



Kingdom of the Netherlands



INSTITUTE OF AGRICULTURAL  
AND FOOD ECONOMICS  
NATIONAL RESEARCH INSTITUTE

# PROTEIN CROP MARKET in POLAND

The study prepared by the Institute of Agricultural and Food Economics -  
National Research Institute



Warsaw, January 2021

The sector of protein crops in Poland has a long tradition, plays an important economic, social and environmental role and is an important element of the food security policy. The cultivation of protein crops is of great economic importance as they are a source of valuable protein in human and animal nutrition. Protein crops are part of food security, which is the objective of the economic policy in each country, encompassing the availability of protein. Hence, a need to provide diversified and reliable sources of protein acquisition. The social importance of the sector stems from the fact that the production of protein crops is a source of income for farmers, and service companies and the related agri-food industry create numerous jobs.<sup>1</sup>

Protein crops have unique natural and economic values. They increase the content of humus in the soil (positive balance of organic matter), enriching the sorption complex of the soil with nutrients. When cultivated in catch crops for „green fertilisers”, they bring 4-8 tonnes of dry matter into the soil. The deep root system allows to derive calcium, phosphorus and potassium from the deeper soil layers and to move them to the surface soil layers, thus making these components available to other plants. In symbiosis with bacteria, protein crops fix atmospheric nitrogen, thus reducing the costs of fertilisation. The introduction of these crops into crop rotation allows to reduce the use of mineral fertilisers, which has an ecological and economic aspect.

This study focuses on protein crops (legumes) cultivated for grain. The information on the spatial distribution of individual crops, due to the availability of data, relates to 2019. On the other hand, the more general information is presented also for 2020 and is largely estimates made by the IAFE-NRI.

### **Cultivation area, yields and harvest**

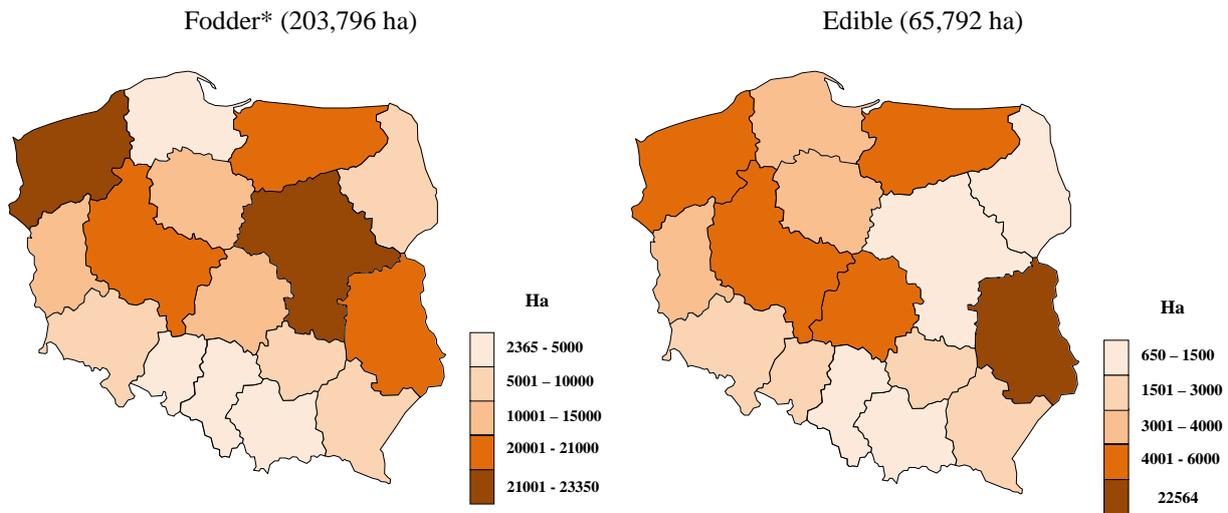
Legumes (protein crops) are cultivated mainly for seeds, which, due to their high nutritive value, are an important component of protein feedstuffs, as well as a valuable element of the human diet. Over the last decade, an increase in the cultivation area of legumes in Poland has been observed. They are cultivated virtually all over the country, although in the case of individual crops a spatial division is also clearly marked. Species cultivated for feed grain are definitely much more important, while the cultivation area of typically edible species is definitely smaller. In 2019, the cultivation area of fodder legumes stood at nearly 204 thousand ha, while that of edible legumes – less than 66 thousand ha. In addition, the cultivation area of fodder legumes for green forage occupied about 20 thousand ha.

The cultivation of fodder legumes is concentrated in the belt of central Poland and in its north-western part. By contrast, fodder legumes are clearly less important in the southern part of the country. This is associated with the specific soil and climatic requirements of individual species as well as with the distribution of the livestock production, which is a beneficiary of harvested yields.

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<sup>1</sup> Support for the cultivation and processing of protein crops – non-GMO – is part of the government programme “Plan for the Countryside”.

## Cultivation area of protein crops (legumes) for grain in 2019



\* for grain including mixtures

Source: CSO data

The cultivation of lupins (117.4 thousand ha in 2019), with the largest acreage, is concentrated in six of the sixteen voivodeships, while in four of them the area is within the range of 10-15 thousand ha, and in two (Mazowieckie Voivodeship and Zachodniopomorskie Voivodeship) it is larger than 15 thousand ha. Just like in the case of most legumes, the cultivation of lupine is of little importance in the southern part of the country.

A clear leader in the cultivation of field bean is the Warmińsko-Mazurskie Voivodeship, where the conditions for its cultivation are favourable, but it results mostly from the fact that in this region, due to training activities, the country's first cluster – Agroport Bartoszyce – has been registered, bringing together about 500 farmers engaged in the cultivation of field bean. In addition, the relatively large area is occupied by field bean in other voivodeships of the coastal belt and in western Poland.

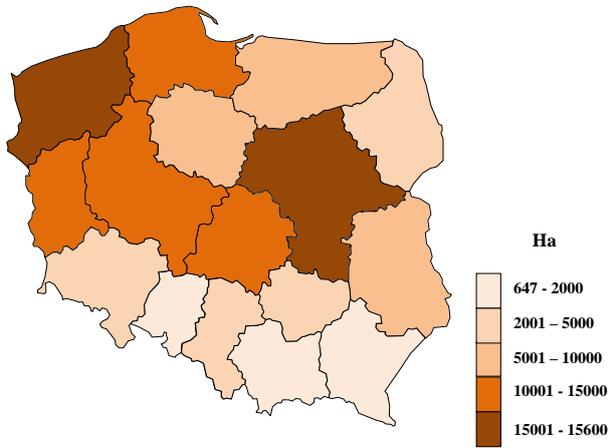
The cultivation of fodder pea is also a clear domain of farmers in the northern part of the country, and it is not much cultivated in the south of Poland. Common vetch is less popular in the Polish conditions, and its cultivation area in recent years has not exceeded 5 thousand ha. It is cultivated mainly in the belt of eastern Poland and in the Dolnośląskie Voivodeship.

Cereal-legume mixtures as well as legume mixtures are of relatively great importance (more than 38 thousand ha in 2019), and their cultivation is located mainly in the belt of central Poland and in the Pomorskie Voivodeship.

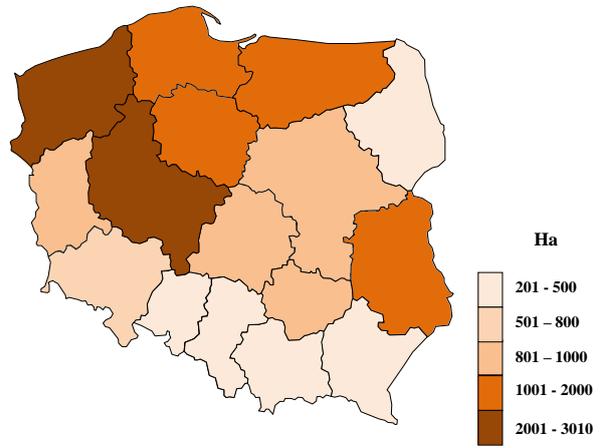
Despite many years of efforts to increase its popularity in the cultivation, soybean is still of marginal importance in the Polish conditions. In 2019, its area was estimated at less than 8 thousand ha and is clearly concentrated in the south, although soybean is cultivated, to a greater or smaller extent, throughout the country.

