

WATER CONSUMPTION INDICATORS OF FORAGE CROPS PER UNIT OF HAY YIELD UNDER DIFFERENT IRRIGATION REGIMES

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Abstract

This article presents data on the amount of water used to produce 1 centner (c) of hay from sorghum, Sudan grass and African millet under different irrigation regimes. The study was carried out on saline soils of the Republic of Karakalpakstan.

Keywords: Republic of Karakalpakstan, saline soils, forage crops, sorghum, Sudan grass, African millet, 1 c of hay yield, amount of water used.

Introduction

The world population is expected to grow rapidly, and water scarcity is becoming more serious. In this situation, food security has become a global problem. The only solution is to produce more food and to increase the production of dairy and meat products, so this issue is especially important. Today, different levels of salinity affect 160 million hectares of cropland in the world, and every year 1.5 million hectares of land become unsuitable for agriculture. Because of drought and climate change, livestock do not have enough fodder, and the prices of meat and meat products on the world market are rising sharply.

In the Republic of Karakalpakstan, scientific research is needed to support livestock farms. This research should focus on agrotechnical measures that enrich the soil with organic matter, improve its reclamation condition and reduce salinity. It should also cover the cultivation of forage crops and the development of irrigation agrotechnology for these crops in order to obtain a high green mass yield. In this way, the nutritious fodder base of livestock production can be strengthened, and the population can be supplied with affordable meat and meat products.

At the Akkavak station of the Cotton Research Institute, the agrotechnology of sowing Sudan grass together with alfalfa was studied in 1973–1975. The crops were sown on 3 April in narrow rows with a grain-grass seeder. The seeding rate was 16 kg/ha for Sudan grass and 24 kg/ha for alfalfa. The researchers studied the development of the root system of both components and determined the accumulation of organic matter in the soil. In the first year of the experiment, the best variants had 23.51 c/ha of stubble residues and 84.54 c/ha of root residues. The root residues included 74.59 c/ha of Sudan grass roots and 9.40 c/ha of alfalfa roots. In the second and third years, only alfalfa roots remained, so the total values decreased [1, pp. 1–58; 2, pp. 32–35; 3, pp. 49–51; 4, pp. 39–44].



Research methods

The field experiments included studies of the agrophysical and agrochemical properties of the soil and phenological observations of the plants. These studies followed the manuals "Methods of Conducting Field Experiments" of the Uzbek Cotton Research Institute and "Methods of Agrophysical, Agrochemical and Microbiological Studies in Irrigated Cotton-Growing Regions". The variation-statistical analysis of the data was carried out according to B. A. Dospekhov's "Methodology of Field Experiment".

Research results

This article presents data on the water used to produce 1 c of hay from sorghum, Sudan grass and African millet under different irrigation regimes. The study was carried out on saline soils of the Republic of Karakalpakstan. The data are given as seasonal and total irrigation norms, and as the hay yield obtained per 1 m³ of irrigation water. In the irrigation regimes below, the three numbers show the pre-irrigation soil moisture (as a percentage of field capacity, FC) in the three main growth periods. In all variants, seasonal water use is the irrigation water applied during the growing season, and total water use is the total water consumption.

Results for 2023 In variant 1 (sorghum), irrigation was applied at a pre-irrigation soil moisture of 65-65-60% of FC. The seasonal irrigation norm was 2,393.6 m³/ha, and the total water consumption was 5,434.4 m³/ha. To produce 1 c of hay, 9.5 m³ of seasonal irrigation water and 21.5 m³ of total water were used. The hay yield per 1 m³ of total irrigation water was 0.47 kg. In variant 2 (sorghum), irrigation was applied at a pre-irrigation soil moisture of 70-70-60% of FC. The seasonal irrigation norm was 2,514.9 m³/ha, and the total water consumption was 5,346.8 m³/ha. To produce 1 c of hay, 9.6 m³ of seasonal irrigation water and 20.5 m³ of total water were used. The hay yield per 1 m³ of total irrigation water was 0.49 kg. In variant 3 (sorghum), irrigation was applied at a pre-irrigation soil moisture of 75-75-65% of FC. The seasonal irrigation norm was 2,575.0 m³/ha, and the total water consumption was 5,271.1 m³/ha. To produce 1 c of hay, 9.5 m³ of seasonal irrigation water and 19.4 m³ of total water were used. The hay yield per 1 m³ of total irrigation water was 0.51 kg. In variant 4 (Sudan grass), irrigation was applied at a pre-irrigation soil moisture of 65-65-60% of FC. The seasonal irrigation norm was 2,177.5 m³/ha, and the total water consumption was 5,238.7 m³/ha. To produce 1 c of hay, 8.8 m³ of seasonal irrigation water and 21.1 m³ of total water were used. The hay yield per 1 m³ of total irrigation water was 0.47 kg. In variant 5 (Sudan grass), irrigation was applied at a pre-irrigation soil moisture of 70-70-60% of FC. The seasonal irrigation norm was 2,498.5 m³/ha, and the total water consumption was 5,402.0 m³/ha. To produce 1 c of hay, 9.9 m³ of seasonal irrigation water and 21.5 m³ of total water were used. The hay yield per 1 m³ of total irrigation water was 0.46 kg. In variant 6 (Sudan grass), irrigation was applied at a pre-irrigation soil moisture of 75-75-65% of FC. The seasonal irrigation norm was 2,629.5 m³/ha, and the total water consumption was 5,339.8 m³/ha. To produce 1 c of hay, 10.1 m³ of seasonal irrigation water and 20.5 m³ of total water were used. The hay yield per 1 m³ of total irrigation water was 0.49 kg. In variant 7 (African millet), irrigation was applied at a pre-irrigation soil moisture of 65-65-60% of FC. The seasonal irrigation norm was 2,218.9 m³/ha, and the total water consumption was 5,347.0 m³/ha. To produce 1 c of hay, 9.6 m³ of seasonal irrigation water and 23.1 m³ of total water were used. The hay yield per 1 m³ of total irrigation water was 0.43 kg. In variant 8 (African millet), irrigation was applied at a pre-irrigation



