WATER CONSUMPTION AND WATER CONSUMPTION COEFFICIENT OF ALFALFA IN TYPICAL GRAY SOIL CONDITIONS OF VAHKSH VALLEY OF TAJIKISTAN

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ABSTRACT
The article presents materials on water consumption and water consumption coefficient in typical gray soil conditions of Vakhsh Valley of Tajikistan. Laboratory and field studies have shown that equitable use of water in the alfalfa fields, against the introduction background of mineral fertilizers norms for alfalfa for three years, it is possible to achieve 80% of CHDNS in the irrigation regime: 80% of CHDNS can be achieved in irrigation mode:100 kg/ha of nitrogen, 300 kg/ha of phosphorus and 150 kg/ha potassium, the water consumption coefficient of standing is 53 m³/c in the first year, 40 m³/c in the second and 43 m³/c in the third year.

Keywords: Alfalfa, water consumption, water consumption coefficient, nitrogen, phosphorus, potassium and irrigation regime.

I. ВВЕДЕНИЕ.
Agricultural workers are always challenged significantly increase the production and agricultural products sale to the state and the population, including livestock products.

To accomplish this important task, not only increase feed production, create a reliable forage base for animal breeding. It should pay special attention to solving the fodder protein problem in animal breeding, primarily by increasing the production of pulses, soybeans, rapeseed, alfalfa and other high-protein crops. Alfalfa is one of the main forage crops in creating a solid forage base for animal breeding. Alfalfa improves the water-physical properties of soils and is a generally recognized nitrogen accumulator and soil phosphates mobilizer of previously applied phosphorus fertilizers. In addition, it is the best crop precursor. Alfalfa as a forage plant has many valuable qualities, used for feeding all farm animal types with green forage, haylage, hay flour; these foods are rich in vitamins. A number of biological features of alfalfa are practically valuable, high productivity, responsive to fertilization, irrigation, resistance to dry conditions, as well as its ability to grow back quickly after mowing, which provides the possibility of continuous feeding of farm animals from spring to late autumn with fresh green forage. High and sustainable alfalfa yield in low-fertile soils can be obtained only by irrigation and application of mineral fertilizers. In these soils conditions, where the soils are mostly infertile, the alfalfa irrigation regime effect can only manifest itself in conditions of uninterrupted and proper nutrition.

Academician V.R. Williams (1951) discovered the irreplaceability law of plant life factors to create continuous growing yields of agricultural crops must be provided with a simultaneous and full inflow of all the factors of development necessary for them simultaneously: water, food, heat, light and aeration. He wrote: We can control two factors of plant life: Food and water, it is especially important that their flow is continuous. If they run at different times, if the plant sometimes has more water, then the plant will idle.

In this regard, the main task is set: Obtaining high yields is the simultaneous supply of plants with water and nutrients in the required amount during the entire growing season. Alfalfa, cultivated for forage, differs from other crops with a longer growing season of 190-210 days. It is starting in early spring (beginning of regrowth) and ending in late autumn. In addition, alfalfa produces abundant vegetative mass and has a large leaf area. It significantly reduces evaporation from the soil surface.
II. RESEARCH RESULTS.

A high and stable yield of this crop can be obtained only with optimal irrigation regimes and rates of mineral fertilizers application. The irrigation regimes development should be decided specifically for each natural and economic zone. The experimental plot soil is old-irrigated, typical gray. Groundwater is below 10 meters. Average volumetric all meter layer of soil is 1,50 g/cm³, specific gravity is 2,72 g/cm³, duty cycle is 45%. Water reserves at UFH in the meter layer are 2440 m³/ha. The initial content in the 0-50 cm humus layer is 1,28%, nitrogen is 0,135%, phosphorus is 23,4%. According to the climate data, our object under study is sharply continental. The absolute maximum temperature is 44-46°C.

The duration of the period with air temperature above 0°C is 320-325 days a year. During our research, the amount of precipitation was 105 mm, and during the growing season it was 65 mm.

Watering rates were determined by the formula:

\[ M=100 \times H(\text{UFH} - \text{B}) \]  

(1)

Here: \( M \) - irrigation rate (m³/ha)

\( H \) - active soil layer

\( \text{UFH} \) - ultimate field humidity (in volume %)

\( \text{B} \) - soil moisture before watering (in volume % which is issued by the (NIV-1) device)

According to the Union of SRCI (1993) methodology, the water loss for evaporation during irrigation is 10% of the irrigation norm m³/ha.