### Cultivation area of fodder legumes for grain in 2019

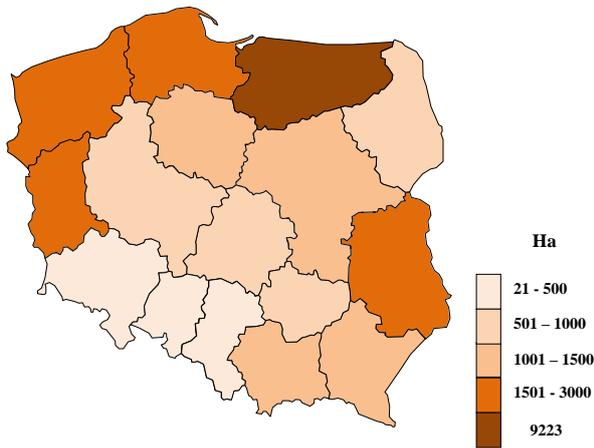
Lupin (117,426 ha)



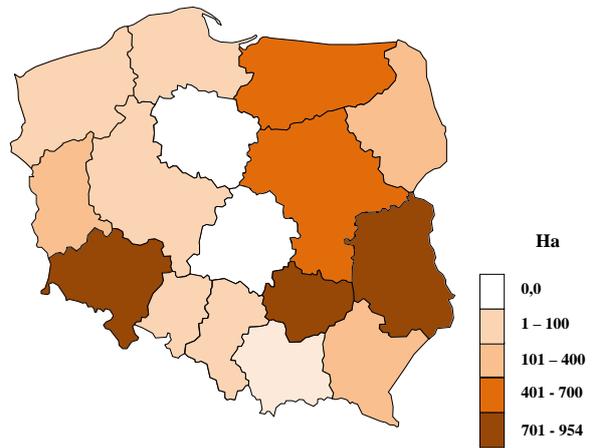
Fodder pea (14,415 ha)



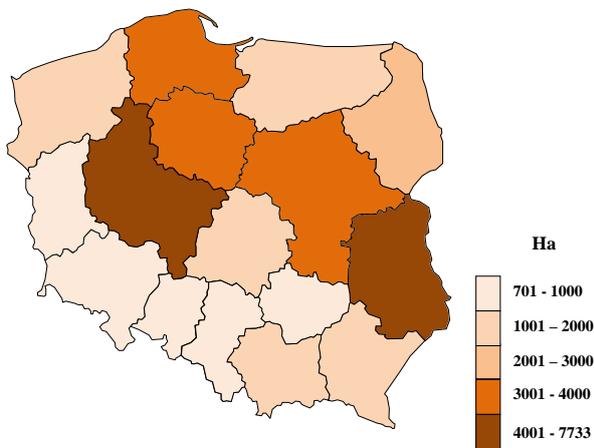
Field bean (26,084 ha)



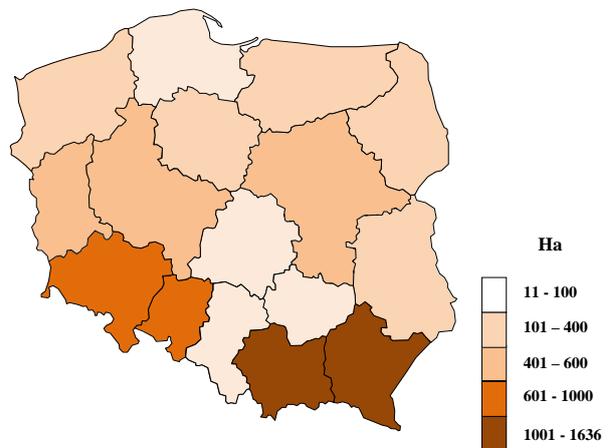
Common vetch (4,749 ha)



Legume and cereal-legume mixtures (38,122 ha)



Soybean (7,924 ha)



Source: CSO data

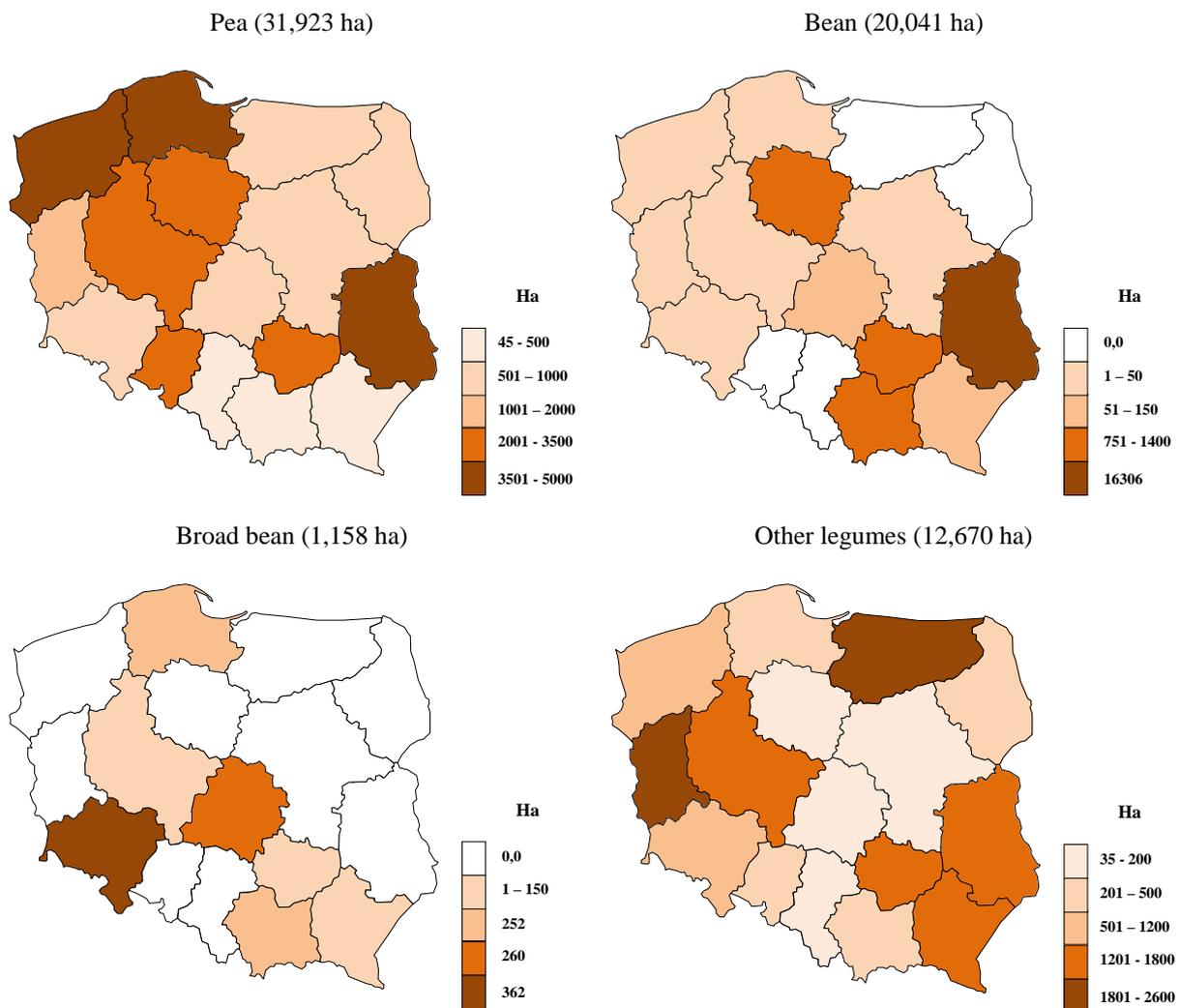
The location of the cultivation area of edible legumes is largely similar to that of fodder crops. Pea, which accounts for almost half of the area of all edible legumes, is cultivated mainly in north-western and western Poland and in the Lubelskie Voivodeship located in the east.

Bean is the domain of south-eastern Poland with the absolute predominance of the Lubelskie Voivodeship, where more than 80% of its cultivation is concentrated. This is linked to the favourable climatic conditions and the long tradition of cultivation of this vegetable.

Broad bean, a vegetable highly appreciated by consumers, is of little importance and is cultivated only in seven of the sixteen voivodeships. It occupies the largest area in the Dolnośląskie Voivodeship and Łódzkie Voivodeship.

The cultivation of other edible legumes is also unevenly distributed throughout the country, whereby they occupy the largest area in the Lubuskie Voivodeship and Warmińsko-Mazurskie Voivodeship and in the south-eastern part of Poland.

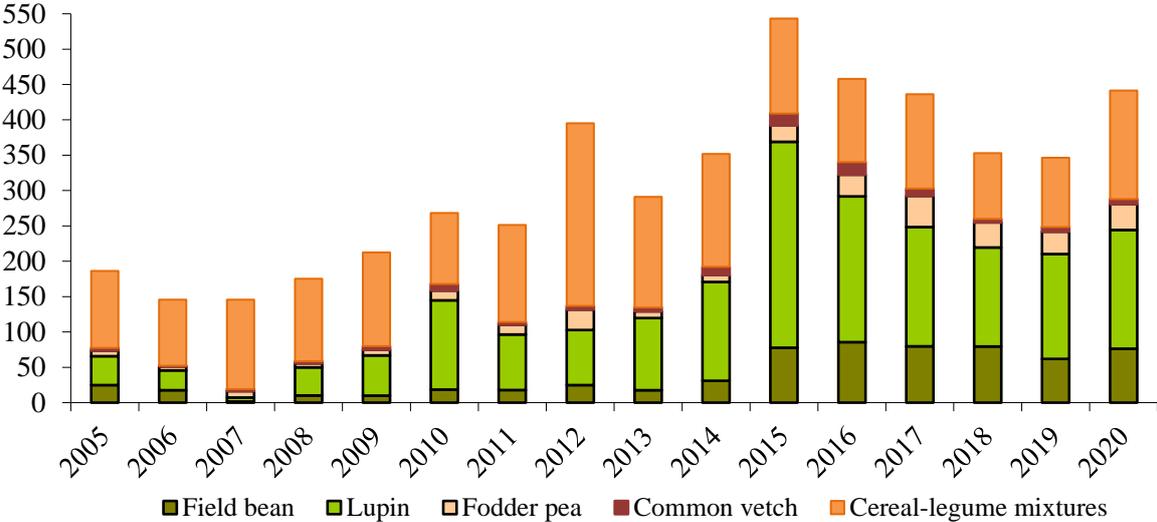
### Cultivation area of edible legumes in 2019



