COMPARATIVE STUDY ON THE CULTIVATION OF TWO WHEAT VARIETIES IN THE AREA OF CENEI, TIMIȘ COUNTY

R. C. JURCUȚ[1], I. MILOVAN[1], A. I. IBRIC[1], F. IMBREA[1], L. BOTOȘ[1]
[1]University of Life Sciences "King Michael I" from Timișoara, Calea Aradului Street, no.119, Timișoara, Romania
Corresponding author: raul.cristian19@gmail.com

Abstract. *Cultivating wheat is an extremely important agricultural activity in Romania, with a significant impact on agricultural production and the country's economy. Notable variations in terms of yield, quality, resistance to unfavorable weather conditions, and adaptability of wheat varieties used in agriculture underscore the importance of choosing the right varieties according to the specific characteristics of the region. In the 2022-2023 agricultural season, characterized by abundant rainfall in September and October 2022, a comparative study is being conducted in the town of Cenei, Timiș County, to evaluate the performance of two wheat varieties in this region with distinct geographic and climatic features. The analyzed varieties are Trublion A, known for its semi-early maturity and resistance to leaf diseases, and Sophie CS, with semi-early maturity, smaller-sized plants, resistance to lodging and winter hardiness. This study focuses on the yield of the obtained crop, the quality of the produced wheat, resistance to stress factors such as drought and pests, as well as the costs and efforts involved in the cultivation process. The results obtained will provide critical information to farmers for making decisions regarding the ideal wheat varieties for cultivation in this region, contributing to the sustainability and efficiency of agriculture. The correct choice of wheat variety can optimize production and bring significant economic benefits in a complex and variable agricultural environment.*

Keywords*: Wheat cultivation; Wheat varieties; Performance evaluation; Agriculture in Romania; Agricultural sustainability.*

INTRODUCTION

The European Union (EU) is implementing the seventh Environmental Action Programme (EAP) to support economic development, with a focus on sustainability. Additionally, the European Commission has defined an action plan for achieving a competitive and low-carbon economy by 2050 (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52012IP0146). This document contains ambitious objectives for reducing carbon dioxide emissions, with a particular emphasis on agriculture. In this context, EU agriculture plays an important role in supporting sustainable development. The EU is a significant player in the global agricultural scene, and crop production has shown a positive trend over the last three years within the EU(https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52012IP0146).

Romania continues to assert itself as an important agricultural producer within the EU. (https://agriculture.ec.europa.eu/dataandanalysis/markets/overviews/marketobservatories/crops/cereals-statistics_en) In 2016, our country ranked first in sunflower production and second in wheat and corn production, following France, according to data from the National Institute of Statistics. Romanian agriculture ranked third in the EU in cereal production in 2018 (https://agriculture.ec.europa.eu/dataandanalysis/markets/overviews/marketobservatories/crops/cereals-statistics_en)

There is a growing interest in achieving the objectives of the Common Agenda 2030 regarding the implementation of intelligent and sustainable solutions in agricultural production, including realizing the maximum productive potential with the rational use of resources to prevent environmental degradation (ANTOHI et al., 2020). These premises clearly indicate the opportunity for a well-founded study of a new approach to intelligent decision-making

processes to maximize positive effects, both ecologically and economically, related to ensuring sustainable production (ANTOHI et al., 2020).

The cultivation of wheat has been one of the most fundamental and vital agricultural practices in the history of humanity (LI et al., 2019). This cereal has represented a staple in the diets of people throughout millennia and has been essential for the development and survival of human societies (LI et al., 2019).

Wheat - A Strategic Crop for Human Food. Wheat (Triticum aestivum) is one of the oldest crops cultivated by humans and, at the same time, one of the most important cereals in terms of food (LI et al., 2019). Wheat is a fundamental source of carbohydrates, proteins, vitamins, and minerals in the human diet. Wheat grains are used in the production of bread, pasta, pastry products, breakfast cereals, and much more. It provides a significant source of energy and nutrients for billions of people worldwide (LI et al., 2019).

