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STUDY OF QUANTITATIVE AND QUALITATIVE INDICATORS IN WHEAT

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Abstract

The aim of the conducted research is to observe the behavior of various winter wheat cultivars under the influence of both biological and technological factors. In the experiment, five distinct wheat varieties (Glosa, Joker, Apache, Alcantara, and Anapurna) were subjected to analysis. Subsequent to the research, the Joker variety emerged as the most economically viable and resilient cultivar. Despite its higher seed cost and comparatively lower bakery indices, it compensated with a significantly elevated production yield. Key quality indices monitored throughout the experimental cycle include hectoliter mass (MH), protein content, and gluten content. The mean values of hectolitre mass per storage volume obtained for the five exceptionally promising wheat varieties align within the ranges specified in the Official Catalogue of Varieties. Notably, the Glosa variety exhibited the highest protein content at 14.2%, while the Joker variety demonstrated the lowest at 11.6%. Average gluten content values ranged from 20% to 32%. The data presented herein highlight the robust productivity potential of gleic chernozems. Capitalizing on groundwater supply, these soils consistently yield high crop outputs even in periods of drought.

Key words: *wheat, production, quality indices.*

INTRODUCTION

Wheat, this gift of the earth, source of nourishment and symbol of fertility, occupies a central place in the history of humanity and in the development of civilizations. Wheat is an important source of carbohydrates, being one of the main staple foods for millions of people around the world.

The importance of wheat cultivation in the international perspective is evident from its multiple agronomic, economic, social and environmental involvements. By continuing agronomic research and innovation, along with adopting sustainable agricultural practices, the global community can ensure consistent and sustainable wheat production to meet the food needs of the ever-growing world population.

The large areas on which it is sown, as well as the attention it enjoys are due to the high content of grains in carbohydrates and proteins and the ratio of these substances, according to the requirements of the human body; the fact that the plant has high ecological plasticity, being cultivated in areas with very different climates and soils with the possibility of integral mechanization of the crop (Belete et al., 2018).

Climate change can have a significant impact on global wheat production, affecting water availability, temperatures and the distribution of diseases and pests. Wheat is one of the most important traded cereals worldwide, and changes in wheat production and prices can have significant economic impacts.

Fluctuations in wheat prices can affect the economic stability of importing and exporting countries (Anderson et al., 2012; Challinor et al., 2014; Lal, 2015; Shewry et al., 2015; Shiferaw et al., 2011). Using the right fertilizers in the right amount is one of the most important management strategies for increasing fertilizer efficiency and maximizing crop productivity. The application of synthetic fertilizers in the wheat field increases the nitrogen, phosphorus and potassium available in the soil.

Grains have a number of characteristics that make them very valuable and appreciated by man, which has made them represent from all times and remain in the future the group of

plants of the greatest importance for human existence and activity (Bîlteanu et al., 1991).

MATERIALS AND METHODS

The objective of the research carried out on the territory of Nadab commune is to monitor the behavior of winter wheat varieties under the influence of biological and technological factors. The experience was monofactorial. The wheat varieties taken into culture are as follows: Glosa, Joker, Apache, Alcantara, and Anapurna.

The previous crops were corn and sunflower crops. The type of soil on which the experiment was located is a gleic chernozem. Gleic chernozem is characterized by a coarse sand content ranging from 9.7% in the Ap horizon to 14.4% in the CG horizon.

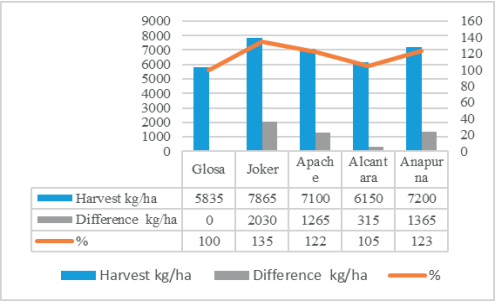
In the experimental cycle, climatic conditions were around the multiannual average of the influence zone, all years being favorable for winter wheat cultivation. Wheat depletes nutrients in the soil, so if it is not properly fertilized, soil fertility begins to decline (Haile et al., 2012). When processing the land, 280 kg of complex 14/14/14 + 11% sulfur was fertilized and at the beginning of March another nitrogen fertilization was made.

RESULTS AND DISCUSSIONS

As part of the experience, we took five varieties of winter wheat into culture. I took the Glosa variety as a control variety. Summary data from the two-year experimental cycle, during which climatic deviations were recorded, which allowed a good analysis of the varieties taken in the study, are shown in Figure 1.