Source: CSO data

In the years 2010-2020, the harvest of fodder legumes (including mixtures) ranged from 251 thousand tonnes to 543 thousand tonnes. This level of production was achieved on an area of 126-313 thousand ha and with average yields of 17-23 dt/ha. The record-breaking level of their production was reached in 2015, when it increased to 543 thousand tonnes. In 2016, there was a decrease and then the stabilisation of the cultivation area at a level slightly exceeding 200 thousand ha. In 2020, this area increased by about 15%, mainly due to the fact that sowings of cereal-legume mixtures increase by 50%. The harvest volume in the individual years depended on the level of yields, which at that time were relatively low due to the unfavourable growing conditions for legumes (drought) and in the years 2018-19 their average level was about 17 dt/ha. In 2020, the production of fodder legumes for grain (including cereal-legume mixtures) could exceed 440 thousand tonnes.

**Fig. 1. Production of fodder legumes for grain (thousand tonnes)**



Source: Own calculations based on the CSO data.

Lupins are cultivated in the largest quantities. Due to the low environmental (soil and climatic) requirements and very favourable phytosanitary properties (*inter alia*, excellent forecrop, significantly reduces the consumption of nitrogen fertilisers – fixes nitrogen from the air and from plant protection products), the interest in their cultivation has increased most. Their cultivation area in 2020 is estimated at about 117 thousand ha and the harvest at 165 thousand tonnes, and in the record-breaking year of 2015 it was 208 thousand ha and 291 thousand tonnes, respectively.

The cultivation area of the demanding field bean, which has the soil and environmental requirements similar to those of intensive cereals, such as wheat, is estimated at 28 thousand ha in 2020, i.e. about 2 thousand more than in the previous year, but 3 thousand ha less than in 2015. The harvest of field bean is estimated at about 71 thousand tonnes, when compared to 62 thousand tonnes in 2019 and 78 thousand tonnes in the record-breaking year of 2015. This is still relatively low, as the profitability of its cultivation against wheat is still low.

A slightly smaller area (about 17.5 thousand ha) in 2020 was occupied by fodder pea, for which no clearer increase in the interest in its cultivation is visible. Its harvest is estimated at about 36 thousand tonnes, when compared to 31.5 thousand tonnes in 2019 and 43.9 thousand tonnes in 2017 which was a record-breaking year for this crop.

A fairly stable but still significant item is the cultivation of cereal-legume mixtures, the area of which was between 32 and 52 thousand ha in the analysed period, with the

exception of 2012, when it increased to 93 thousand ha, and in the years 2017-2019 it was within the range of 38-44 thousand ha. According to preliminary estimates, in 2020 this area increased to around 52 thousand ha and the harvest is estimated at about 154 thousand tonnes, i.e. more than 50% more than in the last two years.

**Table 1. Cultivation area, yields and harvest of fodder legumes**

Specification	2010	2015	2017	2018	2019	2020*
<b>Area (thousand ha)</b>						
Field bean	7.0	31.6	29.8	34.1	26.1	28.0
Lupin	75.7	207.8	103.3	107.4	117.4	115.5
Pea	6.2	12.0	18.9	20.9	17.4	17.5
Common vetch	5.4	11.8	6.6	3.4	4.7	4.6
Cereal-legume mixtures	31.7	49.6	42.5	37.3	38.1	52.0
<b>TOTAL</b>	<b>125.9</b>	<b>312.9</b>	<b>201.1</b>	<b>203.2</b>	<b>203.8</b>	<b>217.6</b>
<b>Yields (dt/ha)</b>						
Field bean	26.5	24.6	26.8	23.3	23.7	27.3
Lupin	16.7	14.0	16.3	13.0	12.6	14.5
Pea	22.3	19.1	23.2	17.0	18.1	20.8
Common vetch	17.2	14.3	15.7	14.5	14.0	16.0
Cereal-legume mixtures	31.7	27.1	31.4	24.9	25.7	29.5
<b>TOTAL</b>	<b>21.3</b>	<b>17.4</b>	<b>21.7</b>	<b>17.4</b>	<b>17.0</b>	<b>20.3</b>
<b>Harvest (thousand tonnes)</b>						
Field bean	18.5	77.7	79.7	79.5	61.8	76.3
Lupin	126.2	291.2	168.7	140.0	148.5	167.9
Pea	13.7	23.0	43.9	35.5	31.5	36.4
Common vetch	9.2	17.0	10.4	4.9	6.7	7.3
Cereal-legume mixtures	100.5	134.4	133.5	93.0	97.9	153.6
<b>TOTAL</b>	<b>268.1</b>	<b>543.3</b>	<b>436.2</b>	<b>352.9</b>	<b>346.3</b>	<b>441.5</b>

*\*estimate by the IAFE-NRI*

*Source: CSO.*

Yields of protein crops in Poland are low and there is no improvement in their productivity in the longer term. The lowest yield is characteristic of lupin whose yield per ha usually does not exceed 15 dt/ha. Pea gives slightly better yields and its yields in the analysed period were within the range of 17-23 dt/ha. In 2020, yields are estimated at 21 dt/ha against 17-18 dt/ha in the last two years.

**Table 2. Cultivation area, yields and harvest of soybean**

Specification	2016	2017	2018	2019	2020*
Cultivation area (thousand ha)	7.5	9.3	5.4	7.9	7.9
Yields (dt/ha)	19.6	21.7	18.9	19.4	21.0
Harvest (thousand tonnes)	14.7	20.3	10.3	15.4	16.6

*Note: statistical data on soybean is available as from 2016.*

*\*estimate by the IAFE-NRI*

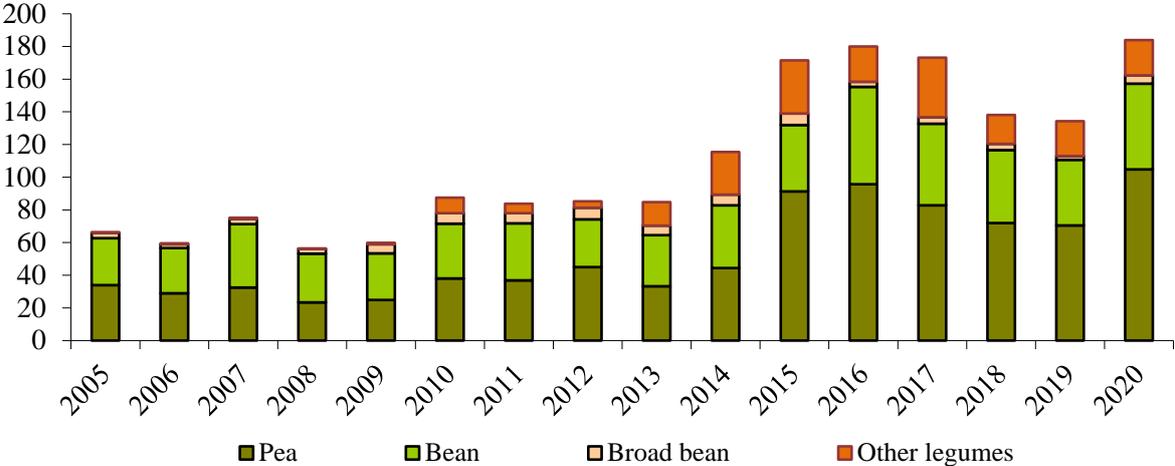
*Source: CSO.*

Among legumes, the best yields are given by field bean, whose average yield per ha in the Polish conditions is 24-28 dt/ha. On the other hand, the level of yields of cereal-legume mixtures is by about 20% lower than average yields of cereals. In 2020, yields of cereal-legume mixtures are estimated at 29.5 dt/ha, when compared to 25.7 dt/ha in the previous year.

The cultivation area of soybean, which, according to many experts (especially those who receive money for research from the budget), is supposed to provide a long-term solution to the problems of feed protein deficiency, was less than 8 thousand ha in the last two years. Yields of soybean in the Polish conditions in the last five years have ranged from 18.9 to 21.7 dt/ha, and the harvest was 10-20 thousand tonnes.

In the production of edible legumes, just like in the case of their cultivation for feedstuffs, there was some recovery in the years 2010-2014, when this type of activity was covered by additional payments. In the years 2015-2017, along with an increase in the announced additional financial support, there was a further increase in the cultivation area and harvest. Then, when edible legumes were excluded from the additional payment scheme, their area slightly decreased. We must be aware of the fact that in the case of edible crops, payments were not as important as in the cultivation of fodder legumes.

**Fig. 2. Production of edible legumes (thousand tonnes)**



Source: Own calculations based on the CSO data.

