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Quality of Polish Wheat Harvest 2020



Research carried out under Task realized for the order of
Ministry of Agriculture and Rural Development: Analysis of
the quality of agricultural Raw materials, taking into account
the risk of contaminants.

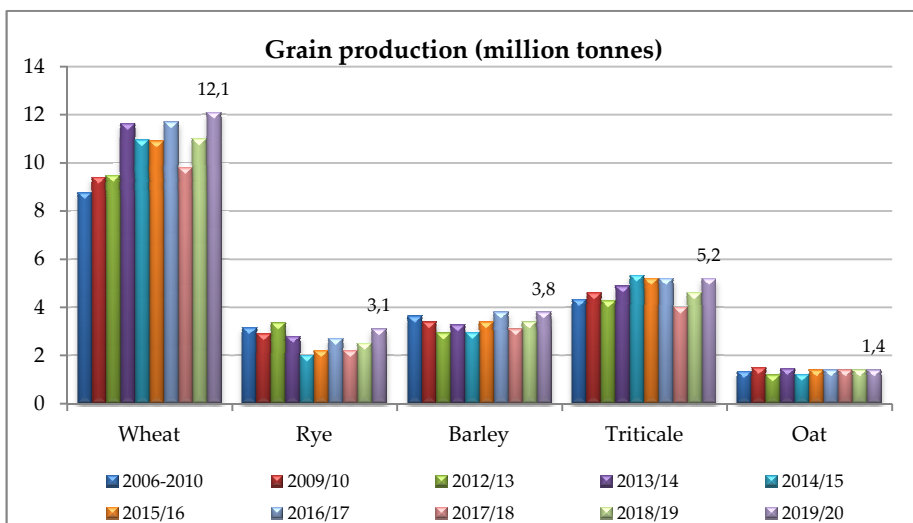




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State Research Institute. Department of Grain Processing and Bakery
Warsaw, June 2021
Source of photos: pixabay.com

Wheat harvest according to Statistics Poland

According to Statistics Poland, main crop production in the year 2020 was on the level of 33.5 mln t, included wheat (12.1 mln t), triticale (5.2 mln t) and barley (3.8 mln t).



Source: Own study based on GUS data.

2020 HARVEST: A RECORD WHEAT PRODUCTION OF OVER 12 MLN TONNES AND A SATISFACTORY QUALITY

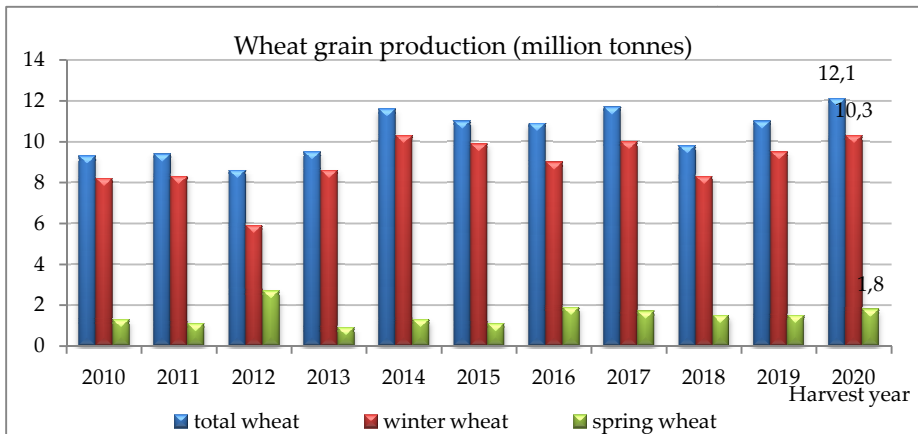
Thanks to good growth and development of winter plants in the final stage of growth in autumn 2019, slight winter losses of winter cereals (only 0.1% of the sown area of winter cereals was plowed) and good soil moisture in June and July 2020, the yields were particularly high this year. Poland harvested 12.1 million tonnes of wheat. That's an increase of 10% compared to the previous harvest.

The Statistics Poland (2020) indicated the following unfavourable factors that influenced plant production in the 2019/2020 economic year: cold days in April and May with drops in air temperature near the ground even below -10°C , inhibiting the growth and development of plants; shortage of rainfall in April, causing excessive drying of the soil and local extreme climatic phenomena occurring in June 2020, such as storms, hailstorms and storms combined with strong winds.