To study irrigation regimes in all experiment variants, we determined the pre-irrigation soil moisture using the NIV-1 device (neutron moisture meter) was studied and verified by E.V. Chapovskaya, Drozhzhina T.M. and Islamov I. (1973), Islamov I. (1978). Accounting for irrigation water by Thomson weirs with a threshold of 90°.

The indicator that determines the water consumption for plant formation is the water consumption coefficient or the ratio of the unit water consumption per unit of marketable product. These costs include both transpiration water and water evaporating from the soil. This article presents the main influence results of the irrigation and alfalfa feeding regimes combination over a three-year period of its standing on the amount of water consumption and the alfalfa hay yield. The experimental plot soils are typical saline black earth.

The experiment included three alfalfa irrigation regime variants as the UFH (ultimate field humidity) percentage 60, 70 and 80 and 4 variants of the mineral fertilization rates in kg/ha: 1- without fertilizers NoPoKo (control):2-N 100 P 200 K 100: 3-N 100 P 300 K 150: 4-N 100 P 400 K 200 for 3 years of standing. In the first year of alfalfa standing, all phosphorus (Ph) and potassium (P) norms were introduced. In the second and third, the remaining 50% of the phosphorus and potassium norm were introduced in equal portions (25% per year).

The specified irrigation regimes for alfalfa during 3 years of its standing were regulated by NIV-1 [1-4]. Soil moisture was determined after irrigation through 6,8,10,12, etc. days before reaching the specified level of pre-irrigation soil moisture. In the first year of standing, in accordance with the growth dynamics of the root system and taking into account the water-physical properties of the soil, the following calculated soil layers were established to determine the irrigation rate before the 1st cut 0-60 cm, after 0-100 cm. In the second and third years of alfalfa standing, a 0-100 cm layer was also taken, since the main part of the root system was distributed in this soil layer.

The amount of water consumption was found by the formula

\[ W=I+P+(W_H-W_K), \]

(2)

here \( B \) - water consumption(in m³/ha), \( M \) - irrigation rate (m³/ha). \( O \) - precipitation, \( W_H \) – initial (spring) moisture reserve of the same layer.

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$W_k$ - final (autumn) moisture reserve of the same layer.

The water consumption coefficient is the ratio of the water consumption values to the alfalfa hay yield:

$$C = \frac{W}{A}.$$  \hspace{1cm} (3)

A

Here;  

- C - Water consumption coefficient, $m^3$/ha
- A - alfalfa hay yield, c/ha,
- B - water consumption, $m^3$/ha.

Table 1  Water consumption, water consumption coefficient and alfalfa yield depending on the irrigation regime and the mineral fertilizers norms

<table>
<thead>
<tr>
<th>3-year rate of mineral fertilizers, kg/ha</th>
<th>The amount of water consumption $m^3$/ha</th>
<th>Average yield of alfalfa hay by years of standing, c/ha</th>
<th>Water consumption coefficient $m^3$/c</th>
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$y = -0.855x + 3.5747$  

$R^2 = 0.9846$
A detailed analysis of crop data depending on the mineral nutrition and irrigation regime levels indicated their close relationship (Table 1). The latter is illustrated in Figs. 1 and 2, where the alfalfa hay yield logarithms are plotted along the ordinate, and the water consumption coefficients logarithms calculated by formula (3) are plotted along the abscissa.

The correlation coefficient is 0.97+0.01 with the correlation series volume 36.

Researches [2,3,4,5,6] found that as a result of an increase in the soil solution concentration under the fertilizers influence in plants, the amount of bound water, especially colloidy bound, increases. As a result, the relative intensity of transpiration decreases and the water content of plant tissues increases. Consequently, water on fertilized crops is consumed more productively than on unfertilized crops at the irrigation regime level, one should expect a vivid manifestation of the mineral nutrition role in the green mass formation, as is known, leads to an absolute increase in water consumption for transpiration.

Thus, the most economical use of water in alfalfa fields can be achieved with an irrigation mode of 80% from UFH against the applying background the mineral fertilizers norms per three years of alfalfa standing: nitrogen 100 kg/ha, phosphorus 300 kg/ha and potassium 150 kg/ha. At the same time, the water consumption coefficient will be 53 m$^3$/c in the first, 40 in the second and 43 m$^3$/c in the third year of alfalfa standing.

### III. CONCLUSIONS.

With the same amount of water consumption, depending on the mineral nutrition level of alfalfa and in particular, the irrigation water supply, you can get an alfalfa hay yield in the first from 38 to 111 c/ha, from 49 to 267 c/ha in the second from 60 to 230 c/ha in the third year of alfalfa standing.

The dependence of the alfalfa hay yield on the amount of water consumption was established when creating optimal options for combining irrigation and mineral nutrition of alfalfa.
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