Adapting Wheat Cultivation to Local Conditions. Successfully cultivating wheat involves, in addition to selecting a suitable variety, adapting to specific local conditions (ANTOHI et al., 2020). In the case of the Sophie CS and Trublion varieties, we observed an adaptation to the conditions of the respective region, even though the initial germination was uneven. This ability to adapt to the variability of climatic and soil factors is an essential component of sustainable agriculture (CANN et al., 2023). Wheat is essential for 40% of the global population (KAZLAUSKAS et al., 2023). Genetic development of wheat to enhance resistance to climate change, extreme temperatures, and biotic stress is a necessity (MAO et al., 2023). Advances in genomics and genetic engineering have ushered in a "golden age" for wheat genetic improvement (MAO et al., 2023). Evapotranspiration in wheat crops is a crucial aspect for yield (ISLAM et al., 2022). In a study on wheat conducted in Bangladesh, ET during the base period was reduced through adjusting sowing dates and introducing heat-resistant varieties to offset the decrease in WP (ISLAM et al., 2022).

Managing Diseases and Pests. Regarding both the Sophie CS and Trublion varieties, we identified the presence of pathogens such as helminthosporiosis, septoriosis, and yellow rust, as well as aphid and bug infestations. Efficient management of these issues is essential for achieving optimal yield and avoiding significant losses (SIMON et al., 2022). Climate change threatens global wheat production by negatively affecting the biology and behaviour of pests (BAIWA et al., 2020). Drought, high temperatures, and increased carbon dioxide levels favour wheat pests, increasing the risk of significant crop losses. Current control solutions are becoming ineffective, and integrated approaches based on innovative management and early pest detection are becoming essential for food security under climate change (BAIWA et al., 2020).

The Impact of Wheat Cultivation on Agriculture and Society. Wheat cultivation has a significant impact on agriculture and society as a whole (CURTIS and HALFORD, 2014). Wheat is a major cash crop and an important driver of national economies (CURTIS and HALFORD, 2014). It also contributes to global food security and increased food production (CURTIS and HALFORD, 2014).

The most recent experience with the Sophie CS and Trublion varieties, including the challenges faced and the success achieved, demonstrates the ongoing importance of developing and managing this crop. Through adaptation to local conditions and efficient disease and pest management, wheat remains a crucial crop for agriculture and human society as a whole.

MATERIAL AND METHODS

In the specific context of the climatic conditions of the 2022-2023 agricultural year, this study focused on assessing the performance of wheat cultivation under the weather conditions of

2023, with an emphasis on the crop's growing period. The analyzed wheat varieties were Sophie and Trublion, both classified in category C1, and they were subjected to the same cultivation technology and climatic conditions. These semi-early varieties exhibit good production potential, are suitable for baking, have a medium height, good disease resistance, and some are awned, while others are not. They were cultivated in various regions of Romania.

The land preparation was conducted following the sunflower harvest, which released the land between August 20 and 30 in the Cenei commune. This interval provided ample time for soil preparation before seeding.

The technology applied for wheat included minimal tillage, where complex chemical fertilizers were incorporated after two passes with disc harrows.

The use of the no-till system as an efficient agricultural practice for soil health maintenance is a paramount practice in sustainable agriculture. No-till not only reduces soil compaction in the superficial layers but also at deeper depths, between 15 and 60 cm. This finding suggests that no-till can be an efficient alternative to traditional plowing methods, especially in soils prone to compaction. By maintaining or increasing the concentration of organic carbon in the soil and water-resistant aggregates, no-till contributes to preserving soil fertility and biodiversity while promoting more sustainable natural resource management (BLANCO-CANQUI et al., 2022).

Fertilizer application took place on August 30 and September 1, with a quantity of 300 kilograms and a 15/15/15 compound, providing wheat with a significant amount of nutrients during the critical consumption period.

After the application of chemical fertilizers, two passes with disc harrows were carried out. The first pass, conducted with a heavy X-type disc, took place at a depth of 15-18 cm between September 5 and 7. The second pass was shallower, targeting the top 10 centimeters of the germination bed, using a lighter disc harrow with a higher working speed than the first pass. Due to issues caused by precipitation in September, the second pass was delayed, occurring between October 13 and 15.