Quality overall is satisfactory and even very good as regards certain features. 69% of the harvest fulfilled the criteria of wheat categories of good flour-milling quality.

WHEAT GRAIN PRODUCTION AND YIELD

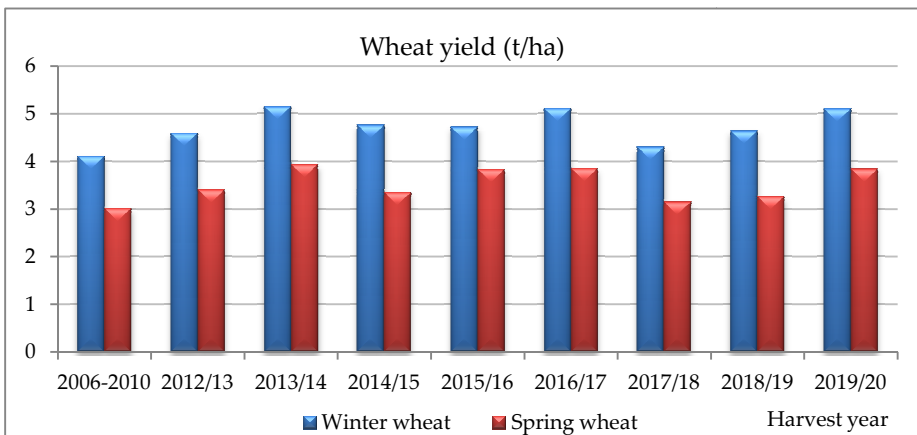
Wheat production in Poland in 2020 r. was 12.1 million tonnes, which is approx. 1.1 million tonnes higher than in previous year and record harvest years in 2014 (11.6 million tonnes) and 2017 (11.7 million tonnes). The 2014-2019 seasons harvest average was 11.0 million tonnes. For comparison, the average harvest on 2006-2010 season was only 8.8 million tonnes.



Source: Own study based on GUS data.

According to Statistics Poland, the harvest of winter wheat was at the record level 10.3 million tonnes (previous record was in 2014 harvest year) which is 0.8 million tonnes higher than in 2019. The average yield was 5.1 t/ha (0.5 t/ha higher than in 2019; 0.5 t/ha lower than on the record 2014 harvest year and 3.9 t/ha higher than last five year average).

The harvest of spring wheat was at the third record level 1.8 million tonnes (previous record was in 2012 and 2016 harvest year – 2.7 and 1.9 million tonnes, respectively) which is 0.3 million tonnes higher than in 2019. The average yield was 3.8 t/ha (0.6 t/ha higher than in 2019; 0.1 t/ha lower than on the record 2014 harvest year and 0.4 t/ha higher than last five year average). Compared to the average for 2006-2010 harvest years (3.0 t/ha), there is a clear progress in breeding.



Source: Own study based on GUS data.



Material

Tested material was 1989 wheat grain samples from 2020 harvest. The research was conducted in Department of Grain Processing and Bakery – Prof. Waclaw Dąbrowski Institute of Agricultural and Food Biotechnology – State Research Institute (IBPRS-PIB). 135 grain samples was delivered from grain elevators and milling companies from various climatic and cultivation regions, adopted by the Research Centre for Clutivar Testing (COBORU). The summary also includes the results of surveys carried out by IBPRS-PIB in domestic cereal and milling companies in the autumn of 2020, based on the assessment of grain in elevators laboratories during the purchase of barch of grain (1854 samples).

The number and origin of wheat grain samples from the 2020 harvest.

Climatic and cultivation area according to COBORU	Number of tested samples	
	number	percentage of all samples
I	177	8,9
II	548	27,6
III	71	3,6
IV	206	10,4
V	683	34,3
VI	304	8,9



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

Analytical methods

The following assessment of the technological value of wheat grain were 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) were determined using the AgriCheck 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 2020 harvest. About 30 samples from different parts 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 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.

Results

Tested wheat grain samples were characterized by good technological quality – the average protein content is 13.4 % DM; gluten content 28.8%; Zeleny sedimentation index 47 cm³; specific weight 77.2 kg/hl; falling number 296 s.

