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EFFECT OF ECOLOGICAL FACTORS ON THE GENERATIVE DEVELOPMENT OF WINTER WHEAT VARIETIES

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Abstract
This article presents data on the influence of environmental factors on the generative development stages of winter wheat in the agrocenoses of the Khorezm region, Republic of Uzbekistan.
The study primarily analyzes the impact of ecological factors particularly temperature on the biological and physiological condition of winter wheat, as well as the crop’s adaptation processes to climatic conditions. The analysis of these data significantly contributes to understanding the ecological potential of winter wheat agrocenoses under the conditions of the Khorezm region.
Furthermore, the results of the study provide a scientific basis for increasing future crop yields of winter wheat and offer practical recommendations for agronomists, farmers, and agricultural specialists. These recommendations aim to enhance productivity based on essential information about climatic factors.

Keywords: environmental factors, winter wheat, climate, temperature, heat stress, maximum, minimum, vegetation period, agrocenosis.

Introduction

Climate change, rising temperatures, and increasing desertification are among the major ecological issues that are exerting a growing negative impact on the productivity of agricultural crops worldwide. In recent years, global climate change has had particularly adverse effects on wheat yields. Heat stress has become one of the most significant environmental factors affecting both the yield and quality of wheat grain.
In the Republic of Uzbekistan, particularly in the Khorezm region, high temperatures are observed during the heading and ripening stages of winter wheat's vegetation period.
Given this context, analyzing the current ecological state of winter wheat agrocenoses, studying weather conditions and the dynamics of climate change, and investigating the characteristics of ecological factors affecting crop growth, development, and yield formation are of great

scientific and practical importance.To this end, the ecological characteristics of agrocenoses in the Khorezm region were studied, with particular focus on the influence of environmental factors on the generative development stages of winter wheat varieties sown at different planting times.

Materials and Methods

The research was conducted between 2020 and 2023 at the experimental farm of Urgench State University, located in the Urgench district.

The study examined the effects of abiotic and anthropogenic factors on the generative development stages of the winter wheat varieties Zimnitsa, Asr, and Gurt under the climatic conditions of the Khorezm region.To ensure efficient use of soil moisture, the seeds of these winter wheat varieties were sown on fields vacated by early-maturing rice varieties on three different dates: October 1, October 10, and October 20.

Ecological monitoring methods such as observation, comparison, and analysis were employed in the experiments. Soil salinity was determined using a conductometer. Irrigation was regulated based on a percentage of the field's moisture capacity, and the volume of water supplied to the field was measured using a Chipoletti weir. Temperature data were obtained from the NASA POWER satellite system [9]. Biometric indicators of plant development, field experiments, and phenological observations were assessed in accordance with the guidelines outlined in “Methods for Conducting Field Experiments” (UzPITI, 2007) [8].

Results and Discussion

It is well known that the thermal requirements of wheat change throughout its development. For winter wheat, the optimal temperature is approximately +16°C during the heading stage, +23°C during flowering, and +26°C during the ripening period [1].

During the study years (2020-2023), the heading and flowering phases of winter wheat typically occurred at the end of April. A temperature range of +18 to +20°C during these stages was found to be sufficient for optimal development [2].

In the heading and flowering phases of winter wheat, the minimum temperature recorded in April 2022 was +6.99°C, which was notably higher compared to other study years. Meanwhile, the dynamics of maximum temperature variation ranged from +29.06°C to +36.98°C during the study period. The highest recorded maximum temperature was observed in 2021 (see Table 1).

Table 1.Temperature Variation Dynamics During the Vegetation Period of Winter Wheat, °C (2020–2023)

Years	Vegetation Period (Months)					
	March		April		May	
	Max. temperature °C	Min. temperature °C	Max. temperature °C	Min. temperature °C	Max. temperature °C	Min. temperature °C
2020	26,7	- 6,32	32,1	-2,03	42,76	11,93
2021	21,78	- 14,16	36,98	-3,68	44,4	10,38
2022	17,93	-4,85	29,06	6,99	34,52	10,51
2023	29,72	-1,48	36,35	0,18	37,0	9,44

According to the data, high temperatures influence morphological, physiological, and molecular responses of winter wheat during both vegetative and reproductive phases [3].

Air temperatures exceeding +32°C have a significant impact on the reproductive organs [4].

In the vegetation cycle of winter wheat, ripening is the final stage. This period lasts from May until the first ten days of June, depending on the sowing dates.

Research shows that the optimal temperature during grain ripening is +26°C. When the temperature exceeds this optimal level by +4°C, wheat yield may decrease by 10–50% [1].

Heat stress caused by elevated temperatures adversely affects spike length, the number of spikelets, the weight of 1000 grains, as well as the external appearance, size, and quality of the grain in winter wheat [5;6].

During the study period (2020–2023), elevated temperatures were observed during the ripening stage of winter wheat. The maximum temperature fluctuations ranged from approximately +34.52°C to +44.4°C. The highest temperature was recorded in 2021, reaching +44.4°C (see Table 1).

High temperatures, particularly during the heading, flowering, and ripening stages, negatively affect photosynthetic parameters, the viability of pollen grains, and reduce both the number and weight of grains in the spike.

Specifically, temperatures exceeding +32°C can reduce the grain weight of wheat by up to 20% [7].

The research results indicate that delayed sowing dates accelerate the phenological development stages of winter wheat, particularly the reproductive phases (heading, flowering, and ripening). This process is primarily associated with increased temperatures, which lead to a reduction in the overall duration of the vegetation period.

Winter wheat varieties sown on October 1 experienced relatively favorable agroclimatic conditions, resulting in stable progression through the reproductive stages. However, samples sown on October 10 and especially October 20 were exposed to higher temperatures, which accelerated their developmental processes. In particular, the heading and flowering stages of winter wheat sown on October 20 were notably shortened, leading to an expedited ripening period.

Specifically, during the period from 2020 to 2023, the vegetation period of the Zimnitsa variety lasted 245-248 days when sown on October 1, 237-242 days when sown on October 10, and 228-232 days when sown on October 20.

For the Asr variety, the vegetation period lasted 247-248 days when sown on October 1, 239-243 days when sown on October 10, and 230–233 days when sown on October 20.

For the Gurt variety, the vegetation period lasted 248-250 days when sown on October 1, 240-243 days when sown on October 10, and 232-234 days when sown on October 20.

Under the conditions of Khorezm region, elevated temperatures influence the generative phases of winter wheat, leading to their acceleration. Consequently, this also results in a shortened overall vegetation period for winter wheat.

Conclusion. Based on the above results, it can be concluded that under the climatic conditions of the Khorezm region, October 1 is the optimal sowing date for the Zimnitsa, Asr, and Gurt varieties of winter wheat.

When winter wheat varieties are sown on October 10 or 20, elevated temperatures during the heading and ripening stages accelerate the plant's development due to a shortened vegetation period. As a result, the grain does not have sufficient time to fully develop, leading to reduced yield and quality indicators.

Based on the research results, it can be stated that selecting sowing dates in an ecologically appropriate manner is a crucial factor in improving the condition of agrocenoses and minimizing the negative impact of environmental factors on crops.

Overall, the findings of this study make a significant contribution to understanding agrocenoses and their ecological conditions in the Khorezm region. Implementing these research results in practice can enhance the potential for obtaining high-quality and increased crop yields in the future.

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