

UDK: 631.4:633.1+631.6

**INFLUENCE OF IRRIGATION METHODS AND REGIMES ON THE  
WATER PERMEABILITY OF SOIL FOR WINTER WHEAT VARIETIES UNDER  
TYPICAL GRAY SOIL CONDITIONS.**

<https://doi.org/10.5281/zenodo.20754749>

**A.X.Rakhimov**

*Doctor of Agricultural Sciences, Associate Professor (TSAU).*

**M.Shodmanov**

*Docent (TSAU)*

**I.I.Kamolov**

*student (TSAU)*

**O.T.Xudayberdiyev**

*student (TSAU)*

**Abstract**

The article presents data on the influence of irrigation regimes and methods for winter wheat varieties Davr and Vekha on soil water permeability under the conditions of typical gray soils of the Fergana region, which are subject to irrigation erosion (with a slope of 1.5°).

**Key words**

Typical gray soils, irrigation erosion, winter wheat, Davr and Vekha varieties, irrigation regime, furrow irrigation, flexible pipeline, irrigation methods, soil water permeability.

**ВЛИЯНИЕ СПОСОБОВ И РЕЖИМОВ ОРОШЕНИЯ СОРТОВ  
ОЗИМОЙ ПШЕНИЦЫ НА ВОДОПРОНИЦАЕМОСТЬ ПОЧВЫ В  
УСЛОВИЯХ ТИПИЧНЫХ СЕРОЗЕМОВ**

**А.Х.Рахимов**

*д.с.х.н, доцент Ташкентского государственного аграрного университета  
(ТДАУ)*

**М.Шодманов**

*доцент (ТДАУ)*

**И.И.Камолов**

*студент (ТДАУ)*

**О.Т.Худойбердиев**

*студент (ТДАУ)*

### **Аннотация**

В статье приведены данные о влиянии режимов и способов орошения сортов озимой пшеницы Давр и Веха на водопроницаемость почвы в условиях типичных сероземов Ферганской области, подверженных ирригационной эрозии (с уклоном 1,5°).

### **Ключевые слова**

Типичные сероземы, ирригационная эрозия, озимая пшеница, сорта Давр и Веха, режим орошения, полив по бороздам, гибкий трубопровод, способы орошения, водопроницаемость почвы.

**1 Introduction.** According to the United Nations data, wheat is cultivated on more than 219.2 million hectares in over 126 countries worldwide, of which 24.2 million hectares are in European countries. In 2022, the average grain yield worldwide was 36.9 centners per hectare, while in European countries this figure reached 55.5 centners per hectare, and the majority of food products are grown on these areas. Currently, China, India, Russia, the USA, Canada, France, Pakistan, Ukraine, Germany, and Turkey are the leading countries in wheat production<sup>87</sup>. In the context of global climate change, the efficient use of available water resources and the application of water-saving technologies in producing high and quality grain yields from winter wheat is one of the most pressing tasks.

In accordance with the tasks set out in Decree No. PF-5853 of the President of the Republic of Uzbekistan dated October 23, 2019, "On Approval of the Strategy for the Development of Agriculture of the Republic of Uzbekistan for 2020-2030,"<sup>88</sup> a number of measures are being implemented to increase the productivity of agricultural crops and soil fertility, to ensure efficient use of land, water, fertilizers, and other resources, and to introduce advanced agricultural technologies.

Today, in the agricultural technology system for cultivating crops in our republic, high results are being achieved through the use of water- and resource-saving technologies in irrigation and the application of local and mineral fertilizers. In particular, in recent years, irrigation methods such as drip irrigation, sprinkling, inter-row mulching with polyethylene film, and the distribution of irrigation water to furrows through flexible pipes have created opportunities for water conservation. In this regard, it is appropriate to expand the scope of scientific research on irrigating cereal grain crops using flexible pipes to distribute irrigation

<sup>87</sup> [https://ru.wikipedia.org/wiki/"List of countries producing wheat"](https://ru.wikipedia.org/wiki/List_of_countries_producing_wheat)

<sup>2</sup> "Decree of the President of the Republic of Uzbekistan No. PF-5853 dated October 23, 2019 'On Approval of the Strategy for the Development of Agriculture of the Republic of Uzbekistan for 2020–2030'"

water into furrows, as part of the efficient use of available water resources in our republic.

