



INSTITUTE OF AGRICULTURAL
AND FOOD BIOTECHNOLOGY
STATE RESEARCH INSTITUTE

Quality of Polish Wheat Harvest 2024



Research carried out under Task realized for the Ministry of Agriculture and Rural Development: *Analysis of the quality of agricultural raw materials with the consideration of the risk contaminants*



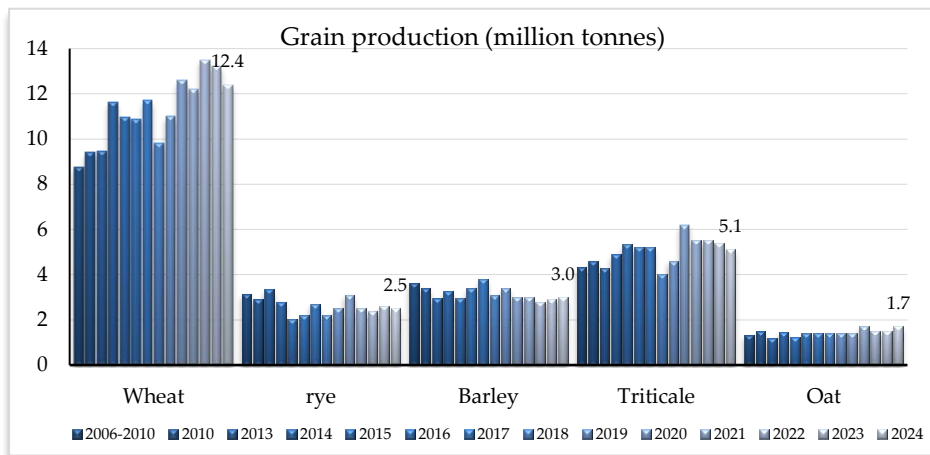


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Wheat harvest according to Statistics Poland

According to the Statistics of Poland (GUS), the main crop production in the year 2024 reached the level of 35.3 mln tonnes, which includes wheat (12.4 mln t), triticale (5.3 mln t) and barley (3.0 mln t).



Source: Own study based on GUS data.

2024 HARVEST: WHEAT PRODUCTION OF 12.3 MLN TONNES AND MEDIUM QUALITY WITH LOW PROTEIN CONTENT

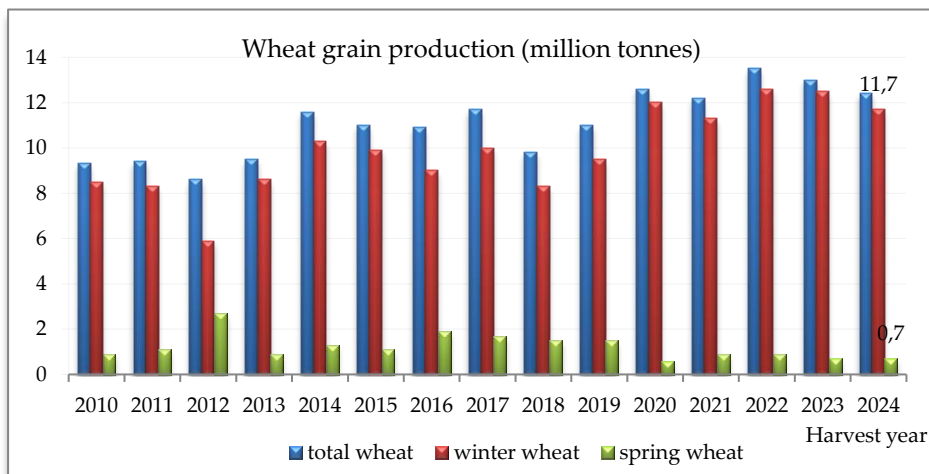
Owing to good growth and development of winter plants in the final stage of growth in autumn of 2023 and slight winter losses of winter cereals (only 0.1% of the sown area of winter cereals was plowed), the yields were particularly high this year. Poland harvested 12.4 mln tonnes of wheat, the fourth record harvest year. Poland is the third largest wheat producer in the EU, after France (25.2 mln t) and Germany (18.2 mln t).

