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DYNAMICS OF SOIL MOISTURE RESERVES AND SOIL WATER PERMEABILITY IN AREAS SUBJECT TO IRRIGATION EROSION

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Abstract. This article presents information on changes in soil moisture reserves and soil water permeability during the growing season of cotton irrigated through furrows with a slight transverse slope (0.25°) in areas affected by irrigation erosion on typical sierozem (gray) soils of the Tashkent region.

Keywords: soil, irrigation erosion, irrigation, soil moisture reserves, watering, water permeability, furrow, slope, transverse slope, beginning and end of the growing season.

Introduction

World cotton-growing experience has established that the efficient use of water, protection of soil from erosion, and preservation of the fertile soil layer make it possible to increase raw cotton yield by 8–10 centners per hectare. In this regard, there is an urgent need to apply intensive methods in the field of agricultural production and to improve modern agrotechnologies for the efficient use of land and water resources under conditions of water scarcity and deteriorating land reclamation status caused by irrigation erosion.

According to data from K.M. Mirzajanov and Sh.N. Nurmatov (1994), irrigation erosion affects the formation of fertility elements in sierozem soils. In particular, as the degree of soil washout increases, the amount and reserves of humus and nutrients decrease, the pH index rises, and the mechanical structure becomes heavier. If the average annual layer of soil washed away during irrigation of cultivated areas is 1 cm, with a bulk density of this layer of 1.0–1.2 g/cm³, then it turns out that 100–120 tons of soil particles are washed away from one hectare of land. Analysis of the washed-out material showed that 800–1000 kg of humus, 80–100 kg of nitrogen, a similar amount of phosphorus, and 100–120 kg of potassium and other macro- and micronutrients are washed away from one hectare of land.

According to data from G.M. Makhsudov and L.A. Gofurova, 77.3% of the Republic's territory falls on areas with a slope of up to 1°. Such areas include plains and deserts in river oases, which do not pose a threat of water erosion. Areas with a slope of 1–3° account for 7.6%, and these areas are subject to irrigation erosion. Areas with a slope of up to 10° account for 6.5%, and moderate to severe water erosion risk is expected on these areas.

Among the types of erosion listed, wind erosion and irrigation erosion cause the most serious damage to agriculture.

Materials and Methods of Research

Research work was carried out under field and laboratory conditions, with all observations, measurements, and analyses of soil particle washout and nutrient content conducted on the basis of the methodological guidelines *"Methods of Agrochemical, Agrophysical and Microbiological Research in Irrigated Cotton-Growing Areas"* and *"Methods of Agrophysical Research"* (1973). Mathematical analysis of the obtained data was carried out using the Microsoft Excel computer program, applying the analysis-of-variance method of B.A. Dospekhov.

The experiment used the medium-fiber cotton variety "Sultan." The experiment consisted of 8 variants, replicated three times, arranged in a single tier. Each variant consisted of 8 rows; measurements were taken in the middle 4 rows, while the two outer rows served as buffer/protective rows.

At the beginning of the cotton growing season, the soil moisture reserve was 16.6% in the 0–50 cm layer, 17.0% in the 0–70 cm layer, 17.6% in the 0–100 cm layer, and 18.7% in the 0–200 cm layer. By the end of the growing season, in the control (variant 1), where irrigation was carried out using traditional furrows with a slope of 2.5°, the soil moisture reserve, compared to the beginning of the growing season, decreased by 6.0% in the 0–50 cm layer, by 5.6% in the 0–70 cm layer, by 5.0% in the 0–100 cm layer, and by 4.0% in the 0–200 cm layer.

In the studied variants with a smaller transverse slope (0.25°, 0.50°, 0.75°, 1.00°), the soil moisture reserve, compared to the control variant, was higher by 0.3–2.1% in the 0–50 cm layer, by 1.3–1.7% in the 0–70 cm layer, by 0.2–1.3% in the 0–100 cm layer, and by 0.4–1.3% in the 0–200 cm layer. The highest soil moisture reserve values were observed in variant 3, where irrigation was carried out through furrows with the smallest transverse slope (0.25°).

The study also determined changes in soil water permeability. At the beginning of the growing season, soil water permeability over 6 hours was found to be 830.5 m^3/ha. By the end of the growing season, in the control variant with irrigation through traditional furrows with a 2.5° slope, water permeability decreased by 186 m^3/ha compared to the beginning of the growing season, while in the variants with a smaller transverse slope (0.25°, 0.50°, 0.75°, 1.00°) it decreased by 35.9, 22.6, 16.9, and 12.8 m^3/ha, respectively. The highest soil water permeability indicator was obtained with irrigation through furrows with the smallest transverse slope of 0.25°.

Conclusion

Under conditions of long-irrigated typical sierozem soils of the Tashkent region subject to irrigation erosion, the highest indicators for preserving soil moisture reserves and soil water permeability are achieved when cotton is irrigated through furrows with a smaller transverse slope of 0.25°.

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