

## **Section: Agricultural Sciences**

# **HYBRID WINTER RYE: CURRENT STATE AND PROSPECTS OF CULTIVATION IN THE FOREST-STEPPE OF UKRAINE**

**Stoliar Svitlana**

Phd in Agriculture, Head of the Department, Associate Professor

**Melnyk Maksym**

Candidate for the degree of Doctor of Philosophy

Department of Technologies in Crop Production

Polissia National University, Ukraine

Winter rye is one of the most important grain crops of strategic importance for Ukraine's agricultural sector. Due to its unpretentiousness to growing conditions, high productivity and wide range of uses, this crop has traditionally occupied an important place in crop rotations in many regions. In recent years, considerable attention has been paid to hybrid forms of winter rye, which demonstrate significant advantages over traditional varieties, in particular in productivity, stress resistance and adaptability to climate change [1].

Of particular importance is the introduction of hybrid rye in the Forest-Steppe region of Ukraine, a region characterized by significant variability in soil and climatic conditions. High yields and the ability of hybrids to efficiently use resources are becoming promising for increasing the economic efficiency of grain production in the Forest-Steppe of Ukraine.

We have analyzed the current state of hybrid winter rye cultivation, identified the main agronomic and economic advantages of this crop and outlined the prospects for its introduction in the Forest-Steppe of Ukraine. Particular attention is paid to the adaptation of hybrids to regional peculiarities and their role in ensuring sustainable agricultural development.

It should be noted that there is a shortage of grain in global grain production, and humanity is facing an acute food crisis. The annual grain production averages about 600 million tons, and by 2025 the demand will be between 840 million and 1 billion tons. As a result, there is a difficult problem of meeting the demand for grain, as the sown areas in the world and Ukraine are decreasing. However, rye yields in most developed European countries have already reached more than 8 t/ha [3, 5].

Winter rye has traditionally occupied an important place in the structure of Ukraine's sown areas, although there has been a general downward trend in its cultivation over the past decade. We have analyzed the sown areas of winter rye in Ukraine and Zhytomyr region, as shown in Figs. 1 й 2 [2].