The Statistics of Poland (2024), indicated the following unfavourable factors which had influenced the plant production in the 2023/2024 economic year: cold days in April with drops in air temperature near the ground even below -9 °C inhibiting the growth and development of plants; shortage of rainfall in spring causing excessive drying of the soil, and local extreme climatic events occurring in June and July 2024, such as storms, hailstorms and storms combined with strong winds.

WHEAT GRAIN PRODUCTION AND YIELD

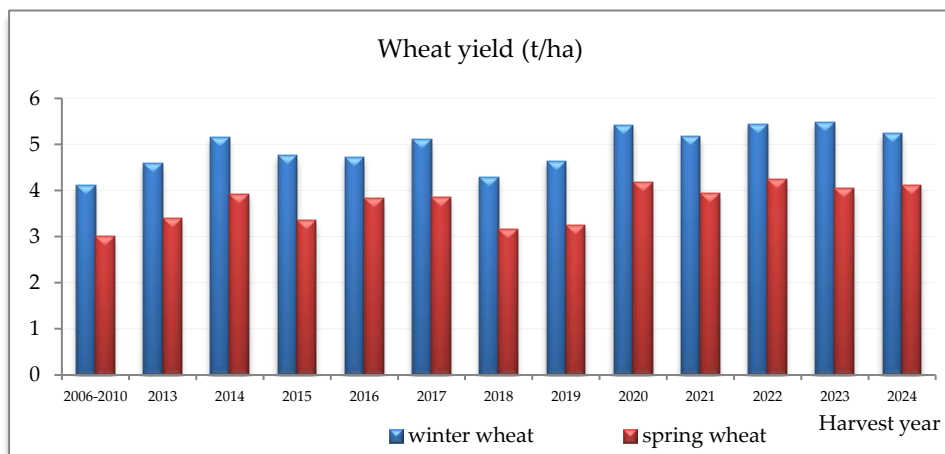
Wheat production in Poland in 2024 achieved a fourth record 12.4 mln tonnes, which is approx. 0.6 mln tonnes less than in the previous year. The 2016-2020 seasons harvest average was 11.2 million tonnes. For comparison, the average harvest in 2006-2010 season was only 8.8 million tonnes.

According to Statistics Poland, the harvest of winter wheat was at the level of 11.7 million tonnes (in 2022 harvest year - 12.6 million tonnes). The average yield was 5.3 t/ha (lower level to 2022 and 2023; 0.3 t/ha higher than last 5 years average). Compared to the average for 2006-2010 harvest years it is 1.1 t/ha higher, which is indicated by a clear progress in breeding.



Source: Own study based on GUS data.

The harvest of spring wheat was on same level that in 2023 harvest year with a value of 0.7 million tonnes. The average yield was 4.1 t/ha (0.05 t/ha higher than in 2023 harvest year and 0.15 t/ha lower than in 2022). Compared to the average for 2006-2010 harvest years (3.0 t/ha), there is also a clear progress in breeding.



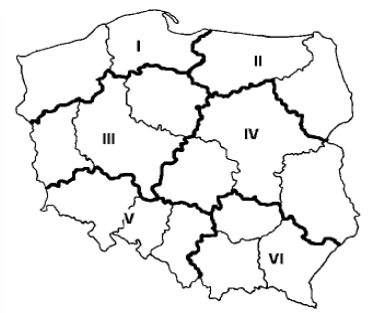
Source: Own study based on GUS data.

Material

Tested material included **586 wheat grain samples** from 2024 harvest year. The research was conducted in the Department of Grain Processing and Bakery – Prof. Waclaw Dąbrowski Institute of Agricultural and Food Biotechnology – State Research Institute (IBPRS-PIB). Grain samples were delivered from Agricultural Advisory Centers from various climatic and cultivation regions, adopted by the Research Centre for Cultivar Testing (COBORU).

The number and origin of wheat grain samples from 2024 harvest.