The wheat crop was sown on October 17, postponed due to large amounts of precipitation occurring within a short time frame. The delay also aimed to protect the crops from potential aphid or cereal fly attacks. All varieties were sown at a density of 400 viable grains per square meter (MA et al., 2018; ZHANG et al., 2022).

A study conducted in the 2016-2017 agricultural year in China on adjusting nitrogen application rates and density had a significant impact on the physicochemical properties of the soil, plant nitrogen use, and the bacterial community in their rhizosphere (LIANG et al., 2023). Changes in plant density influenced nitrogen use by plants, and changes in the composition and function of the bacterial community played a significant role in this influence. Thus, selecting high plant density and a higher nitrogen level achieved greater nitrogen efficiency without significantly affecting yield (LIANG et al., 2023).

Due to extremely favourable conditions for the emergence of weeds, diseases, and especially pests, farmers had to intervene with phytosanitary treatments three times before June 1, 2023. This measure was essential to protect the crops and ensure a healthy and profitable harvest.

The phytosanitary treatments were applied uniformly to all plots, using the same chemicals and at identical time intervals. The three treatments were structured as follows:

1. The first treatment involved the use of the Omera herbicide to control weeds, as well as the Verben fungicide for plant disease prevention and treatment. This treatment was particularly important in the early growth stages.

2. The second treatment included the Zizan 500 fungicide and Azotrolina, along with the Fontex insecticide. This treatment was applied to effectively address fungal diseases and pests threatening the crops.

3. The third treatment consisted of applying the Verben fungicide and Apis Cyperguard insecticide. This treatment aimed to reinforce protection against diseases and pests in the later stages of the growing season.

These interventions were crucial for ensuring a high-quality harvest and maintaining plant health, even though multiple applications were necessary due to the favourable conditions for pathogens.

The soil where the experiment was conducted was of the vertisol type, with 100% clay texture, creating favourable conditions for the development of weeds, diseases, and pests. Therefore, interventions to control these factors were essential and contributed to the health of the wheat crops.

This section has highlighted the details of the materials and methods used in the study, including the applied technology, land preparation, seeding, weed and specific climatic issue management for the 2022-2023 agricultural year. This information is crucial for understanding the context in which the results were obtained and evaluating the performance of wheat cultivation under these conditions.

RESULTS AND DISCUSSIONS

The Trublion variety cultivated in the Cenei commune achieved notable results in the 2023 agricultural year, successfully adapting to the implemented soil technologies. Throughout the entire vegetation period, this variety demonstrated excellent adaptation to local climatic conditions, significantly contributing to the success of the crop. By the arrival of winter, Trublion had satisfactorily produced an average of three spikes per plant, resulting in a good yield for the year.

Regarding its resistance to temperature changes, this variety proved to be highly flexible, experiencing only a low level of stress for a short period. This characteristic was crucial, given the temperature variations between day and night during the growing season.

As for issues related to diseases and pests, the crops were affected to some extent, but overall, the results were satisfactory. Under favorable conditions in this agricultural year, diseases such as Septoria leaf blotch (*Septoria tritici*) were observed at the end of autumn, causing minor issues in spring. However, proper intervention efficiently managed this problem. In spring, Trublion was affected by another disease, powdery mildew (*Erysiphe graminum*), but it was also successfully treated without significant losses.

In terms of pests, one of the notable issues was a mild aphid (*Schizaphis graminum*) attack, which required economic interventions. However, these preemergence treatments were effective in limiting the damage caused by these pests.

By June 1, 2023, the Trublion plants were in excellent condition. The average plant height was 0.94 meters, with six internodes and a well-developed root system. What was impressive was the spike density that this variety offered, with an average of 570 spikes per plant, approximately 1.42 spikes per plant. These results reflected healthy growth and robust development of the Trublion crop in the Cenei commune.