It is found that the highest production of 7865 kg/ha was achieved for the Joker variety, ensuring a production increase of 35% and a difference in production compared to the control variety of 2030 kg/ha, being statistically assured as very significant. The Anapura and Apache varieties also recorded a production increase of 23% and 22% respectively compared to the control variety and a production difference of 1365 kg/ha and 1265 kg/ha respectively, being statistically assured as very significant.

The Alcantara variety registered a difference of 315 kg/ha, compared to the control variety, being statistically assured as distinctly significant. The most profitable and resistant variety was the Joker variety, even if the seed price was higher than the others and the bakery indices, being lower, compensated by significantly higher production.



DL5%=165 kg/ha; DL 1%=250 kg/ha; DL0,1% = 402 kg/ha

Figure 1. Synthesis of harvest results from the experimental cycle, 2021-2022

The quality indices monitored in the experimental cycle are:

1. The standard mass per storage volume (MH) and method of determination;
2. Protein content and method of determination;
3. Gluten content and method of determination.

The standard mass per storage volume (hectolitre capacity) is one of the basic indicators in assessing the quality of cereals, used since ancient times, is the mass of the unit volume. It was determined using the NIR analyzer, Granomat Pfeuffer to determine the hectoliter mass, humidity, temperature.

The basic standard mass per storage volume for wheat intended for bakery shall be 78 kg/hl. According to the current grinding instructions, the total extraction of flour will be greater or less, with the difference between the actual and basic standard mass per storage volume. Wheat grains with an increased hectoliter capacity, as a rule, are well fulfilled, contain a higher amount of endosperm and ensure a high yield of flour when processing them. This index shall be used to calculate the flour yield at milling.

The standard Hectolitric Mass (HM) is a characteristic resulting from the assessment of the quality of grain according to physical

criteria, represents the mass, in kg, for a volume of seeds of 0.1 m^3 and is influenced by the compaction of grain and the intergranular space, by the nature and quantity of dry, broken seeds, shishtave, etc., and has a mainly commercial importance.

In Figure 2 analyzed results regarding the quality characteristics regarding the hectoliter mass of wheat grains under the influence of the experimental factor the cultivated wheat variety. The climatic conditions, even if they were not favorable in both experimental years, positively influenced the affirmation of the biological characteristics of wheat varieties, confirming the conceptions in which it is said that the manifestation of biological characteristics of a variety are conditioned by the pedoclimatic characteristics of the researched area.

The hectolitre mass was 84 kg/hl for the Glosa variety, followed by that of the Alcantara variety (81.5 kg/hl) and Anapurna variety (80.5 kg/hl). (Figure 2). The average values of the standard mass per storage volume obtained for the five varieties of wheat are for each variety, some particularly good, falling within the ranges corresponding to the Official Catalogue of Varieties. Also, the milling requirements for the standard mass per liter of wheat of 75 kg/hl according to STAS are met by each wheat variety.

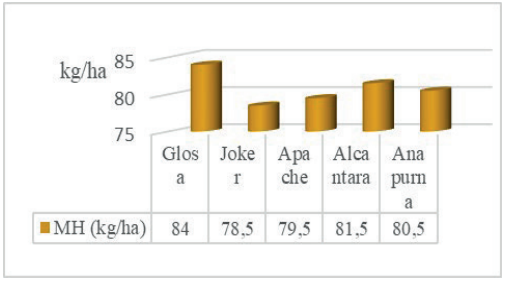


Figure 2. Average values of the standard mass per storage volume of the six wheat varieties in both experimental years

Bakery properties can be estimated by the following parameters: quantity and quality of gluten, physical properties of dough and sample baking indices of bread. Restrictive conditions also include limiting the quantity and quality of gluten in wheat. Its content in wheat, directed to quality grinding, should not be less than 25%, and that for whole grinding - not less than 20%. The quality of gluten in both cases must be not less than group II (http://www.bobulvietii.org).

The mean gluten content values determined over both experimental years are shown in Figure 3. The average values of gluten content determined under laboratory conditions in the five wheat varieties under the influence of cultivation technology and climatic conditions are good. The best results of gluten content are recorded in Glosa (32%) and Alcantara (28.5%).