Climatic and cultivation area according to COBORU	Number of tested samples	
	number	percentage of all samples
I	86	14.7
II	50	8.5
III	119	20.3
IV	142	24.2
V	120	20.5
VI	69	11.8



Climatic and cultivation area according to Research Centre for Cultivar Testing (COBORU)

Analytical methods

The following assessment of the technological value of wheat grain was performed in IBPRS-PIB:

Specific Weight – acc. to PN-EN ISO 7971-3:2019 – is a measure of density in kilograms per hectoliter (kg/hl). Specific weight may be an indicator of potential milling yield and the general condition of the samples.

Falling number – acc. to PN-EN ISO 3093:2010. This parameter indirectly measures the level of alpha-amylase activity. Falling number is expressed in seconds. High falling number values (>250 s) indicate low alpha-amylase activity. Sprouted wheat grain is characterized by low falling number values (<150 s).

The remaining qualitative factors (protein content, gluten content, Zeleny sedimentation index, alveograph baking value “W”) were determined using the X-Grain (Infracont) whole-grain analyzer using the NIR near-infrared measurement technique with installed calibrations developed for domestic wheat grain. The calibrations were adjusted to the wheat grain samples from the 2024 harvest year. About 30-70 samples from different regions of Poland were included to check the calibrations.

The analyses were performed – by reference methods:

Protein content – acc. to PN-EN ISO 20483. Protein content is an important factor in determining the value of wheat and is used as an indicator in trade and by millers of the suitability of wheat for various products. It is calculated by using coefficient 5.7 and refers to dry matter (DM).

Gluten content – acc. to PN-EN ISO 21415-2:2015-12. Wet gluten is a measure of the quantity of gluten proteins in wheat as determined using the Glutomatic System.

Zeleny sedimentation index – acc. to PN-EN ISO 5529:2010. This parameter characterized the quality of gluten proteins. High sedimentation value (>40 cm³) indicates strong gluten while low sedimentation (<25 cm³) indicates weaker gluten.

Alveograph baking strenght “W” – acc. to PN-EN ISO 27971:2015-07. Alveograph measures the rheological properties of flour dough. “W” reflects the amount of energy needed to inflate the dough to the point of rupture and indicates dough strength.

Results

The tested wheat grain samples were characterized by the lowest protein content (average 12.1% d.b.) and gluten content (average 24.9%) in many years. The specific weight (average 76.6 kg/hl) and the falling number (average 315 s) were similar to the long-term average and met the requirements set for grain in consumption purposes.

HARVEST DATA

depended on the climatic and cultivation area acc. to the research of IBPRS-PIB

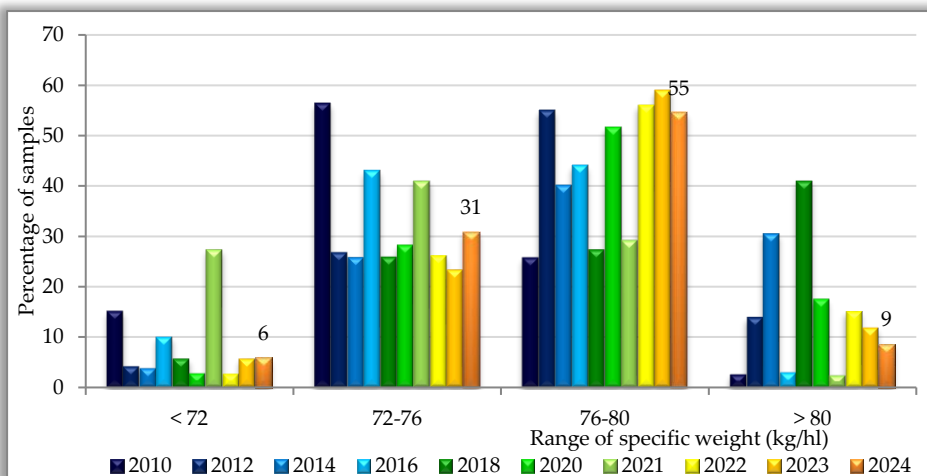
Climatic and cultivation area	Specific weight (kg/hl)	Protein content (Nx5.7) (%s.m.)	Gluten content (%)	Zeleny sedimentation index (cm ³)	Alveograph baking strength "W" (×10 ⁻⁴ J)	Falling number (s)
Average in Poland	76,6	12,1	24,9	33	198	315
range	65,5-83,1	8,1-15,9	13,3-34,7	11-54	<60-361	78-403
I	76,4	12,6	25,6	33	207	302
range	69,0-81,4	8,6-15,9	13,3-32,0	11-47	73-299	78-378
II	77,6	12,4	26,1	36	229	307
range	72,2-82,9	9,8-15,0	15,9-33,6	18-54	93-361	218-362
III	77,3	12,2	25,5	33	197	320
range	71,0-82,6	8,9-15,0	16,8-33,1	16-49	101-304	186-381
IV	76,1	12,3	25,2	33	196	316
range	68,2-83,0	9,5-15,5	16,2-34,7	15-54	91-319	132-403
V	76,3	11,4	23,6	31	192	323
range	69,1-83,1	8,3-15,6	13,8-31,1	11-47	<60-304	217-383
VI	76,4	11,4	23,7	31	183	310
range	65,5-83,0	8,1-14,3	14,1-32,4	11-48	64-305	167-367