Overall, the performance of this Trublion variety was positive in the 2023 agricultural season. Its resistance to climatic factors and adaptability contributed to a satisfactory yield, despite minor issues related to diseases and pests. With proper interventions and careful management, these challenges were successfully addressed. The impressive spike density solidified this variety as a viable choice for farmers in the Cenei commune, indicating significant potential for future yields.

As for Sophie CS, its initial emergence was uneven due to specific conditions in its area, significantly impacting its subsequent performance. However, during the vegetation period, Sophie CS delivered notable performance and demonstrated significant potential.

The initial emergence was problematic due to the preparation of the germination bed, resulting in uneven germination. By the arrival of winter, Sophie CS provided a satisfactory tillering with approximately three spikes per plant, representing a success despite the challenges in the early part of the season. More importantly, the variety proved to be resistant to temperature fluctuations between day and night, successfully adapting to climatic factors.

Regarding diseases and pests, Sophie CS crops were affected by several pathogens. Firstly, a minor attack of tan spot (*Helminthosporium tritici*) required intervention. This issue was efficiently managed to minimize losses. Later, Septoria leaf blotch (Septoria tritici) appeared during the growing season but was successfully controlled. The last encountered pathogen was yellow rust (Puccinia striiformis), which affected the leaves in an early stage and was easily combated.

As for pests, aphid attacks (*Schizaphis graminum*) were observed, and during spike development, a minor bug attack (*Eurygaster* spp.) occurred. However, these attacks were successfully managed, ensuring plant health.

By June 1, 2023, the Sophie CS variety presented itself in excellent form. The average plant height was 0.95 meters, with six internodes and a well-developed root system. Regarding spike density, this variety produced an average of 615 spikes per plant, an impressive density of approximately 1.53 spikes per plant. These results demonstrated healthy growth and robust development of the Sophie CS crop, indicating potential for good future yields.

Thus, Sophie CS faced challenges in the 2023 agricultural season but successfully adapted and delivered satisfactory results. Resistance to climatic conditions and effective management of diseases and pests contributed to the success of this crop. The impressive spike density indicates promise for future yields, highlighting that Sophie CS remains a viable and competitive variety for farmers in the respective area.

CONCLUSIONS

Based on the information obtained, several important conclusions can be drawn regarding the wheat crops and the varieties used:

The yields obtained for the "Sophie CS" and "Trublion" varieties were remarkable, according to the data recorded after harvesting. The "Sophie CS" variety achieved a yield of 7067 Kg/ha, while the "Trublion" variety recorded a yield of 6911 Kg/ha. These data demonstrate the excellent performance of both varieties and the success of the cultivation methods used in these plots.

Outstanding crop yield: Regardless of the wheat variety and planting density, the yields obtained exceeded the threshold of 6 tons per hectare. This suggests that local conditions, applied technology, and superior genetics significantly contributed to the success of the crops.

Variability of varieties: Despite initial challenges, such as poor vegetative growth and attacks by pests or pathogens, the initial differences became less significant at the time of harvest. This emphasizes the importance of evaluating crops over the long term, as the performance of varieties can vary over time.

Variety performance: In the context of the 2022-2023 agricultural season, the Trublion and Sophie varieties proved to be the most productive. Both varieties achieved remarkable yields and exceeded expectations.

Importance of environmental factors: The results show that climatic conditions, cultivation technology, and variety genetics had a significant impact on yield. It is essential to consider these factors when making decisions regarding planting density and sowing period.

The need to adapt planting density: The final conclusion emphasizes the importance of choosing planting density based on specific circumstances. This should take into account climatic conditions, sowing period, and manufacturer recommendations to achieve the best results.

In conclusion, the success of wheat crops depends on various factors, including variety genetics, applied technology, and environmental conditions. Long-term crop evaluation is essential to accurately determine variety performance. In this context, the Trublion and Sophie varieties proved to be the most productive in the 2022-2023 agricultural season. Planting density should be adapted according to specific conditions, ensuring that all relevant factors are considered to achieve optimal results.

