УДК 631.3:811.111
Крицак А. - ст. гр. МГ-11; Волянюк М. - ст. гр. МГ-11
Тернопільський національний технічний університет імені Івана Пулюя

СУЧАСНІ ТЕХНОЛОГІЇ В АГРОІНЖЕНЕРІЇ

Науковий керівник: к.філол.н., Штанюк О. М.

Krytsak A., Volianiuk M.
Ternopil Ivan Puluj National Technical University

MODERN TECHNOLOGY IN AGRICULTURAL ENGINEERING

Scientific Supervisor: PhD in Philology, Shtanyuk O.M.

Ключові слова: точне землеробство, розумне фермерство, агротехнології.
Keywords: precision agriculture, smart farming, agricultural technologies.

Agricultural engineering is an interdisciplinary field that integrates advances in mechanical engineering, electronics, information technology, and agronomy with the aim of increasing the efficiency of agricultural production [1]. The digitalization of production processes and the application of high technologies make it possible to significantly increase crop yields while simultaneously reducing material resource costs. This not only enhances the competitiveness of individual enterprises but also contributes to addressing global challenges — environmental pollution and the food security crisis [5].

A key direction of modern agricultural engineering is precision agriculture — an innovative approach that improves farm efficiency through continuous environmental monitoring and regular calculation of key indicators reflecting the condition of land plots [1]. GPS navigation forms the foundation of this concept: precise positioning makes it possible to minimize areas of overlapping, re-sowing, and missed strips [2]. Agricultural machinery is equipped with receiving antennas connected to the steering control system, and machine guidance can be assistive, semi-automatic, or fully autonomous [3].

Unmanned aerial vehicles (UAVs) have gained widespread use for aerial photography, crop monitoring, and aerial chemical treatment of agricultural land [6]. Agricultural drones are used for pollination, fertilizer application, and spraying crops with pesticides, which reduces the need for manual labor and saves time and resources [7]. When applying crop protection agents by drone, water consumption is reduced by up to 95% compared to traditional self-propelled sprayers, and savings on chemicals range from 10 to 25%. According to DroneUA, the agricultural robotics market in Ukraine grew by 20% in 2022 alone [9].

The Internet of Things (IoT) forms the infrastructure of the "smart farm" [8]. Dedicated sensors, field weather stations, and monitoring devices collect large volumes of data and transmit it via dedicated communication channels to a cloud platform. IoT sensors measure soil and atmospheric moisture levels, temperature fluctuations, precipitation amounts, and nutrient content in the soil, enabling well-informed management decisions regarding irrigation, fertilization, and crop protection [4]. Intelligent analytics and machine learning algorithms support work planning and optimization, and generate dynamic yield maps [8].

Autonomous machinery and AI-based robotics are actively used to automate planting, harvesting, and soil cultivation [5]. AI-controlled tractors are capable of operating around the clock without the need for human supervision, significantly reducing labor costs. Smart farms help conserve resources, increase yields, and reduce negative environmental impact, opening new opportunities to ensure food security even under the most challenging conditions [5]. The further development of agricultural engineering is inextricably linked to the deeper integration of Big Data, artificial intelligence, and renewable energy into the agricultural sector, giving rise to the concept of "Agriculture 4.0" [2].

References

1. WEAGRO. Precision farming in Ukraine: definition and prospects [Electronic resource], 2025. – Available at: https://www.kuhn.ua/ahrarni-innovatsiyi/typy-silskoho-hospodarstva/tochne-zemlerobstvo/tekhnolohiyi-tochnoho-zemlerobstva (accessed: 31.03.2026).
2. Travelite AGRO. Precision agriculture and AgroIT solutions in modern agricultural production [Electronic resource], 2021. – Available at: https://traveliteagro.com/tochne-zemlerobstvo-ta-agro-it-rishennia/ (accessed: 31.03.2026).
3. KUHN. Precision farming technologies [Electronic resource]. – Available at: https://www.kuhn.ua/ahrarni-innovatsiyi/typy-silskoho-hospodarstva/tochne-zemlerobstvo/tekhnolohiyi-tochnoho-zemlerobstva (accessed: 31.03.2026).
4. Pandateam. IoT solutions for precision agriculture [Electronic resource]. – Available at: https://newfood.ua/2024/11/20/rozumni-fermy-iak-shtuchnyy-intelekt-zminiuie-silske-hospodarstvo/ (accessed: 31.03.2026).
5. NEWFOOD. Smart farms: how artificial intelligence is transforming agriculture? [Electronic resource], 2024. – Available at: https://newfood.ua/2024/11/20/rozumni-fermy-iak-shtuchnyy-intelekt-zminiuie-silske-hospodarstvo/ (accessed: 31.03.2026).
6. Roboticagrosystems. Drone services for fields. Aerial crop treatment in Ukraine [Electronic resource], 2025. – Available at: https://roboticagrosystems.com/ (accessed: 31.03.2026).
7. Propozytsiia. "Smart agriculture" — trends and risks [Electronic resource]. – Available at: https://propozitsiya.com/articles/tekhnika-ta-obladnannya-inshe/rozumne-silske-hospodarstvo-tendentsiyi-ta-ryzyky (accessed: 31.03.2026).
8. Kyivstar Business Hub. Efficient operation of agricultural machinery using IoT solutions [Electronic resource], 2024. – Available at: https://hub.kyivstar.ua/articles/efektyvna-robota-agrotehniky-za-dopomogoyu-iot-rishen (accessed: 31.03.2026).
9. AgroPortal. Agricultural drones in Ukraine. Market growth and versatility of use [Electronic resource], 2023. – Available at: https://agroportal.ua/publishing/lichnyi-vzglyad/agrodroni-v-ukrajini-rist-rinku-ta-universalnist-u-vikoristanni (accessed: 31.03.2026).