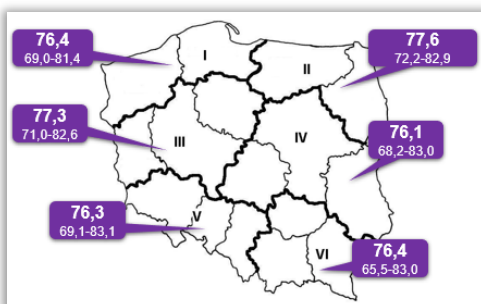
SPECIFIC WEIGHT

Specific weight was in the range of 65.5 to 83.1 kg/hl. The average (76.6 kg/hl) was slight lower than in the previous, 2023 harvest year (average 76.8 kg/hl) but significantly higher than in 2021 (average 74.0 kg/hl). 63.2% of tested wheat samples were characterized by the good milling quality (specific weight above 76 kg/hl). Unsatisfactory level of this parameter – below 72 kg/hl was characterized by 6% of tested samples. 89% of wheat samples met the minimum requirements set for wheat in the UE regulation for public intervention (specific weight above 73 kg/hl).

63.2% of Polish harvest exceeds 76 kg/hl



Percentage of tested samples showing the specific weight within a certain range of values depending on the harvest year.



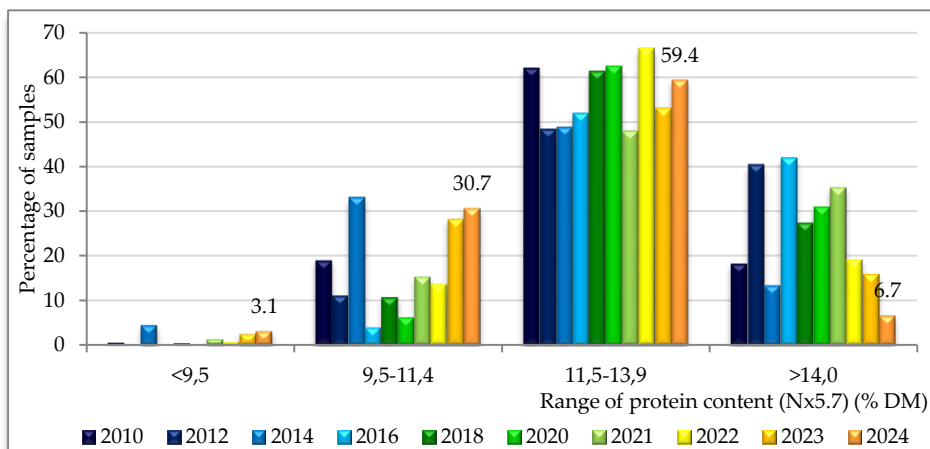
LOW AVERAGE PROTEIN CONTENT OF 12.1% DM

Protein content was reported within the range of 8.1 to 15.9% DM, with average of 12.1% DM, which the lowest in a long-time period. 66% of tested wheat samples were characterized by good baking quality (protein content higher than 11.5%), but only 6.7% showed very good baking quality (protein content higher than 14%). Unsatisfactory level of this parameter – below 9.5% was characterized by 3.1% of tested samples.