soil moisture of 70-70-60% of FC. The seasonal irrigation norm was 2,526.8 m³/ha, and the total water consumption was 5,497.5 m³/ha. To produce 1 c of hay, 10.5 m³ of seasonal irrigation water and 22.8 m³ of total water were used. The hay yield per 1 m³ of total irrigation water was 0.44 kg. In variant 9 (African millet), irrigation was applied at a pre-irrigation soil moisture of 75-75-65% of FC. The seasonal irrigation norm was 2,676.2 m³/ha, and the total water consumption was 5,467.6 m³/ha. To produce 1 c of hay, 10.7 m³ of seasonal irrigation water and 21.9 m³ of total water were used. The hay yield per 1 m³ of total irrigation water was 0.46 kg.

Results for 2024 In variant 1 (sorghum), irrigation was applied at a pre-irrigation soil moisture of 65-65-60% of FC. The seasonal irrigation norm was 2,173.1 m³/ha, and the total water consumption was 4,911.3 m³/ha. To produce 1 c of hay, 8.7 m³ of seasonal irrigation water and 19.7 m³ of total water were used. The hay yield per 1 m³ of total irrigation water was 0.50 kg. In variant 2 (sorghum), irrigation was applied at a pre-irrigation soil moisture of 70-70-60% of FC. The seasonal irrigation norm was 2,374.8 m³/ha, and the total water consumption was 5,023.1 m³/ha. To produce 1 c of hay, 9.2 m³ of seasonal irrigation water and 19.4 m³ of total water were used. The hay yield per 1 m³ of total irrigation water was 0.52 kg. In variant 3 (sorghum), irrigation was applied at a pre-irrigation soil moisture of 75-75-65% of FC. The seasonal irrigation norm was 2,625.7 m³/ha, and the total water consumption was 5,108.6 m³/ha. To produce 1 c of hay, 9.7 m³ of seasonal irrigation water and 18.8 m³ of total water were used. The hay yield per 1 m³ of total irrigation water was 0.47 kg. In variant 4 (Sudan grass), irrigation was applied at a pre-irrigation soil moisture of 65-65-60% of FC. The seasonal irrigation norm was 2,351.4 m³/ha, and the total water consumption was 5,188.5 m³/ha. To produce 1 c of hay, 9.6 m³ of seasonal irrigation water and 21.3 m³ of total water were used. The hay yield per 1 m³ of total irrigation water was 0.47 kg. In variant 5 (Sudan grass), irrigation was applied at a pre-irrigation soil moisture of 70-70-60% of FC. The seasonal irrigation norm was 2,421.3 m³/ha, and the total water consumption was 5,145.6 m³/ha. To produce 1 c of hay, 9.6 m³ of seasonal irrigation water and 20.5 m³ of total water were used. The hay yield per 1 m³ of total irrigation water was 0.49 kg. In variant 6 (Sudan grass), irrigation was applied at a pre-irrigation soil moisture of 75-75-65% of FC. The seasonal irrigation norm was 2,567.5 m³/ha, and the total water consumption was 5,078.2 m³/ha. To produce 1 c of hay, 9.8 m³ of seasonal irrigation water and 19.4 m³ of total water were used. The hay yield per 1 m³ of total irrigation water was 0.52 kg. In variant 7 (African millet), irrigation was applied at a pre-irrigation soil moisture of 65-65-60% of FC. The seasonal irrigation norm was 2,341.0 m³/ha, and the total water consumption was 5,276.9 m³/ha. To produce 1 c of hay, 10.2 m³ of seasonal irrigation water and 23.0 m³ of total water were used. The hay yield per 1 m³ of total irrigation water was 0.43 kg. In variant 8 (African millet), irrigation was applied at a pre-irrigation soil moisture of 70-70-60% of FC. The seasonal irrigation norm was 2,400.9 m³/ha, and the total water consumption was 5,239.0 m³/ha. To produce 1 c of hay, 10.2 m³ of seasonal irrigation water and 22.3 m³ of total water were used. The hay yield per 1 m³ of total irrigation water was 0.45 kg. In variant 9 (African millet), irrigation was applied at a pre-irrigation soil moisture of 75-75-65% of FC. The seasonal irrigation norm was 2,653.0 m³/ha, and the total water consumption was 5,226.8 m³/ha. To produce 1 c of hay, 10.9 m³ of seasonal irrigation water and 21.5 m³ of total water were used. The hay yield per 1 m³ of total irrigation water was 0.47 kg.





Conclusion

On the saline soils of the Republic of Karakalpakstan, the highest hay yield of forage crops was obtained with the irrigation regime of 75-75-65% of field capacity (FC) before irrigation.

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