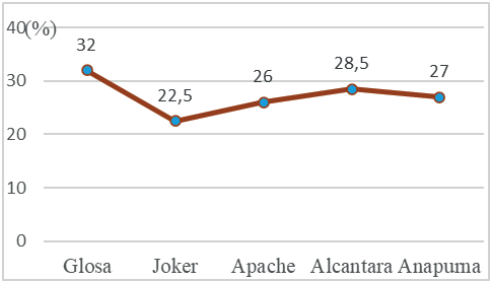


Figure 3. Average gluten content values (%) of the six wheat varieties in the experimental cycle

A number of studies have attempted to explore how the quality parameters of flours depend on each other and thus how the value of some could be predicted, with an acceptable error, of course, at the expense of the value of others. Flours with a higher protein and gluten content generated doughs with longer and more stable formation times (Branlard et al., 1985). Protein substances are the most important part of the wheat grain in terms of nutritional value and quality of the bakery industry. The protein content of the wheat grain depends largely on the wheat variety, cultivation technology (irrigated, non-irrigated, fertilizing) and pedoclimatic conditions. A high protein content is associated with good bakery quality. Among technological factors, fertilization influences the protein in the grain most strongly (Hera et al., 1986).

Figure 4 points out that, following the analysis of the protein content carried out in the five wheat varieties, it ranges from 11.6% to 14.2%. The highest value, 14.2%, was achieved for the Glosa variety, and the lowest value for the Joker variety (11.6%).

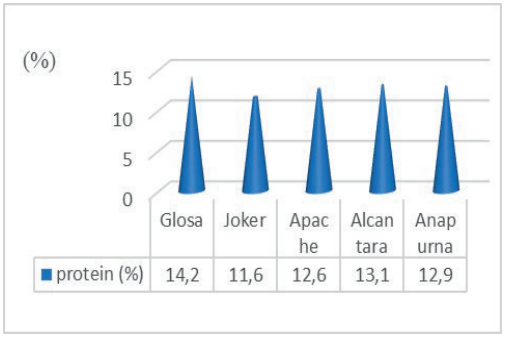


Figure 4. Mean values of protein content (%) of the six wheat varieties in the experimental cycle

In order to highlight the profitability of the wheat crop, we considered it necessary to calculate the main indicators of economic efficiency.

The analyzed indicators are as follows:

– main production (kg/ha);
– value of main production (lei/ha);
– production expenses (lei/ha);
– production cost (lei/kg);
– total profit (lei/ha);
– profit rate (%).

The selling price of wheat in the two experimental years is shown in Figure 5.

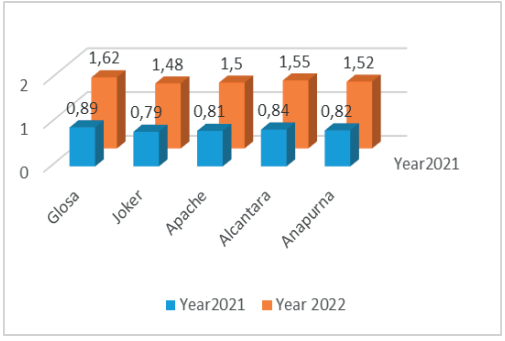


Figure 5. The selling price of wheat for the two experimental years

The value of the main production in both experimental years (Figure 6) is directly proportional to the recovery price, falling between 6048 lei/ha for the Alcantara variety in 2021 and 10550 lei/ha for the Joker variety in 2022.

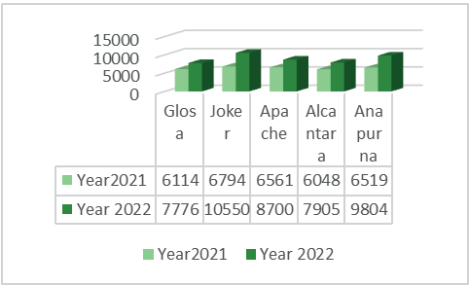


Figure 6. Value of economic indicators: value of main production (lei/ha) in the two experimental years

Production expenses (Figure 7) in 2022 were higher than in 2021 due to higher prices of diesel, chemical fertilisers and herbicides. In both experimental years, the highest expenses were for the Joker variety, of 2415 lei/ha, respectively 4080 lei/ha, these being due to the lower selling price (0.79 lei/kg - 2021 and 14.8 lei/ha - 2022) and the highest purchase price of seeds (202 lei/kg - 2021 and 3 lei/kg - 2022.