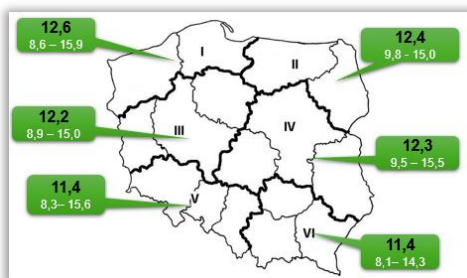
78.5% of wheat samples met the minimum requirements set for wheat in the EU regulation for public intervention (protein content above 11.0%).

66% of Polish harvest exceeds 11.5% DM

6.7% of Polish harvest exceeds 14% DM

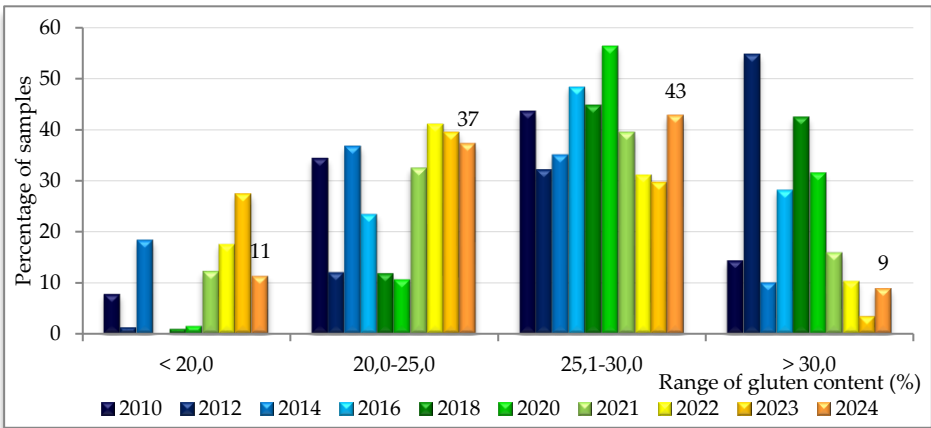


Percentage of tested samples showing the protein content within a certain range of values depending on the harvest year.

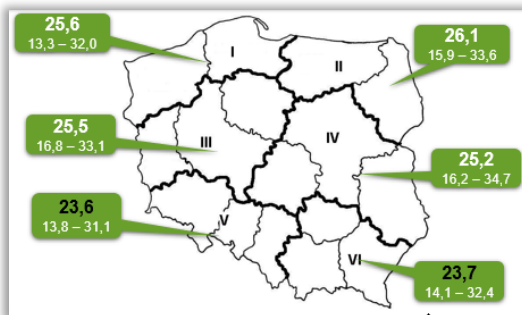


LOW AN AVERAGE WET GLUTEN CONTENT OF 24.9%

Wet gluten was within the range of 13.3% to 34.7%. 52% of tested wheat samples were characterized by good baking quality (wet gluten content above 25%) and only 9% by a very good baking quality (wet gluten content above 30%), which is one of the lowest levels in the presented period of time. Unsatisfactory level of this parameter – below 20% was characterized by 11% of tested samples. However, 37% of samples with lower gluten content in the range of 20 to 25% indicates their possible usage for biscuit production. The wheat grain from 2018 and 2012 harvest year were characterized by the highest gluten content (29.4 and 30.3%, respectively), whereas the lowest value was found for 2014 and 2023 harvest year (24.2 and 22.6%, respectively).



Percentage of tested samples showing the gluten content within a certain range of values depending on the harvest year.