Legumes are highly sensitive to weather conditions during the growing season, particularly to the absence of rainfall, hence their production volume depends not only on the cultivation area but also on changes in yields, which in unfavourable years are lower by even 20-30% when compared to years with favourable weather conditions. For this reason, the production of edible legumes in Poland in the years 2018-2019 was only 134-138 thousand tonnes, when compared to more than 170 thousand tonnes in the preceding three-year period of 2015-2017.

The production is the largest for edible pea, whose harvested volume in 2020 probably exceeded 100 thousand tonnes. The harvest of bean is usually half as big and last year it was more than 52 thousand tonnes. The production of broad bean was around 5 thousand tonnes, more than twice as much as in 2019, but it was by 40% lower than in 2015, a record-breaking year for this crop. In recent years, the cultivation area of other edible legumes has slightly exceeded 10 thousand ha, and the harvest was above 20 thousand tonnes.

Average yields of edible legumes in less favourable years are around 20 dt/ha, and when there is enough rainfall, they increase to about 24 dt/ha. The highest yield is characteristic of pea and slightly lower yields are achieved in the cultivation of bean and broad bean as well as of other legumes.

**Table 3. Cultivation area, yields and harvest of edible legumes**

Specification	2010	2015	2017	2018	2019	2020*
<b>Area (thousand ha)</b>						
Pea	16.7	38.0	30.1	32.0	31.9	40.1
Bean	17.8	25.8	18.0	20.4	20.0	22.2
Broad bean	2.8	3.7	1.5	1.9	1.2	2.2
Other	6.3	23.5	21.8	11.8	12.7	10.7
<b>TOTAL</b>	<b>43.7</b>	<b>91.0</b>	<b>71.3</b>	<b>66.2</b>	<b>65.8</b>	<b>75.3</b>
<b>Yields (dt/ha)</b>						
Pea	22.7	24.0	27.5	22.5	22.1	26.1
Bean	18.7	15.7	27.7	21.8	20.0	23.6
Broad bean	23.3	18.8	27.5	20.0	20.3	23.0
Other	14.9	13.9	16.8	14.9	16.8	20.1
<b>TOTAL</b>	<b>20.0</b>	<b>18.8</b>	<b>24.3</b>	<b>20.9</b>	<b>20.4</b>	<b>24.4</b>
<b>Harvest (thousand tonnes)</b>						
Pea	38.1	91.3	82.8	71.9	70.5	104.8
Bean	33.4	40.7	49.9	44.6	40.2	52.5
Broad bean	6.5	7.0	4.0	3.9	2.3	5.1
Other	9.5	32.6	36.5	17.7	21.3	21.5
<b>TOTAL</b>	<b>87.5</b>	<b>171.5</b>	<b>173.2</b>	<b>138.1</b>	<b>134.3</b>	<b>183.9</b>

*\*estimate by the IAFE-NRI*

*Source: CSO.*

The number of farmers cultivating legumes is characterised by the high variability depending on the economic situation and applicable coupled payments. Most farmers cultivated legumes in 2015 (about 119 thousand), including 34 thousand cultivating edible legumes, 85 thousand cultivating fodder legumes (73 thousand cultivated them in pure sowing and more than 12 thousand – as cereal-legume mixtures).

**Table 4. Number of farmers cultivating legumes for grain and the average area**

Specification	2011	2015	2016	2017	2018	2019
<b>Edible legumes</b>						
Number of farms	30,284	34,133	29,939	23,528	21,649	19,151
Average area (ha)	1.24	2.67	2.45	3.03	3.06	3.44
<b>Fodder legumes</b>						
Total						
number of farms	71,580	85,150	97,324	66,271	72,310	69,914
average area (ha)	1.92	3.17	1.98	2.48	2.39	2.50
<i>including:</i>						
- <i>in pure sowing</i>						
number of farms	49,127	72,865	89,304	56,128	65,150	62,948
average area (ha)	1.94	3.11	1.78	2.28	2.18	2.31
- <i>mixtures</i>						
number of farms	22,453	12,285	8,020	10,143	7,160	6,966
average area (ha)	1.88	3.53	4.20	3.60	4.25	4.21

Source: CSO.

In the years 2017-2019, when the range of protein crops covered by coupled support was reduced, the number of farms cultivating these crops clearly decreased. Notwithstanding market factors, just like in other sectors of agricultural activity, there is a progressive concentration of the cultivation and production of legumes, as reflected in the slowly increasing average cultivation area, especially with regard to edible crops and fodder cereal-legume mixtures.

The sector of protein crops is poorly organised as there is no producer group there. The interests of farmers cultivating protein crops are represented within the Polish Association of Rapeseed and Protein Crop Producers.

### Foreign trade in legumes

Just like in the case of many other agri-food products and articles, also legumes are subject to foreign trade. The volume of this trade is usually dependent on the harvest volume as well as on the economic situation in the markets and the level of transaction prices.

In the years 2016-2019, the export of fresh leguminous vegetables amounted to 6.0-12.8 thousand tonnes, of frozen vegetables – 62.7-80.7 thousand tonnes and of dried vegetables – 41.5-51.6 thousand tonnes. In the case of fresh and frozen vegetables, these were vegetables clearly intended for consumption. On the other hand, in the case of dried legume grain, it is very difficult to distinguish between these legumes in certain cases, due to the way there are classified in the customs tariff and related statistics. This applies, *inter alia*, to broad bean and field bean, which are assigned to one CN code, or pea, where it is difficult to determine its intended use – for consumption or for feed.

An important item in the export is also lupin, whose sales volume to foreign markets in the years 2016-2017 amounted to 61.2 and 71.8 thousand tonnes, respectively. In the

following two years and in the period of I-X 2020, its export level significantly decreased due to a decrease in the production.

**Table 5. Export of leguminous vegetables (tonnes)**

Specification	2016	2017	2018	2019	2020 (I-X)
<b>Fresh</b>	<b>12,814</b>	<b>5,992</b>	<b>9,241</b>	<b>8,496</b>	<b>9,049</b>
pea	9,528	3,838	6,513	4,704	5,830
bean	3,182	2,001	2,246	3,509	2,966
other	103	153	482	282	253
<b>Frozen</b>	<b>69,966</b>	<b>62,709</b>	<b>80,768</b>	<b>67,102</b>	<b>44,339</b>
pea	40,854	31,688	45,216	34,281	22,380
bean	27,886	29,740	34,152	31,973	21,196
other	1,225	1,281	1,400	847	764
<b>Dried</b>	<b>49,364</b>	<b>41,507</b>	<b>43,448</b>	<b>57,619</b>	<b>44,053</b>
pea	22,068	16,806	20,961	14,541	15,793
bean	12,346	13,856	12,753	18,222	9,948
chickpea	358	636	589	929	930
lentil	247	559	638	771	948
broad bean and field bean	14,007	8,839	6,674	20,459	14,529
other	338	810	1,834	2,698	1,904
<b>Lupin</b>	<b>61,183</b>	<b>70,835</b>	<b>34,843</b>	<b>26,902</b>	<b>14,099</b>
<b>Flour, meal and powder made of leguminous vegetables</b>	<b>2,337</b>	<b>2,035</b>	<b>56</b>	<b>220</b>	<b>292</b>

Source: Study by the IAFE-NRI based on the MF data.

In addition, in the years 2016-2017 2.3 and 2.0 thousand tonnes, respectively, of flour and meal made of leguminous vegetables were exported, in 2018 this export volume decreased to 56 tonnes and increased again slightly in the last two years. This decrease was linked to the cessation of exporting to Norway, as it was, in fact, the only significant customer of these products.

In the case of fresh, frozen and dried legumes, the vast majority of export goes to the EU countries (mainly Germany), but also to many other countries of the world. Exported lupin grain, used in animal feedstuffs, was mostly sent to the Netherlands (detailed information on export destinations and volume is provided below in Table 7, and that on import – in Table 8).

The import volume of legumes is, on average, half as low as the export volume, with the exception of dried legumes, where these volumes are similar, especially in the last three years. In recent years, we have seen an increase in the import level. Preliminary trade data for the 10 months of 2020 does not reflect this, but it is worth noting that this import is concentrated in the second half of the year. Moreover, a significant increase in the domestic harvest may have reduced the import demand. What is also observed is an increase in the import of dried legumes, mostly pea grain, which is probably used in the production of feedstuffs. An increase in the import of bean, chickpea and lentil should be linked to the

growing consumer interest and the resulting increase in demand for such products, regarded as health-promoting and organic.

