

Abstract of Contents

The impact of climate change on wheat production in Kazakhstan's diverse soil regions

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Wheat plays a key role in human diet. Flour is obtained from its grains, which is used for the production of bread, pastries and pasta. Moreover, it is valued as a source of vitamins, antioxidants, and fiber that strengthen the immune system and normalize metabolism of humans. Kazakhstan, the ninth largest country, is located in the center of the Eurasian continent. One of the main products produced in Kazakhstan is spring wheat (*Triticum spp.*). Kazakhstan occupies a large territory, therefore it includes different climatic zones. For this reason, climatic conditions and soil characteristics vary throughout the country, which may have different effects on spring wheat production.

This study is aimed to evaluate the influence of soil and climate in three major wheat-producing regions of Kazakhstan (Akmola, Kostanay, North Kazakhstan) on the yield of spring wheat, and identifying trends and relationships between these factors and the amount of spring wheat harvest, namely in the period from 2015 to 2025. Various reliable sources, both international and local, were used to collect data within the framework of the study, such as Kazhydromet, the official national hydrometeorological service, National Bureau of Statistics of Kazakhstan, Food and Agriculture Organization of The United Nations (FAOSTAT) database, United States Department of Agriculture (USDA), and United Nations Environment Program (UNEP), Google Scholar, ResearchGate, and ScienceDirect. Data on the area used for growing wheat, and the yield, was processed using Excel to calculate averages, standard deviation, and create graphs and tables. Meteorological data includes the average, minimum, and maximum values of air and soil temperatures, as well as the amount of precipitation. They were processed using the SPSS program.

The results showed that the largest area dedicated to wheat cultivation belongs to the Akmola region, while the smallest belongs to the North Kazakhstan region. Despite this, the North Kazakhstan area stands out for the highest yield throughout the 10 studied years, while Akmola occupies the last position in this comparison. In general, in all three regions, the area allocated for wheat production remains stable, which proves the importance of wheat for Kazakhstan's agriculture. April, May, and August are the most variable during the growing season and are the months that determine the wheat harvest. Low temperatures in April, high temperatures in May and August, and insufficient rainfall were the main reasons for lower yields. Regarding the soil condition, chernozem prevails in all three regions, however, in the North Kazakhstan region, chernozems are distinguished by higher humus content and moisture storage capacity. These characteristics of chernozem soils can help during the dry periods of the growing season.

In conclusion, Akmola, Kostanay, and North Kazakhstan regions have similar climatic features regarding air and soil temperature, but Akmola is characterized by relatively greater variability. Kostanay gets the least amount of precipitation. Dry periods are one of the main factors limiting wheat production. The North Kazakhstan region, on the other hand, is characterized by a relatively higher amount of precipitation and a more moisture-storing soil, so this region shows significantly better results.

Moreover, in future studies, it is definitely worth considering the impact of monocultural wheat production on soil conditions, more detailed meteorological data, especially snow cover, and a more detailed chronology of spring wheat production in Kazakhstan.