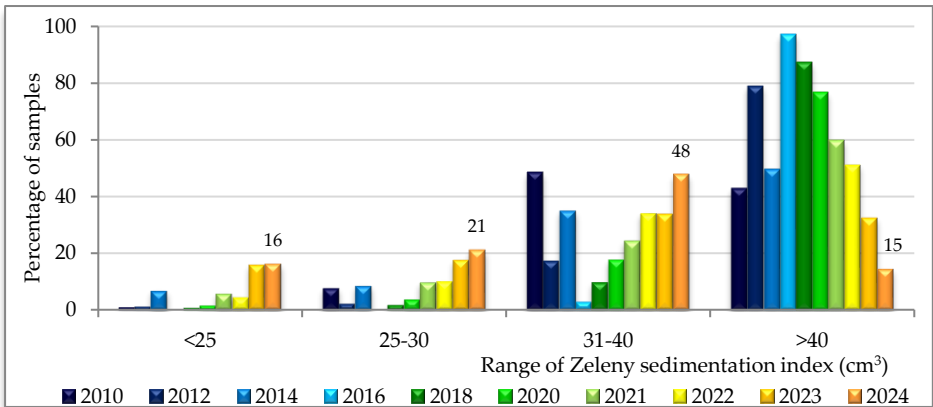


ZELENY SEDIMENTATION INDEX

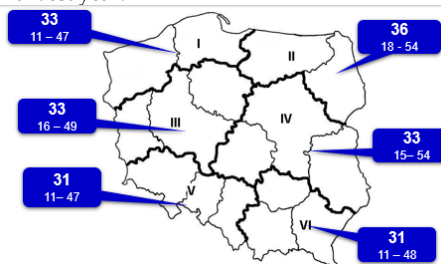
Zeleny sedimentation index was in the range of 11 to 54 cm³. The average value (33 cm³) classifies the grain from this year's harvest in the group of growing seasons of the lowest gluten quality. In the previous year, the lowest value of Zeleny index was found for 2010 and 2014 harvest years (39 and 40 cm³, respectively), whereas the highest value for 2016 and 2011 harvest (58 and 52 cm³, respectively). Only 15% of tested wheat samples were characterized by good baking quality (Zeleny index above 40 cm³), which is required for baking purposes. The weakness of the quality of this parameter this year is characterized both by a low number of samples exceed 40 cm³ and high number of samples with Zeleny index below 25 cm³.

90% of wheat met the minimum requirements set for wheat in the EU regulation for public intervention (Zeleny index above 22 cm³).

15% of Polish harvest exceeds 40 cm³ Zeleny index



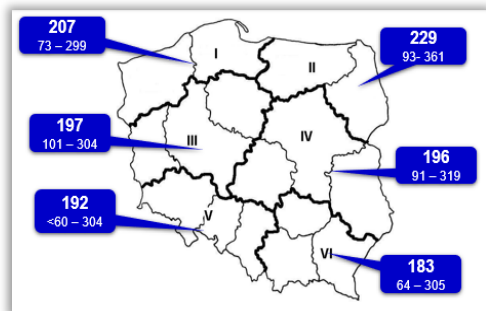
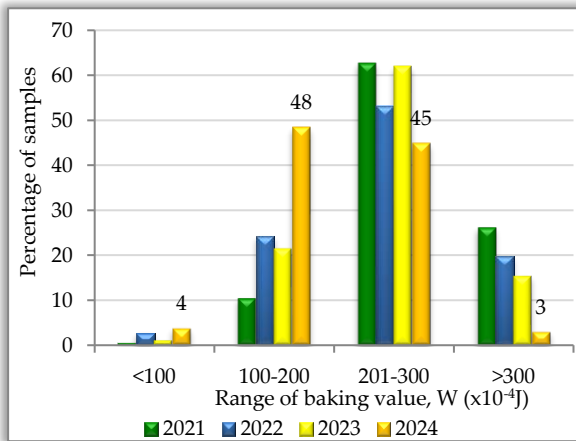
Percentage of tested samples showing the Zeleny sedimentation index within a certain range of values depending on the harvest year.



BAKING STRENGTH, „W”

The baking strength was in the range of below 60 to $361 \times 10^{-4} \text{J}$. Only 3% of tested wheat samples were characterized by baking strength above $300 \times 10^{-4} \text{J}$, which indicates the potential use of grain for the production of flour for baking purposes, e.g. hamburger buns, pizza, frozen dough („W” in the range $300\text{--}400 \times 10^{-4} \text{J}$), or as an improver for flour obtained from weaker wheat („W” above $400 \times 10^{-4} \text{J}$). 45% of tested wheat samples were characterized by baking strength „W” within the range of 201 to $300 \times 10^{-4} \text{J}$, which indicates the possibility of its use in the production of bread, toasted bread, and „crescent” type bread. However, 48% of tested wheat grain samples had baking strength „W” within the range of 100 to $200 \times 10^{-4} \text{J}$, which indicates its potential use for biscuits, small confectionery bread, and baguettes production.