**Table 6. Import of leguminous vegetables (tonnes)**

Specification	2016	2017	2018	2019	2020 (I-X)
<b>Fresh</b>	<b>3,101</b>	<b>2,461</b>	<b>3,430</b>	<b>8,054</b>	<b>1,762</b>
pea	2,390	1,629	2,810	7,347	1,196
bean	306	511	293	380	270
other	406	321	328	327	295
<b>Frozen</b>	<b>8,046</b>	<b>6,321</b>	<b>8,846</b>	<b>12,805</b>	<b>8,903</b>
pea	2,599	2,312	5,019	7,588	4,602
bean	5,013	3,913	3,765	4,980	3,982
other	435	96	61	236	319
<b>Dried</b>	<b>16,721</b>	<b>20,317</b>	<b>39,892</b>	<b>50,349</b>	<b>40,735</b>
pea	2,775	3,850	22,949	31,176	22,486
bean	5,751	5,033	8,362	6,691	6,910
chickpea	2,336	3,702	3,088	5,260	3,667
lentil	4,579	4,054	3,620	6,659	6,012
broad bean	831	1,921	1,687	379	409
other	449	1,759	185	185	1,252
<b>Lupin</b>	<b>13,947</b>	<b>7,996</b>	<b>10,471</b>	<b>8,029</b>	<b>6,004</b>
<b>Flour, meal and powder made of leguminous vegetables</b>	<b>115</b>	<b>107</b>	<b>598</b>	<b>274</b>	<b>238</b>

*Source: Study by the IAFE-NRI based on the MF data.*

The EU countries are the major import destinations for fresh and frozen leguminous vegetables; in the case of fresh vegetables, of key importance are Lithuania and the Czech Republic, while for frozen vegetables – the Netherlands, Belgium and France. The import destinations of dried legumes are more diverse, with the smaller share of the countries. In the last three years, most of them have been imported from Ukraine, and this applies mainly to fodder pea. Pea is also purchased in Lithuania and the Czech Republic. In the import of lupins the importance of the EU countries is decreasing, while the role of Russia and Ukraine is growing. Legume meal is imported from the EU countries as well as from India, Russia and Ukraine.

**Table 7. Export of leguminous vegetables by geographical destinations (tonnes)**

<b>Specification</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020 (I-X)</b>
<b>Fresh</b>	12 814	5 992	9 241	8 496	9 049
EU-28	12 794	5 899	9 223	8 289	9 032
<i>Germany</i>	3 566	3 467	6 198	4 948	6 070
<i>Romania</i>	2 290	1 472	1 551	1 654	803
<i>Lithuania</i>	4 236	168	109	303	13
Other	20	94	18	207	16
<b>Frozen</b>	69 966	62 709	80 768	67 102	44 339
EU-28	34 061	30 388	35 950	33 930	24 386
<i>Germany</i>	13 599	9 195	13 231	11 811	7 923
<i>Czech Republic</i>	3 079	2 775	3 748	5 160	4 708
<i>Romania</i>	2 707	4 961	4 712	6 031	4 475
<i>Netherlands</i>	3 938	2 342	2 524	1 598	678
<i>Belgium</i>	3 195	3 840	2 917	1 312	759
CIS	14 448	13 752	11 366	13 051	6 376
<i>Belarus</i>	12 969	12 140	9 065	10 173	3 653
<i>Ukraine</i>	924	1 002	1 701	2 139	2 331
Developing countries	11 830	7 573	14 553	6 111	2 881
<i>Saudi Arabia</i>	4 805	1 800	4 980	1 406	912
<i>Egypt</i>	3 113	1 728	2 094	2 094	1 030
<i>United Arab Emirates</i>	1 587	1 080	2 367	815	264
Other developed countries	9 423	10 829	18 503	13 734	10 390
<i>USA</i>	6 279	7 029	12 599	9 760	7 867
<i>Canada</i>	2 213	2 831	4 698	3 103	2 181
Other	205	168	396	277	306
<b>Dried</b>	49 364	41 507	43 448	57 619	44 053
EU-28	20 031	32 114	37 563	44 752	33 885
<i>Germany</i>	2 448	9 138	18 579	22 322	16 577
<i>Italy</i>	4 419	8 718	4 541	6 067	3 362
<i>Netherlands</i>	7 149	4 960	5 748	2 795	3 963
<i>Spain</i>	1 545	3 536	1 593	4 641	998
Norway	8 063	4 282	2 110	5 682	6 592
Central and Eastern Europe	1 684	1 697	1 305	2 154	1 475
<i>Serbia</i>	1 439	1 394	1 253	2 100	1 446
Developing countries	18 169	1 710	721	3 486	1 077
<i>Egypt</i>	10 794	-	-	242	200
<i>Pakistan</i>	2 629	115	-	-	-
<i>China</i>	1 910	484	310	7	150
<i>Turkey</i>	54	175	110	2 304	419
Other developed countries	1 270	1 024	1 541	1 278	856
<i>RSA</i>	1 166	879	1 401	984	484
Other	148	681	208	269	168
<b>Lupin</b>	61 183	70 835	34 843	26 902	14 099
EU-28	61 008	70 718	29 933	25 767	13 676
<i>Netherlands</i>	43 431	41 922	24 232	12 937	5 876
<i>Germany</i>	7 938	22 963	5 227	11 183	6 679
<i>Spain</i>	8 215	4 938	-	840	1
Norway	-	-	4 424	351	-
Switzerland	-	-	368	628	99
Other	175	116	118	156	325
<b>Flour, meal and powder made of leguminous vegetables</b>	2 337	2 035	56	220	292
EU-28	3	1	2	185	246
<i>Germany</i>	-	-	-	37	115
CIS	78	42	54	34	28
<i>Russia</i>	59	25	38	22	19
<i>Ukraine</i>	19	17	16	12	8
Norway	2 256	1 992	-	-	18

Source: Study by the IAFE-NRI based on the MF data.

**Table 8. Import of leguminous vegetables by geographical destinations (tonnes)**

Specification	2016	2017	2018	2019	2020 (I-X)
<b>Fresh</b>	<b>3 101</b>	<b>2 461</b>	<b>3 430</b>	<b>8 054</b>	<b>1 762</b>
EU-28	2 974	2 038	3 090	7 336	1 324
<i>Lithuania</i>	55	304	1 451	5 427	910
<i>Czech Republic</i>	1 496	340	800	1 213	26
<i>Slovakia</i>	519	200	138	306	84
<i>Hungary</i>	500	659	390	197	47
Other	127	423	340	718	437
<b>Frozen</b>	<b>8 046</b>	<b>6 321</b>	<b>8 846</b>	<b>12 805</b>	<b>8 903</b>
EU-28	7 940	6 205	8 778	12 405	8 581
<i>Netherlands</i>	3 679	1 261	1 955	3 086	1 347
<i>Belgium</i>	2 170	2 846	2 705	3 243	2 615
<i>France</i>	386	411	449	1 645	1 583
<i>Hungary</i>	371	121	1 609	531	369
<i>United Kingdom</i>	0	41	632	1 825	988
Other	106	116	68	400	323
<b>Dried</b>	<b>16 721</b>	<b>20 317</b>	<b>39 892</b>	<b>50 349</b>	<b>40 735</b>
EU-28	5 979	9 155	6 781	11 052	15 047
<i>Lithuania</i>	734	3 586	1 435	3 186	4 033
<i>Czech Republic</i>	487	515	593	1 667	4 072
<i>Germany</i>	770	812	1 464	2 507	1 821
<i>Netherlands</i>	1 031	1 069	1 046	546	585
CIS	3 719	3 487	23 619	27 162	15 284
<i>Ukraine</i>	688	1 021	21 133	23 908	12 935
<i>Russia</i>	740	1 442	1 467	1 233	868
<i>Kazakhstan</i>	1 685	542	264	723	370
Developing countries	5 131	3 873	4 275	5 028	5 823
<i>China</i>	3 201	1 590	1 746	1 677	1 444
<i>Argentina</i>	482	1 248	903	1 341	2 375
Other developed countries	1 869	3 802	5 217	7 103	4 581
<i>Canada</i>	1 232	2 093	2 298	5 957	4 105
<i>USA</i>	637	1 708	2 845	1 146	476
Other	23	-	2	5	-
<b>Lupin</b>	<b>13 947</b>	<b>7 996</b>	<b>10 471</b>	<b>8 029</b>	<b>6 004</b>
EU-28	11 965	5 165	5 649	4 176	967
<i>Germany</i>	6 096	4 682	5 421	4 087	760
<i>Estonia</i>	2 519	-	41	-	-
<i>Latvia</i>	1 835	307	22	-	20
CIS	1 831	2 690	4 207	3 767	4 925
<i>Russia</i>	1 618	632	1 545	1 910	2 759
<i>Ukraine</i>	213	1 857	2 108	1 633	1 954
Other	151	141	615	86	111
<b>Flour, meal and powder made of leguminous vegetables</b>	<b>115</b>	<b>107</b>	<b>598</b>	<b>274</b>	<b>238</b>
EU-28	115	106	114	117	103
<i>Germany</i>	67	44	10	19	24
<i>Netherlands</i>	39	41	39	37	31
<i>Denmark</i>	1	-	-	0	14
<i>United Kingdom</i>	1	3	30	5	3
<i>Spain</i>	-	-	16	40	3
Developing countries	-	-	471	137	0
<i>India</i>	-	-	468	126	-
CIS	-	1	-	20	135
<i>Russia</i>	-	1	-	20	43
<i>Ukraine</i>	-	-	-	0	92
Other	-	-	14	-	-

Source: Study by the IAFE-NRI based on the MF data.