HARVEST DATA

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

Climatic and cultivation area	Test weight (kg/hl)	Protein content (Nx5.7) (% DM)	Gluten content (%)	Zeleny sedimentation index (cm ³)	Falling number (s)
Average in Poland	77.2	13.4	28.8	47	296
range	66.6-86.0	9.1-18.0	10.6-42.0	10-75	80-496
I	80.2	12.6	26.2	47	304
range	70.9-85.2	9.2-16.8	16.4-38.6	16-72	170-405
II	77.4	13.1	28.3	44	285
range	70.0-86.0	9.1-16.1	10.6-38.4	10-70	186-411
III	76.2	13.1	28.8	51	283
range	69.7-81.6	10.0-15.4	20.1-38.6	23-73	170-290
IV	76.8	13.8	30.7	46	313
range	68.8-85.5	10.5-17.0	14.2-42.0	23-75	213-443
V	77.3	13.4	28.8	49	294
range	66.6-84.2	9.4-18.0	19.0-39.0	29-72	86-412
VI	75.4	13.7	29.9	46	300
range	68.0-83.5	10.6-16.5	20.6-38.0	29-70	170-496

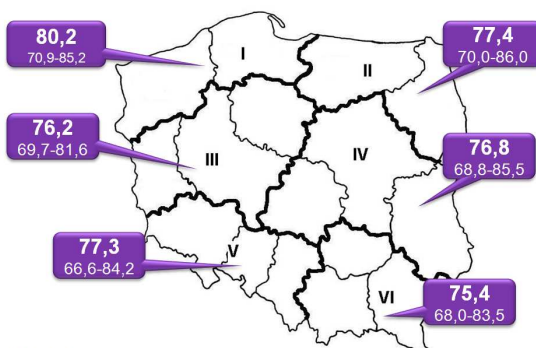
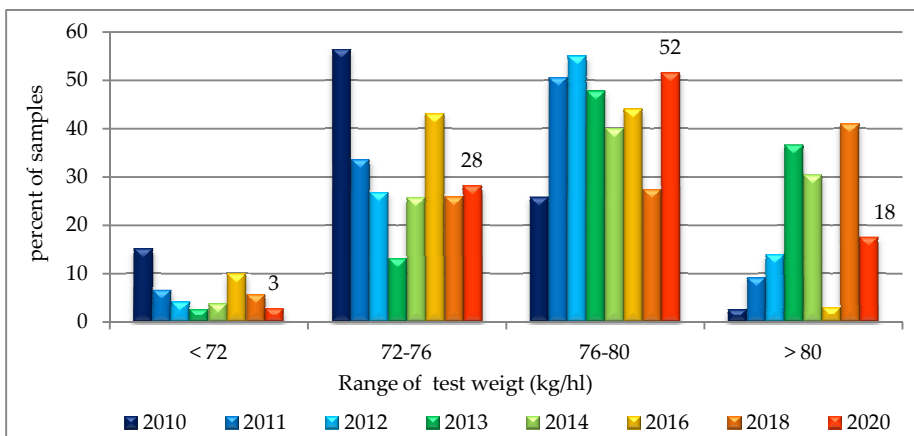
Source: Department of Grain Processing and Bakery. Prof. W. Dąbrowski Institute of Agricultural and Food Biotechnology – State Research Institute, 2021.

SPECIFIC WEIGHT

Specific weight was in the range of 66.6 to 86.0 kg/hl. The average (77.2 kg/hl) was significant higher than in the previous 2019 harvest year (average 75.7 kg/hl). 69% of tested wheat samples were characterized by good milling quality (specific weight above 76 kg/hl). Unsatisfactory level of this parameter – below 72 kg/hl was characterized by only 2.8% of tested samples.

91% of wheat met the minimum requirements set for wheat in the EU regulation for public intervention (specific weight above 73 kg/hl).