Medium baking strength of $198 \times 10^{-4} \text{J}$ on average

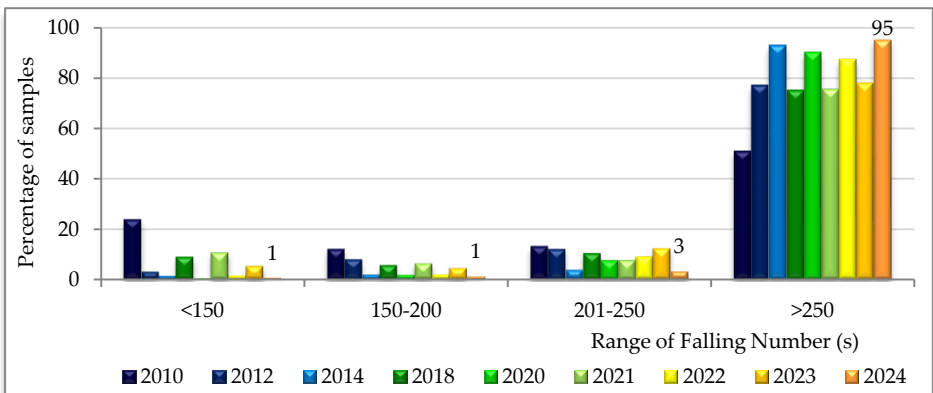


LOW ALPHA-AMYLASE ACTIVITY

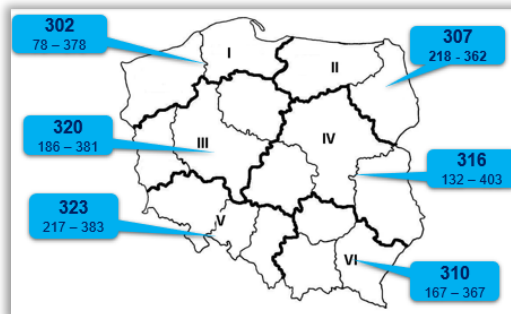
The Hagberg Falling Number (FN) was in the range of 78 to 403 s. 95% of tested wheat samples were characterized by FN above 250 s, which indicates low alpha-amylase activity. It is the best result among tested harvest years. In comparison – over 90% of tested grain samples of 2013 and 2014 harvest were characterized by a FN above 250 s. Unsatisfactory level of this parameter – below 150 s was characterized by only 1% of tested samples. In the previous years, only in 2010 and 2011 harvests, the greater part of grain (23 and 35%, respectively) was characterized by high alpha-amylase activity (FN<150 s). 97% of wheat met the minimum requirements set for wheat in the EU regulation for public intervention (Falling Number above 220 s).

95% of wheat above 250 s.

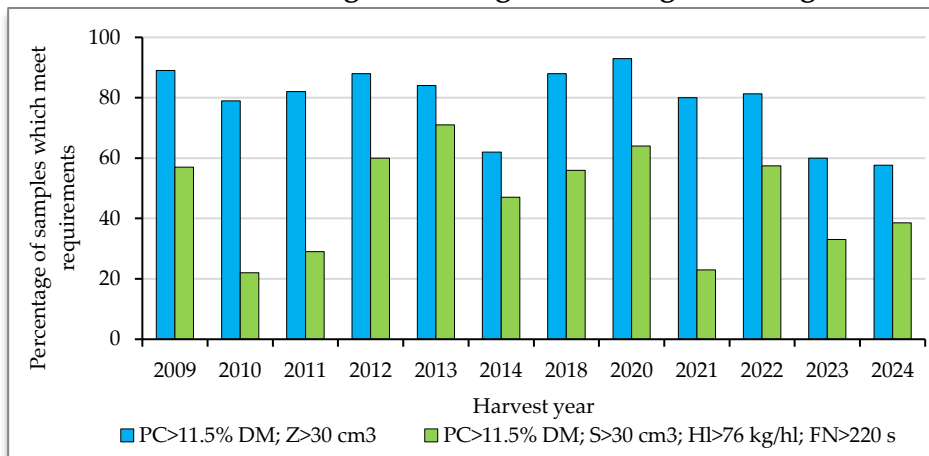
Low risk of preznce of sprouted grain.