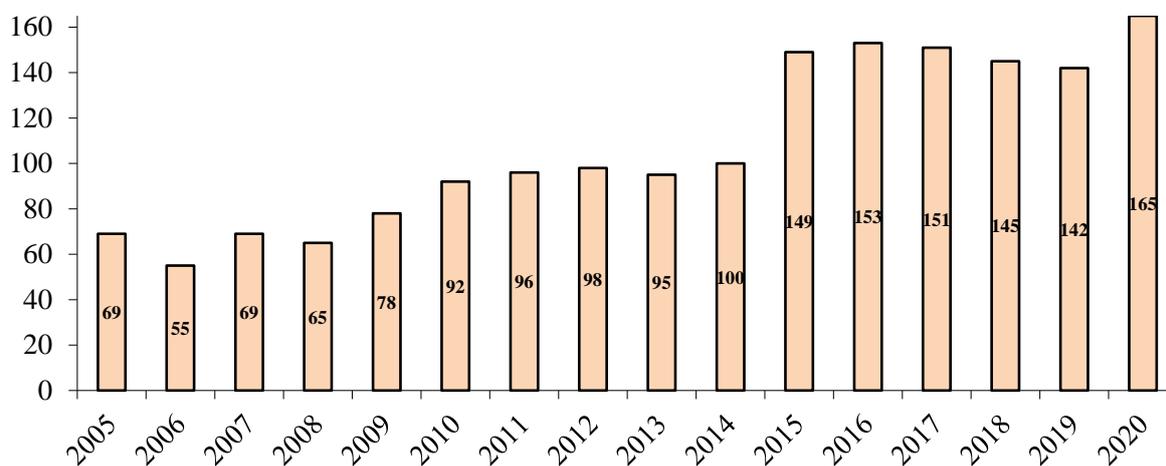
## Consumer use of legumes in Poland

In Poland, virtually no statistical data on the consumption of legumes is collected. The CSO does not identify it in studies on the consumption in households. There is no such information in any publications, nor in the unpublished CSO data (obtained by the IAFE-NRI). An attempt to make an independent balance of edible legumes would be very risky and encumbered with an excessive error, due to the quality and reliability of the CSO production data, the ambiguity of foreign trade statistics and the need to use unspecified conversion factors in this regard.

Therefore, the only source of information on the consumption of legumes is the Statistical Yearbook of Agriculture, in the section on balances of individual products. Due to the non-compliance of the information contained therein with other statistics, it was decided to use this data only in the part concerning the consumption and it is presented in the chart below.

As it results from the data presented, by 2014 there was a slow upward trend in the consumption of leguminous vegetables, which by the end of that period increased to 100 thousand tonnes, which meant only 0.26 kg *per capita* a year. In 2015, there was a surge (by around 50%) in the consumption of these vegetables (at least according to CSO statistics) to about 150 thousand tonnes (0.40 kg *per capita*) and it was at this level over the next five years. In 2020, due to a significant increase in the production of legumes, their consumption could increase by at least 10% when compared to the years 2018-2019.

**Fig. 3. Consumption of legume grain\* (thousand tonnes)**



\* pea, bean, broad bean, lentil

Source: Based on the Statistical Yearbook of Agriculture 2020 and previous years, CSO

In Poland, processing into flour, protein isolate and textured vegetable protein is of little importance, has a niche character and applies to a very small number of companies. The scale of their production, due to the absence of any statistical data, is difficult to determine. The vast majority of these products offered by commercial companies or wholesalers are

imported and countries such as Belgium, Serbia, Turkey, Argentina and China are designated as a place of origin. However, several small Polish companies (including family companies) processing legume seeds or at least defining their commodities as their own production have been identified. They can also use the services of milling legumes into flour and meal, pack them and sell under their own brand.

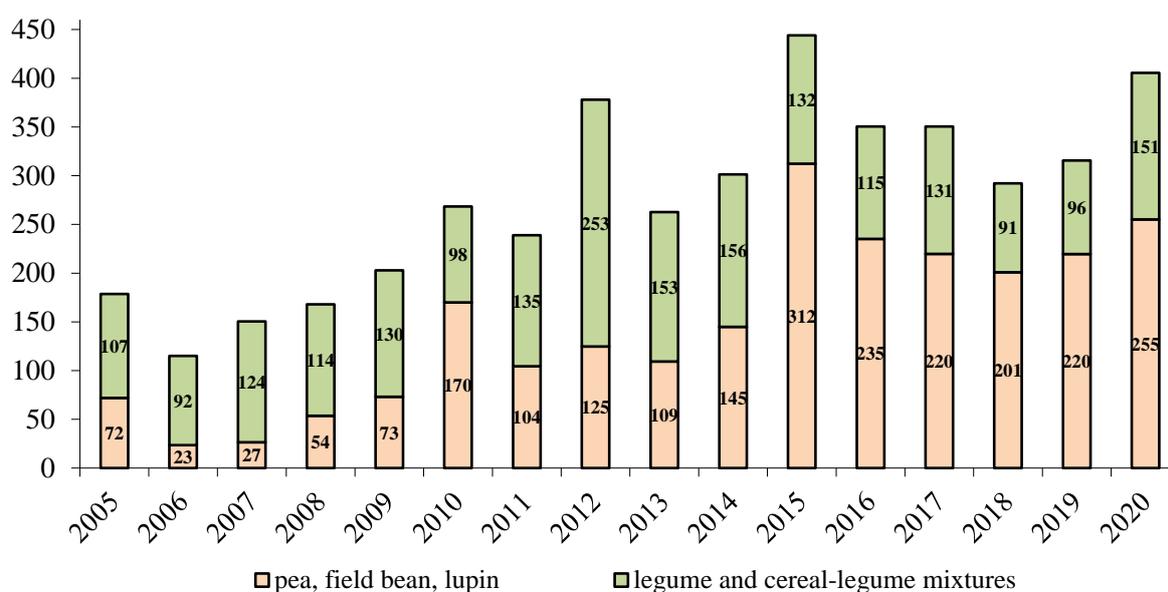
The list of domestic companies processing edible legumes:

<b>BadaPak sp.j.</b> Borowski Bieganowski Bieniewiec ul. Katowicka 9 96-321 Żabia Wola	<b>NATURAL EXPERT</b> PPH Kamil Chojnowski Andersa 40/26, 15-113 Białystok	<b>Vivio</b> "RADZIOWI" Sp. z o.o. ul. Chopina 8A 36-200 Brzozów
<b>SUDEX</b> ul. Kościuszki 24 05-334 Latowicz	<b>Młyn Kopytowa koło Krosna</b> Kopytowa 47 38-459 Kopytowa	<b>AGROTRADE Sp.z o o</b> Aleje Jerozolimskie 42 m.8/9 00-024 Warszawa

### Feed use of legume grain (protein crops)

Just like in the case of the consumer use of legumes, the information on their feed consumption is very limited. Here, long-term studies and estimates by the IAFE-NRI were used to determine this consumption, based on the statistics of harvest and foreign trade. A distinction has been made between the consumption of legumes in pure sowing (pea, field pea, lupins) and of cereal-legume mixtures, which, in the Polish realities, are an important item and can only be used for feeding directly on farms.

**Fig. 4. Feed consumption of legume grain\* (thousand tonnes)**



The feed consumption of legumes is characterised by an upward trend, the course of which is similar to that in the case of the human consumption. The volume intended for grazing of cereal-legume mixtures is, as a rule, quite stable and in the years 2005-2020 it was

within the range of 100-150 thousand tonnes (except in 2012, when their production as reported by the CSO was significantly higher).

On the other hand, the feed use of fodder legumes in pure sowing (pea, field bean and lupin) has clearly increased since 2010, when the additional payment scheme for their cultivation was introduced. In 2015, when the amount of payments significantly increased, the feed consumption of fodder legumes also increased (to more than the estimated 312 thousand tonnes), but to a lesser extent than the harvest, as at the same time their sales (mainly lupins) to foreign markets increased. In the years 2016-2019, their consumption was within the range of 201-235 thousand tonnes, and in 2020, due to a marked increase in the harvest, it could increase to the level of 255 thousand tonnes.

In the Polish conditions, the vast majority of legumes are consumed directly on farms, and only a small, but steadily growing, percentage of them is used for the production of industrial feedstuffs.

In order to determine the scale of using fodder legume grain by the feed industry, in the second half of 2020 the IAFE-NRI conducted a survey of feed companies being members of the Grain and Feed Chamber bringing together the vast majority of market representatives, including all leading producers in the sector. Despite the difficulties in acquiring information (due to the information policy and production and trade secret declared by these companies), it was possible to obtain data from a significant number of companies (bringing together more than thirty production plants) and covering 40-45% of the production and sales of industrial feedstuffs.

The studies conducted showed that from among fodder seeds, the greatest interest of the feed industry is enjoyed by fodder pea. In 2019, feed companies bought almost 39 thousand tonnes of fodder pea, so even slightly more than its production, and this applied only to companies that had responded to the surveys. Thus, its actual use in the whole feed industry was probably even higher, and a significant part of its supply was either imported or pea, included in statistics as edible pea, was used.