69% of Polish harvest exceeds 76 kg/hl



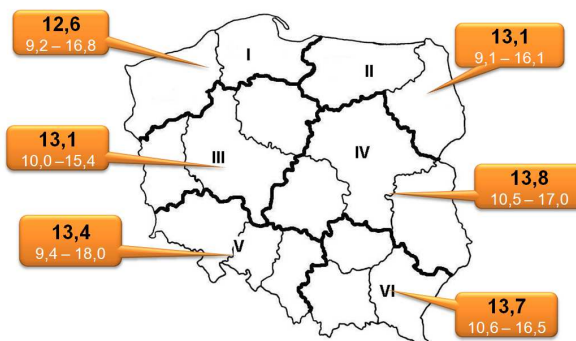
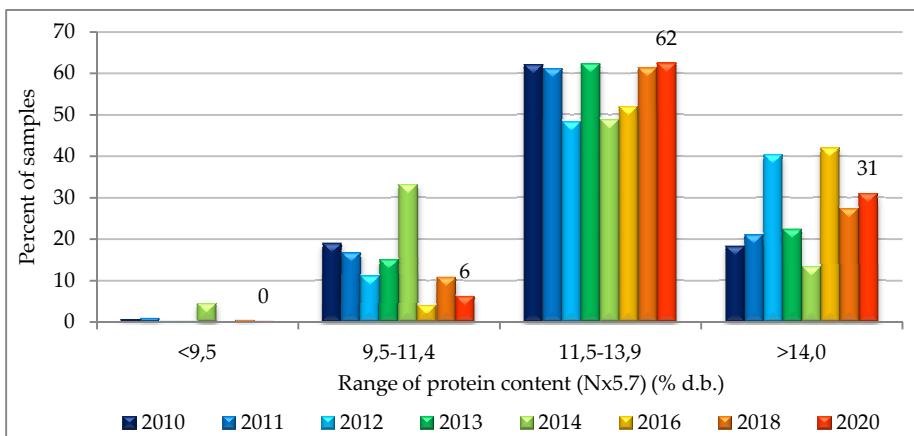
AN AVERAGE PROTEIN CONTENT OF 13.4% DM

Protein content was in the range of 9.1 to 18.0% which is third record average value after 2012 and 2016 harvest year (13.6%). 93.5% of tested wheat samples were characterized by good baking quality (protein content above 11.5%). Unsatisfactory level of this parameter – below 9.5% was characterized by only 0.2% of tested samples.

95% of wheat met the minimum requirements set for wheat in the EU regulation for public intervention (protein content above 11.0%).

93.5% of Polish harvest exceeds 11.5% DM

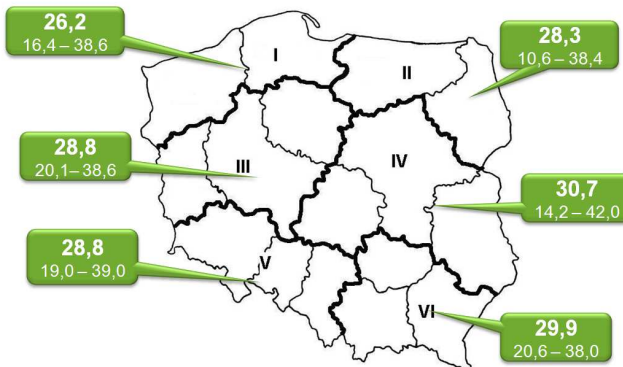
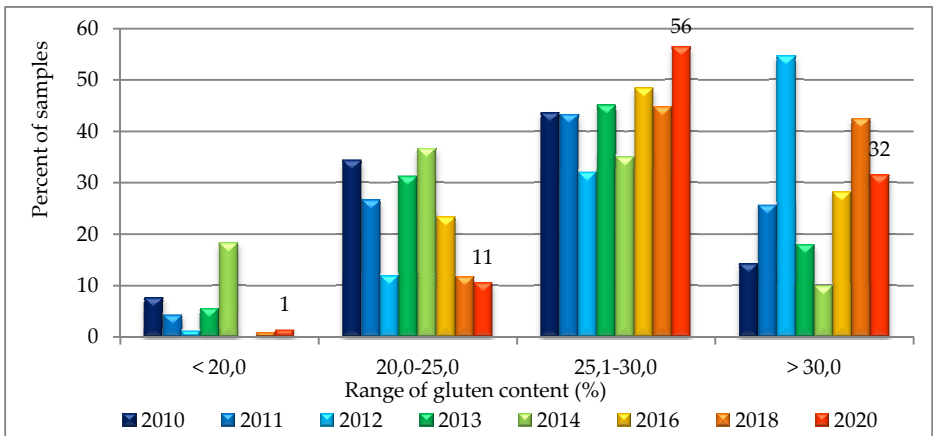
31% of Polish harvest exceeds 14% DM



AN AVERAGE WET GLUTEN CONTENT OF 28.8%

Wet gluten content was in the range of 10.6 to 42.0%. 88% of tested wheat samples were characterized by good baking quality (wet gluten content above 25%) and 30% very good baking quality (wet gluten content above 30%). Unsatisfactory level of this parameter – below 20% was characterized by only 1.4% of tested samples.