Percentage of tested samples showing the falling number within a certain range of values depending on the harvest year.



Criteria for evaluating the baking and milling value of grain.

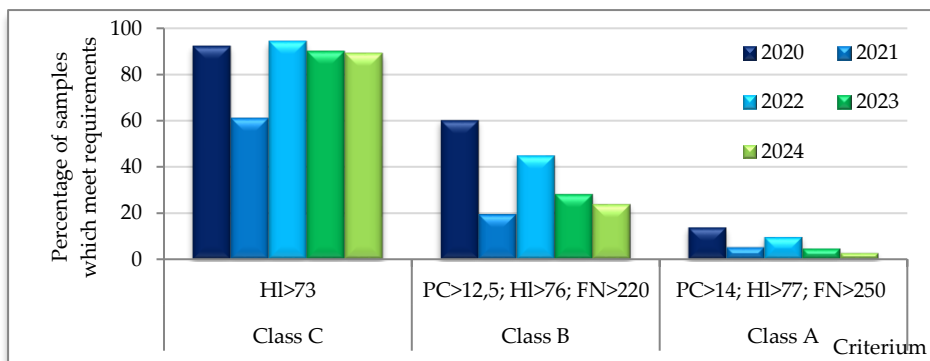


PC - protein content (Nx5.7) (DM); Z - Zeleny sedimentation index; HI - specific weight; FN - Falling Number.

58% of grain from 2024 harvest met the requirements for baking purposes (including protein content >11.5% and Zeleny index >30 cm³) compared to 90% of samples tested in 2020. Only 39% of grain from 2024 harvest met the criteria of baking and milling value (including the specific weight >76 kg/hl and FN >220 s).

In presented period of time, the lowest technological value was reported for grain from the 2010, 2011 and 2021 harvest - only 22; 29 and 23% of wheat samples met the requirements of good baking and milling value of grain because of the unfavourable weather condition which caused sprouting of grain.

Wheat classification according to Agricultural Exchange Market requirements



Explanations: „PC” - protein content (% DM), „HI” - specific weight (kg/hl), „FN” - Falling Number (s).

Quality characteristics of the most popular wheat cultivars during study

Cultivar	Number of tested samples	Protein content (N×5.7) (D.M.)	Gluten content (%)	Specific weight (kg/hl)	Alveograph baking value "W" (×10 ⁻⁴ J)	Falling number (s)
Euforia	51	11.7	23.8	77.2	180	305
Intuicja	14	12.0	24.8	78.2	208	317
KWS Fenomen	12	12.1	24.1	76.5	177	307
SU Banatus	10	11.3	22.7	76.2	160	289
Hondia	9	12.2	25.0	76.5	194	311
RGT Kilimanjaro	9	11.8	24.7	77.0	195	327
Wilejka	9	12.6	25.3	77.6	193	313
Arkadia	8	11.9	23.9	75.4	179	308
RGT Bilanz	8	11.5	24.1	76.1	186	339
LG Keramik	7	11.7	23.9	77.3	190	330
Pallas	7	12.4	26.9	77.7	229	331
Aplauz	6	14.3	31.0	77.0	308	312
Elektra	6	11.0	22.1	72.9	161	314
Julius	6	11.9	25.1	76.3	198	326
Findus	5	12.3	25.3	78.1	198	294
KWS Donovan	5	11.3	23.5	77.1	189	315
KWS Revolver	5	11.8	23.6	75.6	196	332
Opal	5	12.6	25.9	79.1	208	339
Opoka	5	11.4	24.4	76.7	201	307
Patras	5	10.8	21.3	76.3	152	340
RGT Depot	5	12.4	25.7	76.9	192	316
RGT Technik	5	11.6	24.0	77.1	194	331



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