereal mixes (Tab. 3). Skarzyńska and Pietrych (2018) predict, for a near future, an increase of yields and of selling prices of cereals, both in Poland and in the EU. Leszczyńska (2010) concludes that a characteristic feature of plant production in Poland is a large area of mixed sowings. The regional diversity of harvested amounts of cereal mixes in our country is affected primarily by the habitat conditions (poorer soils) and by organisational factors (size and area structure of farms). The highest importance is attributed to cereal mixes in the north-eastern part of the country. Dzwonkowski (2017) believes that the decrease of demand for potato in Poland applies only to fodder potato. The harvested amounts are, however, partially compensated for by the level of yields. Izdebski *et al.* (2014) report that the basic oil-bearing plant in Poland is oilseed rape, the demand for which as a raw material for biofuel production caused a nearly 2-fold increase of its production, significantly exceeding the consumption requirements. The reduction of the scale of production of first generation biofuels may, however, change that situation. Waś (2016) is of the opinion that changes taking place on the sugar market in Europe, which began in 2006 and were terminated by the elimination of the production quota system in 2017, have had an impact on the scale of sugar beet production in the EU and therefore also in Poland.

CONCLUSIONS

1. In the period of 2010-2019 there was an increase in the area of wheat cultivation in Poland. A stable level of cultivation areas was characteristic of barley, oat, triticale and oilseed rape. Cultivation areas of cereal mixes decreased a little, while those of sugar beet increased. The area under potato production decreased to a greater extent ($R^2 = 0.6$).

2. In the analysed years the yields of the main crops in Poland were at a stable level. A small increase was noted only in the case of yields of sugar beet and oilseed rape, and a slight decrease was noted in the yields of cereal mixes.

3. In the ten-year period under analysis no greater changes were noted in the harvested amounts of crops in Poland. Due to the low values of the coefficient of determination, only a slight increase was noted in the harvest volume of sugar beet and wheat, and a more pronounced decrease in the harvest volume of cereal mixes.

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