ACKNOWLEDGEMENT

Support was also received by the project Horizon Europe (HORIZON) 101071300 - Sustainable Horizons -European Universities designing the horizons of sustainability (SHEs)

BIBLIOGRAPHY

ANTOHI, V.M.; IONESCU, R.V.; SERBAN, C.; STANCIU, S.; VIRLANUTA, F.O.; ZLATI, M.L. 2020 - New Agricultural Model of Economic Sustainability for Wheat Seed Production in Romania. Sustainability 12 (13), 4182. Romania

BAJWA, A. A., FAROOQ, M., AL-SADI, A. M., NAWAZ, A., JABRAN, K., SIDDIQUE, K. H. M. 2020 - Impact of climate change on biology and management of wheat pests. Crop Protection, Volume 137, 2020, Australia.

BLANCO-CANQUI, H., HASSIM, R., SHAPIRO, C., JASA, P., KLOPP, H. 2022 - How does no-till affect soil-profile compactibility in the long term? Geoderma, Volume 425, USA

CANN, D. J., HUNT, J. R., PORKER, K. D., HARRIS, F. A. J., RATTEY, A., HYLES, J. 2023 - The role of phenology in environmental adaptation of winter wheat. European Journal of Agronomy, Volume 143, 126686, ISSN 1161-0301.Australia

CURTIS, T., HALFORD, N. G., 2014 - Food security: the challenge of increasing wheat yield and the importance of not compromising food safety. Annals of Applied Biology, Ann Appl Biol 164: 354–372. UK

ISLAM, A.T., ISLAM, A.K.M.S., ISLAM, G.M.T., BALA, S.K., SALEHIN, M., CHOUDHURY, A.K., DEY, N.C., HOSSAIN, A., 2022 - Adaptation strategies to increase water productivity of wheat under changing climate, Agricultural Water Management, Volume 264, 107499, ISSN 0378-3774. Bangladesh

KAZLAUSKAS, M., BRUČIENĖ, I., SAVICKAS, D., NAUJOKIENĖ, V., BURAGIENĖ, S., STEPONAVIČIUS, D., ROMANECKAS, K., ŠARAUSKIS, E., 2023 - Life Cycle Assessment of Winter Wheat Production Using Precision and Conventional Seeding Technologies. Sustainability, Lithuania.

LI, Y.; QUAN, S.; SONG, J.; WANG, M.; ZHANG, T., 2019 - Adaptation to Climate Change and its Impacts on Wheat Yield: Perspective of Farmers in Henan of China. Sustainability, 11, 1928, China.

LIANG, Z., LI, J., CAO, X., TANG, Y., MO, F., NANGIA, V., LIU, Y. 2023 - Responses of wheat nitrogen uptake and utilization, rhizosphere bacterial composition, and nitrogen-cycling functional genes to nitrogen application rate, planting density, and their interactions. Elsevier. Applied Soil Ecology, Volume 193, China.

MA, S.-C., WANG, T.-C., GUAN, X.-K., ZHANG, X., 2018 - Effect of sowing time and seeding rate on yield components and water use efficiency of winter wheat by regulating the growth redundancy and physiological traits of root and shoot, Field Crops Research, Volume 221, Pages 166-174, ISSN 0378-4290.China

MAO, H., JIANG, C., TANG, C., NIE, X., DU, L., LIU, Y., CHENG, P., WU, Y., LIU, H., KANG, Z., WANG, X. 2023 - Wheat adaptation to environmental stresses under climate change: Molecular

basis and genetic improvement. Molecular Plant, Volume 16, Issue 10, Pages 1564-1589. China

SIMÓN M. R., STRUIK P. C., BÖRNER A, 2023 - Fungal wheat diseases: etiology, breeding, and integrated management, volume II. Frontiers in Plant Science ,14, 2023. Argentina

ZHANG, J., MU, J., HU, Y., REN, A., LEI, B., DING, P., LI, L., SUN, M., GAO, Z., 2023 - Effect of Planting Patterns and Seeding Rate on Dryland Wheat Yield Formation and Water Use Efficiency on the Loess Plateau, China. Agronomy, 13, 851. China

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52012IP0146

https://agriculture.ec.europa.eu/dataandanalysis/markets/overviews/marketobservatories/crops/cereals-statistics_en