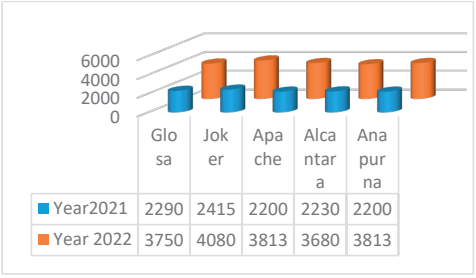


Figure 7. Value of economic indicators: production expenses (lei/ha) in the two experimental years

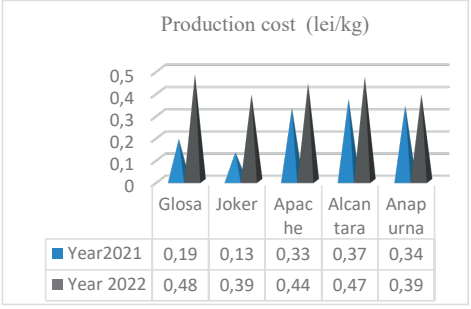
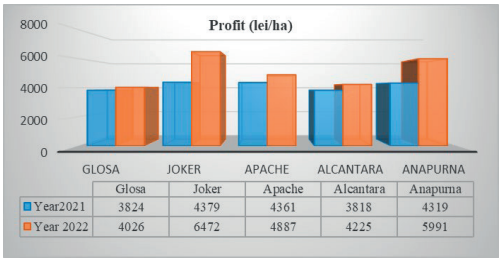


Figure 8. Value of economic indicators: production cost (lei/ha) in the two experimental years

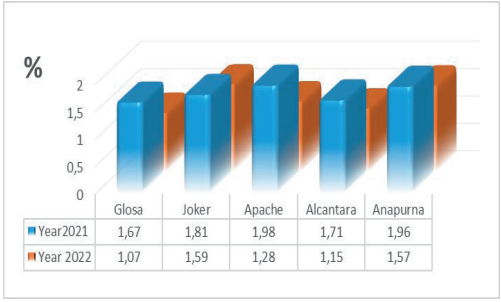
In 2021, the highest profit was made for the Jocher variety, of 4379 lei/ha, and the lowest profit was made for the Alcantara variety, of 3818 lei/ha. The year 2022 brings the highest profit also for the Jocher variety of 6472 lei/ha, and the lowest profit for the Glosa variety of 4026 lei/ha (Figure 9).



	Glosa	Joker	Apache	Alcantara	Anapurna
Year2021	3824	4379	4361	3818	4319
Year 2022	4026	6472	4887	4225	5991

Figure 9. Value of economic indicators: profit (lei/ha) in the two experimental years

The profit rate (Figure 10) was 1.07% for the Glosa variety in 2022, also the lowest rate in the two experimental years, and 1.98% for the Apache variety in 2021, being the highest in the two experimental years.



	Glosa	Joker	Apache	Alcantara	Anapurna
Year2021	1,67	1,81	1,98	1,71	1,96
Year 2022	1,07	1,59	1,28	1,15	1,57

Figure 10 Value of economic indicators: profit rate (%) in the two experimental years

CONCLUSIONS

Following the research carried out in both experimental years (2021-2022), the following conclusions were drawn:

Production is genetically determined but is largely influenced by climatic conditions during the growing season and applied technology.

The production capacity of wheat is strongly influenced by climatic conditions, therefore the average grain wheat yields differ from one year to another.

In both experimental years, the highest production was recorded for the Jocher variety of 7865 kg/ha, ensuring a production increase of 35% and a difference in production compared to the control variety of 2030 kg/ha, being statistically assured as very significant.

The Anapura and Apache varieties also recorded a production increase of 23% and 22%, respectively, compared to the control variety.

The average values of Hectolitric Mass obtained for the five varieties of wheat are for each variety, some particularly good, falling within the ranges corresponding to the Official Catalogue of Varieties. Also, the milling requirements for the standard mass per liter of wheat of 75 kg/hl according to STAS are met by each wheat variety.

The average values of gluten content determined under laboratory conditions in the five wheat varieties under the influence of cultivation technology and climatic conditions are good.

The highest value of protein content, 14.2%, was achieved for the Glosa variety, and the lowest value for the Joker variety, of 11.6%.

In both experimental years, the highest expenses were for the Joker variety, of 2415 lei/ha, respectively 4080 lei/ha, due to the lower selling price and the highest purchase price of seeds.

The year 2022 brings the highest profit also for the Jocher variety of 6472 lei/ha, and the lowest profit for the Glosa variety of 4026 lei/ha.

The profit rate was 1.07% for the Glosa variety in 2022, also the lowest rate in the two experimental years, and 1.98% for the Apache variety in 2021, being the highest in the two experimental years.

The most profitable and resistant variety was the Joker variety, even if the seed price was higher than the others and the bakery indices, being lower, compensated by significantly higher production.

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