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IMPACT OF COLD STRESS ON WHEAT YIELD IN UKRAINE UNDER GLOBAL WARMING CONDITIONS

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Wheat (*Triticum aestivum* L.) is one of Ukraine's primary food crops and is of immense economic importance, as it also makes a significant contribution to global food security. Wheat is not just a grain; it is an important indicator of a nation's stability. Today, we are witnessing how traditional agricultural giants are being forced to rethink their strategies. While China and India are focused on building up record domestic reserves, export-oriented countries like Ukraine are fighting for their share of global grain exports. For Ukraine, the 2024/25 season has been a test of endurance. Despite the hostilities, the area planted with wheat has stabilized at a level that not only ensures domestic security but also allows for the export of over 14–15 million metric tons. Ukraine ranks among the top ten wheat-exporting countries in the world. The wheat harvest is negatively affected by abiotic factors and plant diseases. The impact of climate change on the wheat harvest is most pronounced in the Poltava region, an arid climate zone where we conduct our own experiments. In 2025, the region suffered from frosts on April 27–29, with temperatures dropping to -4.5°C at the soil surface. The study aimed to investigate the effect of cold stress on wheat yield and to identify cold stress genes. The PCR-based primers were used to detect the *CBF-A3* gene (Babben et al. 2018). Analysis of the 2025 harvest showed that the variety least resistant to cold stress was Katrusya Odessa, which experienced a 2.7-fold decrease in yield (grain weight per spike was 1.56 g in the control and 0.58 g

under frost conditions). The var. Pylypivka proved to be more resistant to cold, yielding 2.49 and 2.0 g, respectively. Farmers received almost half the yield for different wheat varieties compared to 2024. In contrast, the varieties bred in Poltava showed significantly higher productivity under frost conditions. For example, in the Vilshana variety, the grain weight per spike was 3.1 g in 2024 and 2.9 g in 2025 under conditions of severe cold stress. Similar results were obtained for the varieties Sonata Poltavska, Zelenyi Hai, and Dykanka, Tvorchist Odeska, Favorite, Panyanka. These varieties carry the *CBF-A3* cold stress gene. In some lines developed by I. Motznyi and DSV-Ukraine in May 2024 and 2025, specific chlorotic-yellowish streaks resembling a viral infection were observed when daily temperature fluctuations exceeded 18°C. However, no viruses affecting wheat were detected. Therefore, this is a reaction to cold stress, spring frosts, and daily temperature fluctuations. These lines lack the *CBF-A3* gene. It was also not detected in the Odesa varieties Pylypivka and Katrusya Odeska, which farmers are currently planting. Importantly, we have identified the aforementioned varieties bred in Poltava that carry the *CBF-A3* cold stress gene. They should be incorporated into the breeding program to enhance resistance not only to winter frosts but also to spring frosts.

Keywords: winter wheat, yield, frosts in April, resistance, *CBF-A3* cold stress gene.

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