## 2 Materials and Methods.

With the aim of partially addressing the above-mentioned scientific issues, scientific research on developing irrigation regimes for the winter wheat varieties Davr and Vekha was carried out during 2021–2024 in the Gulshan Yangi Bog' area of the Fergana district, Fergana region, under conditions of typical serozem soils subject to irrigation erosion. The slope of the field is 1.5°, and the groundwater level is at a depth of 8–10 meters. The experiment consisted of 8 variants, arranged in 4 replications and 1 tier. Each plot is 100 m long and 4.8 m wide. Each variant consists of 8 rows, with a total area of 480 m<sup>2</sup>, and the calculated area is 240 m<sup>2</sup>. Field experiments were conducted according to the methods described in "Methods of Conducting Field Experiments" [1] and "Methods of Agrochemical, Agrophysical, and Microbiological Research in Irrigated Cotton-Growing Regions" [2; p. 124]. The experimental design is presented in Table 1.

It is known that the amount of water-stable soil aggregates (water-resistant macroaggregates) does not exceed 20%. Typical serozems (gray soils) are characterized by high water permeability. During soil tillage, the soil aggregates are not very stable; therefore, when wetted, they often disintegrate and wash away, and after drying through evaporation, they form a hard crust. As a result, soil compaction occurs. Water permeability decreases, and bulk density, especially in the 0–30 cm layer, exceeds the standard. Water permeability is more sensitive than other physical properties of the soil and varies across different layers. However, this variation is not of significant practical importance.

**Table 1**  
**Experimental design**

Variant number	Winter wheat variety	Irrigation method	Pre-irrigation soil moisture, % of LFMC
1	Davr	Furrow irrigation	60-70-60
2		<b>Flexible pipe</b>	
3		Furrow irrigation	70-75-70
4		<b>Flexible pipe</b>	
5	Vekha	Furrow irrigation	60-70-60
6		<b>Flexible pipe</b>	
7		Furrow irrigation	70-75-70
8		<b>Flexible pipe</b>	

According to D. Crevoisier, Z. Popova, J. Mailhol, P. Cand Ruelle [3; Pp. 354–366], J. Kim, J. Diao, M.W. Shepherd et al. [4; Pp. 1302–1307], soil aggregation and water permeability are closely interrelated. During crop irrigation, the interaction of water with aggregated soils reduces the resistance of clods to water. This, in turn, leads to a decrease in aggregation compared to the beginning of the growing season and a deterioration in water permeability. The soil becomes compacted, and the infiltration of rainfall and irrigation water decreases. However, the water-holding capacity of the soil increases, and evaporation from the soil surface intensifies.

According to S.O. Khusanov [5; P. 186], on meadow soils of the Andijan region, when winter wheat was irrigated at regimes of 70-70-70, 75-75-75, and 80-80-80% of field capacity, a decrease in soil water permeability was observed at the end of the season compared to the beginning. Specifically, in the 0–50, 0–70, and 0–100 cm layers, water permeability decreased by 140.5, 133.9, and 123.5 m<sup>3</sup>/ha, respectively, depending on the irrigation regime.

### 3 Results and Discussion

Based on the scientific results obtained in 2021 from our research, before sowing the winter wheat varieties (at the beginning of the season), the soil water permeability was 201 m<sup>3</sup>/ha in the first hour; in the second, third, fourth, fifth, and sixth hours, it was 169, 106, 77, 65, and 59 m<sup>3</sup>/ha, respectively. The total over 6 hours was 677 m<sup>3</sup>/ha, with an average of 112.8 m<sup>3</sup>/ha per hour (Figure 1).

By the end of the season, a significant influence of irrigation regimes and methods on soil water permeability was observed. At the end of the season, in variant 1, where the winter wheat variety Davr was irrigated by furrows at a regime of 60-70-60% of field capacity, water permeability over 6 hours was 615 m<sup>3</sup>/ha, with an average of 102.5 m<sup>3</sup>/ha per hour. Compared to the beginning of the season,

