DUCA, Maria; Steliana CLAPCO; Oana CRACIUNESCU and Elena Iulia OPRITA. Sustainable sunflower management: Climate resilience and bioactive compound valorization in the circular economy. In: RAD, 2025 International Conference on Radiation, Natural Sciences, Medicine, Engineering, Technology and Ecology. Book of Abstract. Herceg Novi, 13th edition, June 16-20, 2025. Niš: RAD Centre, Niš, Serbia 2025, p. 20. ISBN 978-86-901150-8-2. Disponibil: https://doi.org/10.21175/rad.abstr.book.2025.4.12

Sunflower (Helianthus annuus L.) represents a vital crop with significant economic, ecological, and industrial importance, serving as a key pillar of the circular economy due to its diverse applications in food production, biofuels, and high-value industrial products. Ensuring the sustainability of sunflower cultivation necessitates an integrated approach that optimizes agronomic practices, enhances genetic resilience, and leverages precision technologies to improve productivity while conserving environmental resources. Globally, sunflower cultivation plays a crucial role in sustainable agriculture by contributing to soil health, crop diversification, and resource efficiency. In the Republic of Moldova, sunflower is among the most extensively cultivated crops, significantly influencing the agri-food sector and national economy. Between 2016 and 2023, the cultivated area fluctuated between a minimum of 358.6 thousand hectares in 2019 and a maximum of 440.2 thousand hectares in 2022. The production of sunflower seeds is highly susceptible to climatic variability, particularly in the absence of a wellestablished irrigation infrastructure. The lowest recorded yield was 492.5 thousand tons in 2020, a year marked by severe drought, while the highest production reached 960.1 thousand tons in 2021. These fluctuations underscore the necessity of adopting resilient agricultural practices to mitigate climateinduced risks. This study examines key aspects of sustainable sunflower crop management, including site selection, optimized agronomic practices and genetic improvement, et all. Given the increasing impact of climate change, research on biotic and abiotic stress factors is essential for the development of stresstolerant hybrids. Rising temperatures, irregular precipitation patterns, and soil degradation necessitate breeding programs focused on drought-resistant, disease-resistant, and high-yield hybrids. Additionally, sustainable agricultural strategies, including crop rotation, biological pest control, and soil fertility management, contribute to ecological balance and long-term productivity. Beyond its agronomic significance, sunflower has substantial potential for industrial and pharmaceutical applications through the valorization of its by-products. The extraction of biologically active compounds, such as polyphenols, flavonoids, and biopeptides, presents a valuable opportunity for the development of high-value-added products in nutraceuticals, cosmetics, and pharmaceuticals. These bioactive substances exhibit antioxidant, antimicrobial, and anti-inflammatory properties, reinforcing the multifunctionality of sunflower cultivation within the circular economy. By maximizing the utilization of sunflower biomass and derivatives, economic efficiency is enhanced while minimizing agricultural waste. The future of sunflower cultivation lies in the convergence of advanced biotechnological research, eco-friendly agricultural practices, and efficient resource management. Strengthening resilience to climatic stressors, enhancing oil yield quality, and expanding industrial applications will ensure the long-term sustainability of this crop. Through the implementation of sustainable strategies, sunflower can significantly contribute to food security, economic development, and environmental sustainability, positioning itself as a cornerstone of modern agro-industrial systems.