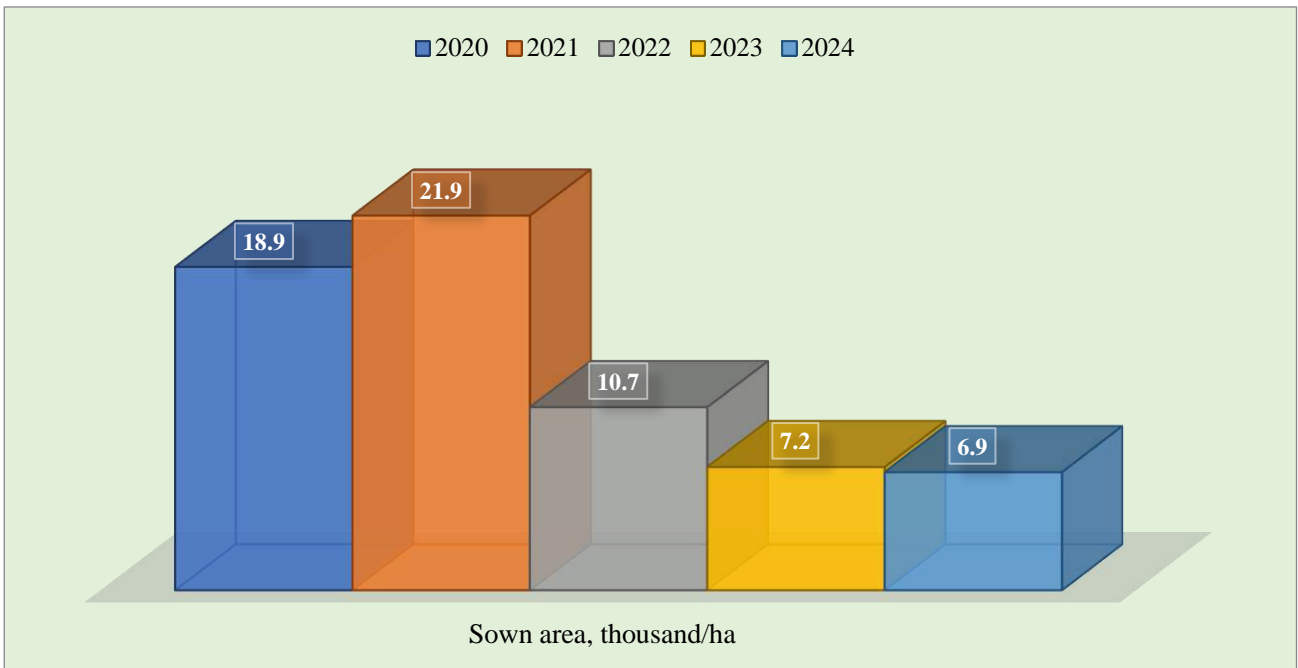


Figure 1. Sown areas of winter rye in Ukraine

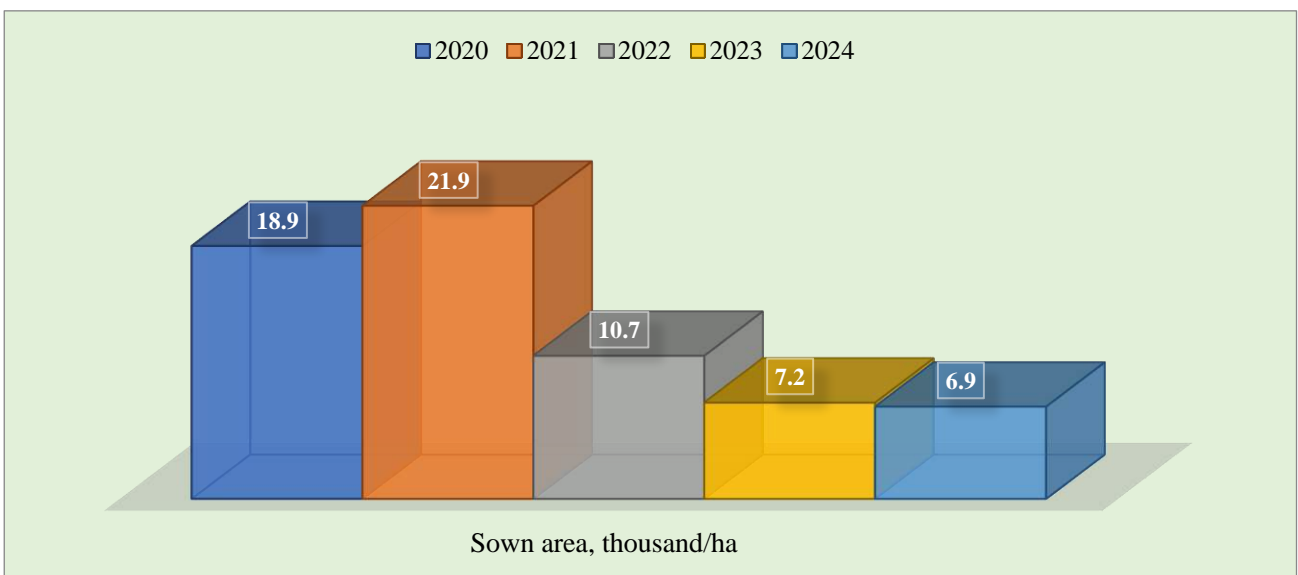


Figure 2. Sown areas of winter rye in Zhytomyr region

The analysis of winter rye acreage shows a decrease in 2020-2024 by 57.7% in Ukraine and 68.5% in Zhytomyr region. Such a reduction may be due to economic factors, changes in the structure of sown areas, reduced profitability of crops, and the impact of climate change.

Thus, it is necessary to introduce modern agricultural technologies, in particular, to grow promising hybrids of winter rye, to increase productivity and grow the crop's acreage.

Comprehensive approaches to improving the efficiency of cultivation and maintaining stable production of hybrid winter rye [4, 6]:

- ✓ hybrid rye demonstrates higher yields compared to traditional varieties, which allows to obtain more phytoproducts from a smaller area;

- ✓ resistance of hybrids to abiotic and biotic factors, reducing the risk of crop losses;
- ✓ application of resource-saving technologies (minimum tillage) will help reduce production costs;
- ✓ introduction of precision agriculture for the rational use of fertilizers and plant protection products;
- ✓ the possibility of using rye on less fertile and sandy soils where other crops have low yields;
- ✓ improving crop rotation to preserve soil fertility;
- ✓ focusing on the production of high-quality grain for the food industry, which creates added value for the crop;
- ✓ development of hybrid rye use (fodder, bioenergy, etc.).

To this end, a comprehensive study of the formation of productivity, growth and development characteristics, adaptive properties and competitiveness of plants of modern varieties and hybrids of winter rye in organic and conventional production has been launched in the conditions of the Levor farm in the Berdychiv district of the Zhytomyr region since 2023 (Fig. 3).



Figure. 3. Experimental plot of different varieties and hybrids of winter rye, 2024 (original photo)

Winter rye is the second most important crop in Ukraine after wheat, with its food value determined by the high content of proteins (12.8%) and carbohydrates (69.1%) in its grain. The presence in rye bread of complete proteins rich in essential amino acids (lysine, arginine), a large amount of easily digestible carbohydrates, important vitamins (A1, B1, B2, B3, B6, PP, C), and a high caloric content (1 kg of rye bread provides 2481.2 kcal) indicates its high nutritional value as a food product.

A number of scientific studies on breeding and grain production are devoted to this crop: V. Skoryk (2011), O. Ryabushchyts (2011), K. Manko (2011), O. Bunyak (2010), G. P. Maliavko (2010), V. P. Derevianko (2008).

Particular attention should be paid to winter rye hybrids characterized by high adaptability, stable yield, short stem, resistance to lodging and diseases, lower grain losses, which are able to ensure high profitability and profitability of production.

Thus, hybrid winter rye has a number of advantages that make it a promising crop in modern agriculture:

1. Higher yields: hybrids demonstrate consistently high yields that exceed traditional varieties by 20-40%. This is due to the use of modern breeding technologies that combine the best genetic characteristics of parental lines.

2. Resistance to abiotic stresses: hybrids are highly adaptable to abrupt climate change. They adapt better to adverse environmental factors, such as drought, temperature changes and soil salinity.

3. Resistance to biotic factors: hybrids show higher resistance to major diseases and pests, including powdery mildew, rust and fusarium, which reduces the need for pesticides and is an important environmental and economic factor.

4. Rapid vegetation recovery in spring: due to the increased growth energy, hybrids recover faster after the winter period, which contributes to the optimal use of spring moisture and improves overall productivity.

5. Improved grain quality: hybrid rye grain is characterized by a higher protein content and improved technological qualities, which makes it attractive for the food industry, in particular for the production of flour and bakery products.

Thus, the introduction of hybrid winter rye into the agricultural production of the Forest-Steppe is a promising area that contributes to the efficiency of the agricultural sector due to its sustainability, productivity and environmental benefits.

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