31.6% of Polish harvest exceeds 30%

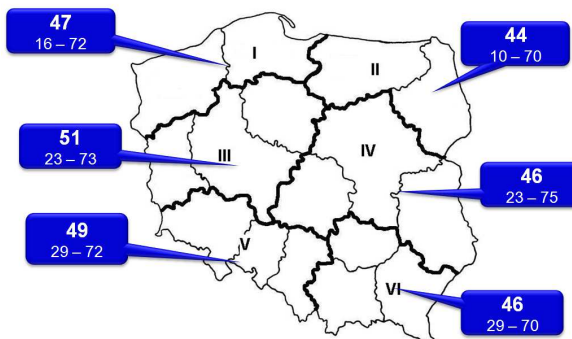
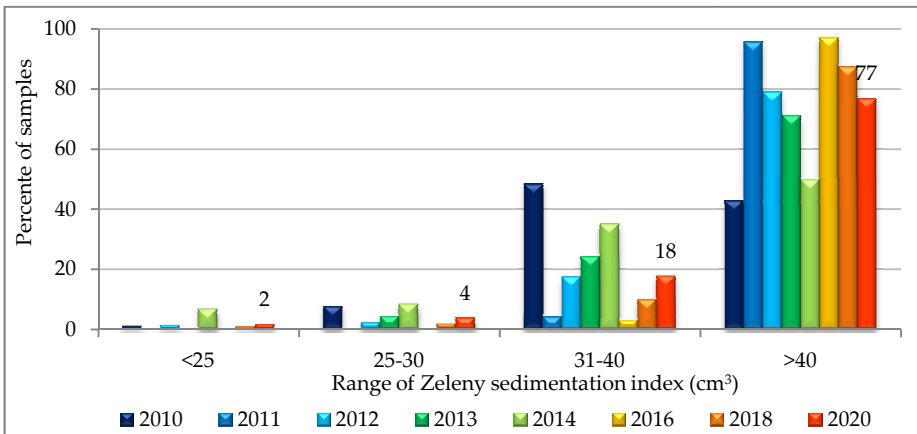


ZELENY SEDIMENTATION INDEX

Zeleny sedimentation index was in the range of 10 to 75 cm³. The average (47 cm³) was lower than in 2016 and 2011 harvest years (58 and 52 cm³, respectively) and higher than in 2010 and 2014 harvest (39 and 40 cm³, respectively). 77% of tested wheat samples were characterized by good baking quality (Zeleny sedimentation index above 40 cm³) which is fourth results in last years. Unsatisfactory level of this parameter – below 25 cm³ was characterized by only 1.7% of tested samples.

More than 98% of wheat met the minimum requirements set for wheat in the EU regulation for public intervention (Zeleny index above 22 cm³).

77% of Polish harvest exceeds 40 cm³

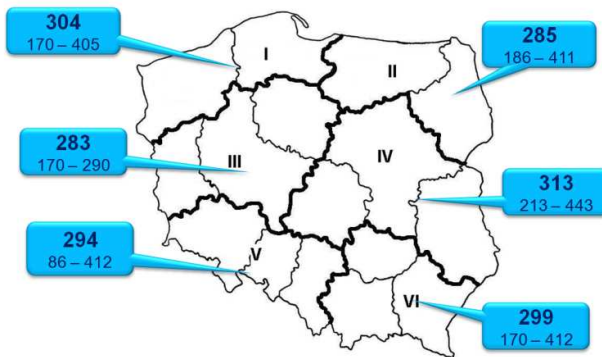
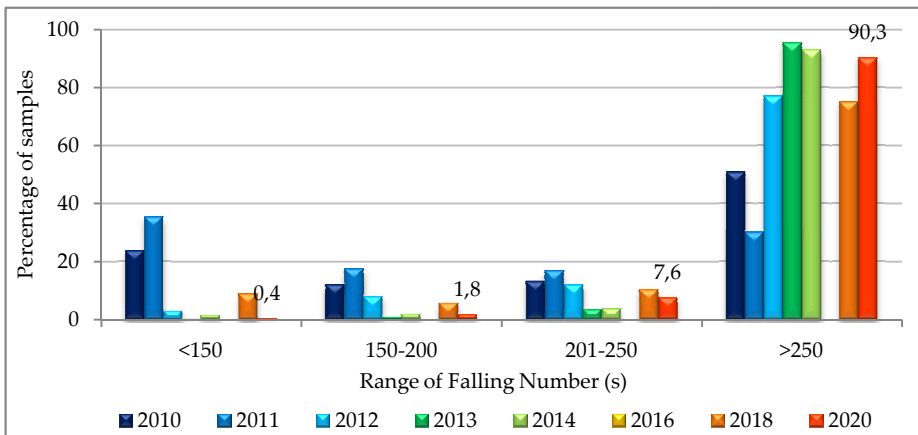


