Тематичний напрям № 2

Точне землеробство та використання геоінформаційних систем у сільському господарстві

УДК 631.6:631.5:631.7

MODERN APPROACHES TO INCREASING THE EFFICIENCY OF LAND RECLAMATION SYSTEMS IN UKRAINIAN AGRICULTURE

СУЧАСНІ ПІДХОДИ ДО ПІДВИЩЕННЯ ЕФЕКТИВНОСТІ МЕЛІОРАТИВНИХ СИСТЕМ У СІЛЬСЬКОМУ ГОСПОДАРСТВІ УКРАЇНИ

Антоніна Галєєва
Миколаївський національний аграрний університет
Миколаїв, Україна

Irrigated agriculture is an important element of ensuring food security and stable functioning of the agricultural sector of Ukraine. At the same time, it is characterized by significant consumption of water resources, which in the context of climate change, increasing food needs and limited natural water supply creates significant challenges for the industry. This is especially true for the southern and steppe regions of the country, where moisture deficiency is combined with increased risks of soil degradation. In such conditions, the relevance of implementing modern approaches to increasing the efficiency of land reclamation systems, focused on rational use of water, reducing environmental pollution and ensuring economic efficiency of production, is increasing.

Despite the relatively small share of irrigated land in the structure of agricultural land, their importance for production is extremely high, since it is on these areas that a significant part of the harvest of vegetable and industrial crops is formed. At the same time, existing land reclamation systems are often in unsatisfactory technical condition, which is accompanied by significant losses of water during transportation and its irrational use. Additionally, the situation is complicated by the processes of water resource pollution and the deterioration of the physicochemical properties of soils.

Modern challenges in the development of irrigated agriculture are related to the need to achieve a balance between economic efficiency, environmental safety and social accessibility of water resources. Intensification of climate change, increasing frequency of droughts, soil degradation and uneven access to water necessitate the introduction of adaptive and resource-saving technologies. In this context, diversification of water supply sources is of particular importance, in particular the use of treated wastewater, rainwater harvesting and the use of alternative solutions to ensure a stable water regime.

An important direction for increasing the efficiency of land reclamation systems is the introduction of modern irrigation methods that provide localized water supply directly to the zone of the plant root system. Such approaches allow significantly reducing unproductive water losses, optimizing the soil water regime and increasing crop productivity. At the same time, the use of limited water supply regimes helps to save resources, but requires a well-founded approach, since long-term use can lead to a deterioration of the soil condition and a decrease in yield.

One of the key problems that accompanies the intensification of irrigation is the accumulation of salts in the upper layers of the soil. This phenomenon is especially characteristic of heavy soils with low permeability and insufficient drainage. In the short term, modern irrigation methods can contribute to the movement of salts beyond the active root zone, but in the long term, in the absence of proper management, their re-accumulation occurs due to evaporation and capillary rise of moisture. This negatively affects the availability of nutrients, inhibits plant development and reduces the productivity of agrocenoses.

The distribution of moisture in the soil profile with localized irrigation methods is uneven and largely depends on the physical properties of the soil. In heavy soils, horizontal water distribution prevails, which contributes to the formation of zones of increased salt concentration. As a result, the root system of plants is often located in the upper layers, where the risk of salinization is greatest, which creates additional restrictions for the growth and development of crops.

Increasing the efficiency of land reclamation systems involves an integrated approach that takes into account the relationship between irrigation regimes, soil properties and biological characteristics of cultivated crops. This includes the implementation of precision agriculture technologies, the use of information systems for monitoring soil moisture and irrigation management, as well as the integration of various water supply sources. An important component is also the improvement of drainage systems and the use of agrotechnical measures aimed at preventing the accumulation of salts.

Therefore, increasing the efficiency of land reclamation systems in Ukrainian agriculture is possible only if innovative irrigation technologies are combined with rational management of water and soil resources. This approach will minimize negative environmental impacts, increase the productivity of agroecosystems, and ensure their long-term sustainability in the face of global climate change.

Список використаних джерел

1. Шевченко О. В., Лавриненко Ю. О. Ефективність використання води при вирощуванні сільськогосподарських культур на зрошенні / О. В. Шевченко, Ю. О. Лавриненко // Зрошуване землеробство. - 2022. - № 77. - С. 12-18.

2. Коваленко П. І., Михайлов Ю. О. Технічна модернізація меліоративних систем України: сучасний стан і перспективи / П. І. Коваленко, Ю. О. Михайлов // Меліорація і водне господарство. - 2023. - № 2. - С. 20-27.

3. Вожегова Р. А., Малярчук М. П. Вплив зрошення на родючість ґрунтів і продуктивність агроценозів / Р. А. Вожегова, М. П. Малярчук // Таврійський науковий вісник. - 2024. - № 128. - С. 33-40.

4. Smith M., Kivumbi D., Heng L. Water productivity and irrigation efficiency in modern agriculture / M. Smith, D. Kivumbi, L. Heng // Agricultural Systems. - 2022. - Vol. 198. - 103377.

5. Ayers R. S., Westcot D. W. Water quality for agriculture: modern perspectives / R. S. Ayers, D. W. Westcot. - FAO Irrigation and Drainage Papers. - 2023. - №. 29 (updated edition).

6. Zhang X., Chen S., Sun H. Deficit irrigation and soil salinity interactions under arid conditions / X. Zhang, S. Chen, H. Sun // Field Crops Research. - 2024. - Vol. 303. - 109112.

7. UNESCO. Water for Sustainable Development Report 2023: Partnerships and Cooperation for Water. - Paris : UNESCO, 2023. - 186 p.