



WATER BALANCE OF THE WINTER WHEAT EXPERIMENTAL FIELD

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Abstract

This article examines the water balance of an experimental field where winter wheat is cultivated under the conditions of irrigated agriculture in Uzbekistan. Throughout the research, key indicators such as precipitation, irrigation water, soil moisture reserves, evaporation, and water consumption by plants are analyzed. Particular attention is paid to determining the water requirements of winter wheat, establishing irrigation rates and schedules, and improving water use efficiency. The results obtained serve as a scientific and practical basis for optimizing the irrigation regime, conserving water resources, and achieving high and sustainable crop yields.

Keywords: Winter wheat, water balance, soil moisture, irrigation, water consumption, evaporation, experimental field.

Introduction. Winter wheat is one of the main grain crops grown under the conditions of irrigated agriculture in Uzbekistan. Its growth, development, and yield depend largely on the amount of water in the soil and the efficiency of water use. Particularly in irrigated lands, studying the soil water balance during winter wheat cultivation is highly important for determining the crop's water requirements and properly establishing irrigation rates.

By studying the water balance in the experimental field, key indicators such as precipitation, irrigation water, soil moisture reserves, evaporation, and the amount of water consumed by plants are evaluated. Determining these indicators allows for assessing the water security level of winter wheat and utilizing water resources effectively. Therefore, studying the water balance of the winter wheat experimental field is crucial for optimizing the irrigation regime, conserving water, and developing the scientific basis for achieving high and sustainable yields.

The total water consumption for agricultural crops grown on saline lands was 30–45% higher compared to crops grown on non-saline lands due to leaching. Additionally, on saline lands, groundwater is located close to the soil surface and continuously affects the soil aeration zone. Studying and managing the water balance of crop areas cultivated under such land-reclamation conditions is an important task.

Research Object and Methods.

To conduct a scientific study on the urgent issue mentioned above, field experiments were carried out on meadow-ish, moderately and strongly saline light-colored gray soils (calcic xerosols / light serozem) in the Syrdarya region.

In studying the water balance of moderately and strongly saline areas where winter wheat was cultivated, the input component of the balance was accounted for throughout the season (months X–VI) by atmospheric precipitation, leaching, water volumes applied during the growing season, and water lost to filtration from irrigation networks within the balance

area boundary. The output component of the balance was evaluated based on the seasonal evapotranspiration of the winter wheat field and drainage outflow.

Research Results and Discussion.

The results of studying the water balance of moderately and strongly saline winter wheat fields are presented in Table 1. As the data in this table show, compared to the total input component of the balance, the share of atmospheric precipitation was 21–30% in the moderately saline field, and water filtered from irrigation networks accounted for 9–11%. These indicators amounted to 19–32% and 10–13%, respectively, in the strongly saline field.

In both experimental fields, the main part of the balance was constituted by water applied during the leaching and growing periods. This indicator was 61–68% in the moderately saline field and 71–72% in the strongly saline field.

In the output part of the water balance, 92% consisted of water consumed by evapotranspiration from the crop area, while the remaining 8% was accounted for by drainage outflows.

Table 1

Water Balance of the Experimental Field Cultivated with Winter Wheat (3-year average)

Variant No.	Input Component						Output Component				Total Overview		
	Pr		Ir		Fnet		E0+T		Dr		Input	Output	Diff
	m ³ /ha		m ³ /ha		m ³ /ha		m ³ /ha		m ³ /ha				
Moderately Saline													
1	2180	30.0	4527	61.0	668	9.0	7510	92.0	404	5.4	7375	7914	-539
2	2180	21.0	7250	68.0	1194	11.0	7510	92.0	634	8.0	10624	8144	+2870
Strongly Saline													
1	2180	32.0	4820	71.0	706	10.0	7510	92.0	500	6.7	7706	8010	-304
2	2180	19.0	8205	72.0	1399	13.0	7510	92.0	694	8.0	11784	8204	+3580

**Note: Pr – atmospheric precipitation, Ir – seasonal irrigation rate, Fnet – water lost to filtration from irrigation networks, E0+T – evapotranspiration, Dr – drainage water flow.*

The total input component of the water balance of the winter wheat field was 7375 m³/ha in variant 1 of the moderately saline field, 10624 m³/ha in variant 2, 7706 m³/ha in variant 1 of the strongly saline field, and 11784 m³/ha in variant 2. The total output component of the balance was 8144 m³/ha in variant 1 and 8204 m³/ha in variant 2.

At both levels of soil salinity, a "negative" water balance (the input part is less than the output part) was observed in the unleached variant 1. In this case, there is no risk of soil waterlogging or bogging, but it was observed that most of the salts within the soil structure were retained. In variant 2, a "positive" water balance (the input part is greater than the output part) occurred, which increases the risk of soil waterlogging or bogging, creating an ongoing positive water balance. This situation in variant 2 occurred due to the water rate spent on leaching. Since leaching activities mostly take place during the autumn-winter months, excess

soil moisture is regulated through drainage systems. When a "negative" water balance occurs during the crop growing season in variant 1 of the experiment, secondary soil salinization takes place.

Conclusions:

The input part of the water balance of the moderately and strongly saline experimental fields planted with winter wheat is formed mainly due to water applied for leaching and winter wheat irrigation, accounting for 61–68% in the moderately saline field and 71–72% in the strongly saline field; evapotranspiration made up the total output component of the balance.

At both soil salinity levels of the experiment, it was determined that a "negative" water balance occurs in the unleached variant 1 (the input component of the balance is less than the output component), and a "positive" water balance occurs in the leached variant 2 (the input component is greater than the output component).

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