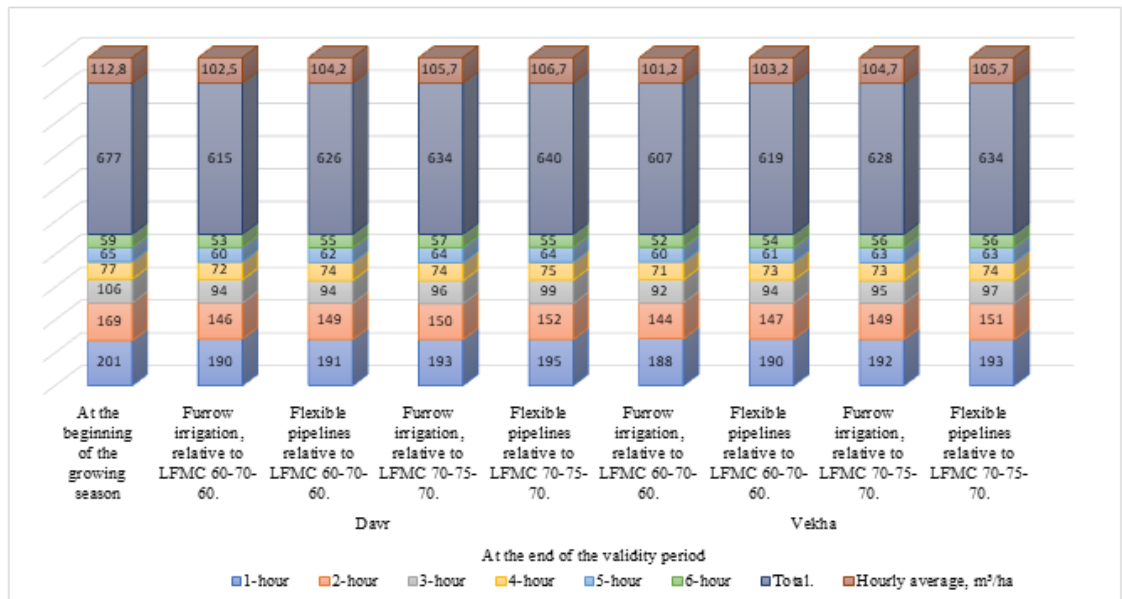


Figure 1. Influence of irrigation methods and regimes of winter wheat varieties on soil water permeability, m³/ha (2021–2022)

soil water permeability decreased by 62 m³/ha over 6 hours and by 10.3 m³/ha per hour. In contrast, for the same variety with the same irrigation regime but irrigated using flexible pipes instead of furrows (variant 2), soil water permeability over 6 hours was 625 m³/ha, and the average per hour was 104.2 m³/ha. Compared to the beginning of the season, this represented a decrease of 52 m³/ha over 6 hours and 8.6 m³/ha per hour. Thus, it was determined that by using flexible pipes for irrigation, the water permeability was 10 m³/ha higher over 6 hours and 1.7 m³/ha higher per hour compared to variant 1.

In the studies, for the Davr variety of winter wheat irrigated by furrows at a pre-irrigation soil moisture regime of 70-75-70% of field capacity (variant 3), the soil water permeability decreased by 43 m³/ha over 6 hours and by 7.3 m³/ha per hour compared to the beginning of the season. Comparing these data with variant 1, it was found that soil water permeability was higher by 19 m³/ha over 6 hours and by 3.2 m³/ha per hour.

For the Vekha variety of winter wheat, in variants 5 and 6, irrigated at a pre-irrigation soil moisture regime of 60-70-60% of field capacity using furrows and flexible pipes, respectively, the soil water permeability at the end of the season was 607 m³/ha and 619 m³/ha over 6 hours, and 101.2 m³/ha and 103.2 m³/ha per hour, respectively. Comparing these indicators with variants 1 and 2 (where Davr was grown), it was found that at the end of the season, soil water permeability was lower by 8 m³/ha and 7 m³/ha over 6 hours, and by 1.3 m³/ha and 1.0 m³/ha per hour, respectively.

In our research, relatively optimal indicators were observed in variant 4, where the Davr variety of winter wheat was irrigated using flexible pipes at a pre-irrigation soil moisture regime of 70-75-70% of field capacity. At the end of the season, soil water permeability was 640 m<sup>3</sup>/ha over 6 hours and 106.7 m<sup>3</sup>/ha per hour, which was found to be higher than in variant 3 by 6 m<sup>3</sup>/ha and 1.0 m<sup>3</sup>/ha, respectively.

The patterns noted above were also observed in the scientific data obtained in 2022 and 2023.

#### **4 Conclusion**

In conclusion, under conditions of typical gray soils subject to irrigation erosion, irrigating the Davr and Vekha varieties of winter wheat using flexible pipes at a pre-irrigation soil moisture regime of 70-75-70% of field capacity has a positive effect on soil water permeability.

#### **REFERENCES:**

1. "Methods of Conducting Field Experiments" – Tashkent. 2007. P. 180.
2. Methods of Agrochemical, Agrophysical, and Microbiological Research in Irrigated Cotton-Growing Regions. 3rd ed. Tashkent. 1963. P. 124.
3. Crevoisier D., Popova Z., Mailhol J., Cand Ruelle P. "Assessment and simulation of water and nitrogen transfer under furrow irrigation," *Agricultural Water Management*. 2008. Vol. 95, no. 4. Pp. 354–366.
4. Kim J., Diao J., Shepherd M.W., Jr., Singh R., Heringa S.D. Validating thermal inactivation of *Salmonella* spp. in fresh and aged chicken litter. *Appl. Environ. Microbiol.* 2012. Vol. 78. Pp. 1302–1307.
5. Khusanov S.O. Study of the irrigation regime for new varieties of winter wheat and replanted soybeans on meadow soils of the Andijan region. Doctor of Philosophy (PhD) dissertation in Agricultural Sciences. Tashkent, 2021. 186 p.