The second most important protein crop, whose seeds are used in the feed industry, is field bean, in 2019 purchased by the surveyed companies in the quantity of 9.4 thousand tonnes (with its domestic production of 62 thousand tonnes and the absence of import). Lupin, whose production is the largest (148.5 thousand tonnes in 2019), was purchased by the surveyed feed industry in the quantity of 0.8 thousand tonnes only. In 2019, fodder legumes accounted in total for 4.7% in the structure of purchasing protein raw materials in the surveyed companies, including 3.7% for pea, 0.9% for field bean and only 0.1% for lupin. In the first half of 2020, the share of legumes in purchases was even smaller, totalling 4.2%, including, as in the previous year, 3.7% for pea, while the share of field bean decreased to 0.5% and the share of lupin was vestigial (76 tonnes and 0.0% share.).

From among the larger companies that did not agree to participate in the survey (mainly those with foreign capital), according to expert assessments and information obtained through an online market survey, protein crops are virtually not used (this applies, *inter alia*, to an American company CARGILL, a strong leader in Poland in the production of industrial

feed). Legumes can be used in small, local mixing plants for the purposes of organic livestock production, but in Poland it is still marginal.

Feed companies identified a number of barriers to the use of protein crops in the industrial production of feedstuffs. The most important of them are:

a) economic:

- impossibility to acquire legume raw materials,
- impossibility to guarantee regular deliveries (continuity of deliveries),
- no quantities in the market that would be able to cover the demand for the permanent share of field bean, pea or lupin in mixtures,
- small batches of raw material, instability to determine the costs of raw material components.
- legume prices are too high and introducing them into recipes at market prices increases the cost of recipes – only pea is on the brink of profitability (as indicated by the interest in it and the scale of its purchase by the feed industry),
- subsidies for the harvested yield, not for the sown area – as a way of preventing frequent situations where crops are ploughed without the harvest (theoretically, payments are for harvested seeds, in practice it is difficult to verify).

b) technical:

- lack of storage space for new raw materials – limited access to legume seeds is a problem in maintaining the adequate stock allowing for the stable production of feedstuffs,
- lack of the necessary number of storage silos and production dispensers (we want to replace one raw material – soybean meal – with several raw materials). Plants ensure that available storage and production areas are fully utilised (tanks are not built according to the principle: maybe one day they will be useful),
- lack of NIRS calibration to determine nutrients in legumes (impossibility to assess the quality of raw materials when admitting them to the warehouse and to segregate them appropriately in relation to their different quality),
- in some plants, where raw materials are milled before mixing, legume seeds must not be used as they tend to clog sieves, which creates production problems,
- high risk of the presence of pests,

c) technological:

- high levels of anti-nutritional substances (tannins, protease inhibitors, lectins, alkaloids),
- anti-nutritional factors cause a global deterioration in production results on farms, deterioration of animal health, loss of export competitiveness of Polish breeders,
- sweet lupin contaminated with bitter lupin (presence of alkaloids) must not be used in compound feedstuffs – common cases,
- lack of dedicated enzymes to improve the nutritive value of these raw materials.

Below please find the list of identified feed companies using legume grain in the industrial production of feedstuffs:

**GOLPASZ S.A.**  
ul. PTTK 50  
87-400 Golub-Dobrzyń

**Wytwórnia Pasz w Pile PZZ**  
Sp. z o. o.  
ul. Wawelska 113 G,  
64-920 Piła

**Agri Plus Sp. z o. o.**  
Oddział paszowy w Poznaniu  
ul. Marcelińska 92  
60-324 Poznań

**Piast Pasze Sp. z o.o.,**

Lewkowiec 50A  
63-400 Ostrów Wlkp

**SCHAAP-POL Sp. z o.o.**

Połczyno, ul. Gdańska 22,  
84-100 PUCK

**PHU AGROIMPEX**

Sp. z o. o.  
Słonów 89  
66-520 Dobiegniew

**De Heus Sp. z o.o.**

ul. Lotnicza 21B  
99-100 Łęczycza

**WIPASZ S.A**

Wadąg 9  
10-373 Olsztyn

## **Polish Government's policy on supporting the production of protein crops**

Food security, encompassing the availability of plant protein, is the superior objective of each country's economic policy, hence the need to ensure diversified and reliable sources of its acquisition. Also for the Polish Government, including, in particular, the Ministry of Agriculture, support for the production of protein crops is one of key issues.

The development of livestock production, especially poultry farming, resulted in a very significant increase in the demand for feed protein, which has been satisfied mainly by easily available and competitive, in terms of quality and price, imported soybean protein. As part of the Government's policy „GMO-free Poland”, in 2006 the Feed Act was adopted which introduced the prohibition on the production, marketing and use in animal nutrition of genetically modified feedstuffs and organisms intended for feed use. At the same time, a moratorium on their use has been introduced, which is systematically extended every several years. The last amendment to the Feed Act was made in November 2020, pursuant to which the moratorium was extended for further two years, i.e. until 1 January 2023. Every several years, livestock breeders, farmers and feed companies have to fight for preventing the prohibition on using GMO feedstuffs from entering into force, which would have very negative consequences for many industries in the agri-food sector.

Taking into account the high fodder value of seeds and green mass of legumes, the beneficial impact on the soil environment and the fact that in Poland, before transforming the economy into the market-oriented one, legumes for seeds were cultivated on an area of more than 300 thousand ha, the Ministry of Agriculture and Rural Development took many measures to increase the area of these species and the interest of farmers and producers of feed in their cultivation. As part of these measures, a payment scheme has been introduced to increase the profitability of the cultivation of these species. In addition, by resolution of the Council of Ministers, a multi-annual programme for 2011-2015 entitled „Enhancing national vegetable protein sources, their production, trading and use in animal feeds” was established in 2011. The objective of the programme was to create the conditions for reducing the import of feed protein (post-extraction soybean meal) by about 50% as a result of increasing the biological and useful value of vegetable protein derived from native raw materials. At the same time, in the event of a global protein crisis, the conditions were to be created so as to ensure national protein security (a large amount of own seed material, new varieties and cultivation technologies, optimal feed recipes and animal nutrition systems, and a seed production and marketing system).

Subsequently, in 2016-2020, another multi-annual programme, financed from the state budget and entitled: „Enhancing the use of national feed protein for the production of high-quality animal products under the conditions of sustainable development” was implemented, whose major objective was to create opportunities to increase protein security of the country for feed and food purposes under the conditions of sustainable development. The programme

implementers show that currently national feed protein resources can cover 40% of their annual demand, which, however, is wishful thinking, as the actual share of national protein in the balance of protein feed raw materials is within the range of 25-30% (taking into account significant resources and the consumption of national rapeseed meal).

The studies under the latest programme focused on legumes useful for cultivation and for feed, genetics and plant breeding, including the resistance to water and nutrient scarcity, flower falling, the presence of anti-nutritional compounds and processes determining the stability and quality of yielding. To date, methods to shorten the breeding process of varieties of peas and narrow-leaf lupin have been developed, starting materials have been created for cultivating varieties of determinate, low-tannin field bean with a non-dehiscing seed coat, and the effectiveness of using stimulants in the cultivation of legumes has been assessed. Work supporting the creative breeding of new varieties of pea, lupin and field bean is continued. The essence of establishing and implementing the above-mentioned multi-annual programmes was and is to provide knowledge to farmers, advisors, plant variety breeders, feed processors and monogastric livestock breeders. Soybean was not taken into account in those studies conducted under the above-mentioned programmes. For the programme, the website is kept - <http://bialkoroslinne.iung.pl/>, which presents the achievements of the programme, *inter alia*, the recommendations for the efficient cultivation of legume crops, the list of available plant protection products, feed recipes, training information and the recently launched virtual plant protein storage have been published.

**The key element of support were and are special area payments for the cultivation area of legumes, applicable since 2010.** Since then, the scope and amount of support have been modified. A very wide range of plant species was covered by the support: In the years 2010-11, the amount of support was about EUR 10 million (PLN 207-220/ha) and in the years 2012-2014 support increased to EUR 30 million (PLN 566-719/ha). In 2015, the financial envelope was increased to 68.2 million and payment could be received by a farmer who cultivated protein crops in the main crop, such as: broad bean, field bean, chickpea, common bean, runner bean, pea, snap pea, lentil, soybean, white lupin, narrow-leaf lupin, yellow lupin, field pea, bird's foot, red clover, white clover, alsike clover, Persian clover, crimson clover, common bird's foot trefoil, common sainfoin, alfalfa, hybrid alfalfa, hop clover, grass pea, honey clover, hairy vetch and common vetch. This payment was granted to an area of up to 75 ha. In the years 2015-2016, its amount was PLN 422-430/ha.

Since 2017, two payments have been introduced instead of one: for grain legumes (75% of the sector envelope – about EUR 51.3 million) and for fodder crops (25% of the envelope), with the pool of funds remaining unchanged. **Vegetable (edible) legumes (broad bean, chickpea, common bean, runner bean, snap pea, round pea and lentil) were excluded from support.**

**Payment for grain legumes included: field bean; pea, including field pea, exclusive of snap pea and round pea; white lupin; narrow-leaf lupin; yellow lupin; soybean, as well as mixtures of the above-mentioned crops.** In order to receive payment, it is necessary to harvest grain (seeds). In the case of more than 75 ha, the rate of payment is lower by 50%. In the years 2017-2020, the amount of these payments was PLN 606-766/ha and was lower by half in the case of an area of more than 75 ha.