HIGH FALLING NUMBERS SHOW A LACK OF GERMINATION

The Hagberg Falling Number was in the range of 80 to 496 s. Almost 91% of tested wheat samples were characterized by Falling Number above 250 s, which indicates low alpha-amylase activity (the third record results in last years). Unsatisfactory level of this parameter – below 150 s was characterized by only 0.4% of tested samples.

94% of wheat met the minimum requirements set for wheat in the EU regulation for public intervention (Falling Number above 220 s).

91% of wheat above 250 s



Criteria for evaluating the baking and milling value of grain

Characteristics of the suitability for baking purposes of wheat from the 2020 harvest compared to grain from the 2009-2018 harvest

	Harvest year								
	2009	2010	2011	2012	2013	2014	2016	2018	2020
PC>11,5%									
Z >30 cm ³	89	79	82	88	84	62	96	88	90
PC>11,5%									
Z >30 cm ³									
HI >76 kg/hl							50*		
FN >220 s*	57	22	29	60	71	47		56	69

PC- protein content (N \times 5.7) (DM); Z –Zeleny sedimentation index; HI – specific weight; FN – Falling Number

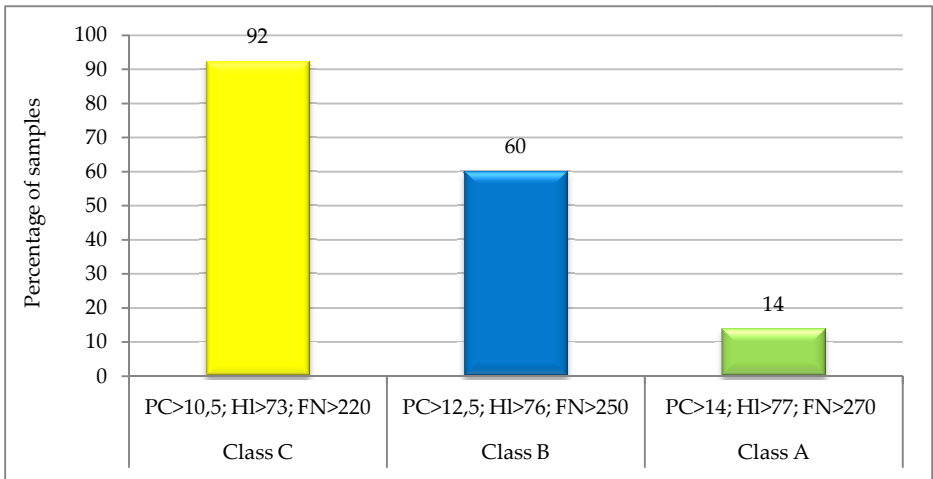
* - In the case of grain samples from the 2016 harvest, the falling number was not taken into account

90% of grain from 2020 harvest met the requirements for grain for baking purposes (including protein content >11.5% and Zeleny sedimentation index >30 cm³) compared to only 62% of samples tested in 2014 harvest.

69% of grain from 2020 harvest met both criteria of baking and milling value (included also the specific weight >76 kg/hl and the falling number >220 s).

In presented period of time, the lowest technological value was stated for grain from the 2020 and 2011 harvest – only 22 and 29%, respectively of wheat samples met the requirements for the good baking and milling value of grain. These years were characterized by unfavorable weather condition which cause sprouting of grain and low specific weight.

Wheat classification according to Agricultural Exchange Market requirement



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





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