Another element of support **are payments for certified legume seeds under de minimis aid.** In 2020, due to the limited pool of funds, the amount of payments for purchased seed material amounted to less than PLN 109/ha.

Another important initiative was the introduction in 2017 by the Research Centre for Cultivar Testing of innovative methodological solutions and the extension of the range of variety experimentation in this group of crops, bearing in mind a need to increase the

cultivation area of large-seed legumes and soybean so as to improve the feed balance in the country. The introduced experimental innovations refer to traditional native large-seed legumes: field bean, pea, narrow-leaf lupin, yellow lupin and soybean included in oilseeds. The major objective of the measures taken was to modify the existing Post-Registration Variety Experimentation (PDO) system so that it was possible to determine the regions of the country which are most suitable for cultivating individual protein crop species, while identifying the best varieties for cultivation. To this end, the number of variety experiments carried out has been significantly increased and the location has been changed so as to ensure that they are distributed quite evenly across the country for each species. In the case of soybean, many more experiments were located in the northern part of the country.

In addition, in the case of this species, there was a temporary modification of the system to test varieties from the Community catalogue of varieties of agricultural plant species (CCA), not registered in Poland, which are commonly propagated in our country and their seed material is offered for sale. These varieties may be submitted for PDO studies, without the so-called diagnostic tests. Owing to this, soybean varieties from the CCA Community catalogue may be submitted for PDO experiments two years ahead. Potentially, the cultivation of non-GMO soybean varieties is a high opportunity to improve the feed and protein balance in our country. The introduced organisational changes enabled the general recommendation of varieties of large-seed legumes and soybean as from 2019. It can be expected that the Lists of Recommended Varieties for cultivation in the individual voivodeships will allow to optimise the choice of varieties, which should significantly reduce the risk of cultivating protein crops. On the other hand, it will take a long time to designate the regions of the country which are most suitable for the cultivation of individual protein crop species.

Another governmental measure to promote the development of the cultivation and production of protein crops was the “Action Plan to use alternative protein sources for GM soybean protein in animal nutrition”, adopted in 2019 by the MARD. It assumes:

- extension of research,
- activation of breeding new varieties in Poland,
- permanent extension of the variety offer of soybean and other protein crops as well as rapeseed to be cultivated in the climatic conditions of Poland,
- increased production of certified seed material,
- implementation and dissemination of results of experimental work and variety recommendations under the „COBORU Protein Initiative”,
- regular verification of suitability of all regions of the country for cultivation of soybean and other large-seed legumes,
- examination of suitability of the largest possible number of soybean varieties and other species of large-seed legumes available in the market for cultivation, in terms of yield rate and stability, earliness and adaptability in the regions of the country, as well as their tolerance to biotic (resistance to diseases) and abiotic stresses (drought and other extreme environmental conditions), assessment of the quality of seeds of soybean and other legume species
- introduction, in all regions, of a system of common recommendation of soybean varieties and other large-seed legumes in the form of annually drawn up lists of varieties recommended for cultivation,
- popularisation of cultivation of soybean and other large-seed legumes among farmers,
- organising a market for the purchase of soybean and other large-seed legumes,
- increasing the interest of the feed industry in using seeds of domestic soybean and traditional protein crops, rapeseed,

- activation of industry livestock breeding associations in using native protein feedstuffs, including those based on soybean,
- creation of commercial chains (from farmers through purchase, feed industry to livestock breeders),
- continuation of payments for the cultivation of legumes and payment for seed material,
- participation of Poland in the Danube Soya programme, i.e. non-GM soybean,
- active participation of Poland in the EU forum in the “European Soya Declaration” project,
- general training and implementation and dissemination activities.

In addition, under the RDP 2014-2020 support instruments for agricultural producers, including those involved in the production of protein crops, are implemented. Aid aimed at increasing the viability and competitiveness of farms and facilitating their restructuring is available under the instruments such as „Modernisation of agricultural holdings”, „Restructuring of small holdings” and „Aid for young farmers”. Under the above-mentioned support instrument, as part of the operation selection system, *inter alia*, business plans taking into account the production of protein crops are preferred. In addition, under the sub-measure „Support for investments in the processing, marketing or development of agricultural products”, support is possible as regards the production of feed for livestock. In line with the amendment to the RDP 2014-2020 (November 2018) for the sub-measure „Support for investments in the processing, marketing or development of agricultural products”, aid may specifically concern, *inter alia*, the production of feedstuffs based on non-genetically modified raw materials.

One of the latest ideas is to introduce an indicator goal for the share of feed protein of national origin in the industrial production of feedstuffs, which would oblige feed companies to use national protein sources when producing feedstuffs, in the amount determined annually by the Minister of Agriculture, so as to stimulate the demand. It seems that this is another idea which is unsuccessful and criticised by experts, at least due to the specificity of feed recipes for individual animal species and the difficulty in checking the achievement of the objectives.

When assessing the impact of the applied CAP support instruments in building strategies for the development of national feed protein, as well as other measures of the Polish Government, so far they have not brought a big growth. The production and use of protein seeds in Poland is developing very slowly, and in the nearest future there are no signs that this situation could change significantly.

### **Possibilities of increasing the cultivation of protein crops in Poland**

In recent years, the cultivation of legumes worldwide has been characterised by an upward trend, with a rather large problem in distinguishing and breaking down legumes for consumption and for feed. The global area of major protein crops, important from the viewpoint of the EU and Polish markets, namely pea, broad bean, field bean and lupins, has increased by about 20% to around 11 million ha in the last ten years, thanks to increasing the area of pea (by 30%), while stabilising the area of field bean and lupins. Pea is definitely dominant (the share of about 70%), field bean is less important (22%), so are lupins (8%).

In the EU-28, the cultivation area of the above-mentioned protein crops has occupied 1.5-1.6 million ha in the last five years, half of which was pea, about 40% - field bean and

10% - lupins. Their total harvest in the individual years, depending on yield fluctuations, was within the range of 3-5.2 million tonnes. In Poland, on the other hand, the cultivation of lupins is essential, while field bean and pea, crops more useful in terms of the actual demand of the Polish feed industry, are less important.

In Poland, there are relatively favourable conditions for the cultivation of protein crops virtually throughout the country, although the specific regions of Poland are preferred for individual crops.

The most suitable regions for cultivating field bean is the belt of northern and southern Poland and also other regions, but those with more rainfall and very good and good grade I-IIIb soils. Pea has varying soil requirements depending on varieties. Edible varieties (always with white flowers) have higher soil requirements, and they give better yields there. They should be cultivated on grade I-IIIb soils, while fodder varieties, especially those with colourful flowers and slightly lower requirements, can be cultivated on grade IIIb-IVb soils. Pea, due to the lower water requirements than field bean, can be cultivated all over the country. Narrow-leaf lupin, due to its short growing season, can be cultivated all over the country, yellow lupin in the belt of western and central Poland, and white lupin in the belt of western Poland. Yellow lupin has the lowest soil requirements, due to the deepest root system. It gives good yields on grade IVa-V soils. For narrow-leaf lupin, the best soils are grade IVa-IVb soils. The third underrated lupin species with the highest yield potential is white lupin, which has the longest growing season and can be successfully cultivated on grade IIIa, IIIb, IVa and IVb soils. Pea and narrow-leaf lupin ripen the fastest – in the second half of July, followed by yellow lupin ripening at the turn of July and August and white lupins and field bean ripening in the second half of August. Excessive rainfall prolongs the vegetation of each species and results in uneven ripening, and under these conditions seeds can, as a rule, have a reduced germination capacity. In very poor statistics on legumes, there is no distinction among the individual species of lupins.

The actual suitability of soybean for the cultivation in Poland will be verified in the coming years and during this time it is necessary to refrain from assessing this suitability, although the results are quite satisfactory as regards experimental crops and on a small scale. Progressive climate change can be favourable for this plant in the long term, especially if the tendency of warm and humid weather in July and of above-average mean temperatures in September are going to persist, then the interest in the cultivation of soybean in Poland may significantly increase in real terms, especially in the south of Poland.

The main problems in the development of the production of protein crops are, first of all, difficulties with selling harvested yields, mainly due to the lack of greater interest of the feed industry in legume seeds (whose reasons have been explained in the section on the use of legumes for feed) resulting from the relatively high prices with the relatively low content and poorer quality of protein than in the case of other protein raw materials (soybean meal). The profitability of their cultivation is also relatively low, despite the financial support scheme. Payments for harvested yields rather than for sown areas would be a way of preventing frequent situations where crops are ploughed without the harvest (in theory, payments are for

harvested seeds, in practice it is difficult to verify). In addition, recently the interest of farmers in field bean has been lower, since there are restrictions on using chemical treatments to receive greening payments.

In the coming years, we should expect the stabilisation and, in the optimistic version, a slight increase in the cultivation of protein crops. The interest of farmers in legumes could increase more significantly in the event of a rise in their buying-in prices and a clear improvement in the profitability of cultivation, while increasing the real demand on the part of feed companies.

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