LOW INTENSITY IRRIGATION EFFICIENCY AND THEIR APPLICATION IN THE CONDITIONS OF MOUNTAIN AGRICULTURE IN AZERBAIJAN

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ABSTRACT

This article examines the issues of introduction of low-intensity irrigation systems that are justified by their efficiency in the use of the conditions of mountain agriculture in Azerbaijan. The author argues that the advantage of low-intensity irrigation technology lies in the fact that at a minimum a small amount of moisture throughout the irrigated area is formed microclimate for more intensive development of plants, thus significantly increases the yield of different types of crops, improved water distribution process ensures uniform distribution scheme concentration, etc.

Key words: low-intensity, irrigation, microclimate, soil moisture, yield, impulse sprinkler, finely divided aerosol, sprinkler irrigation, drip irrigation, injection irrigation, micro irrigation.

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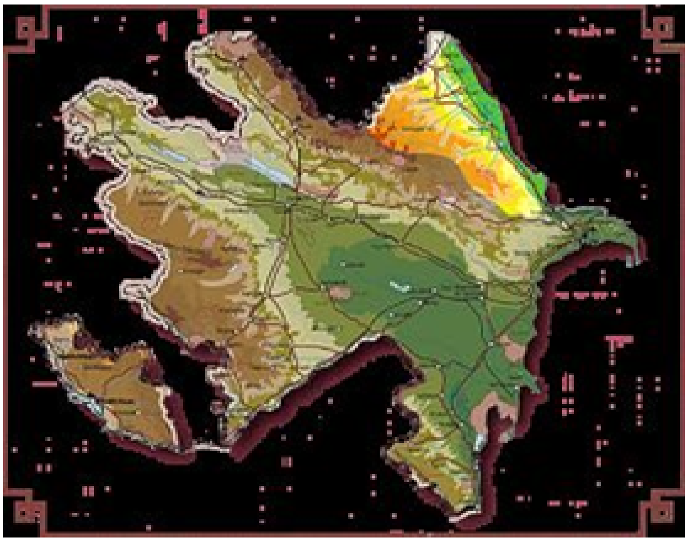
INTRODUCTION



In conditions of severe water shortages (characteristic mainly mountain and foothills areas Republic) consumed for irrigation and growing crops, using a low-intensity environmentally friendly technologies and means watering for different soil and climatic conditions becomes very great economic importance.

The advantage of low-intensity irrigation technology is that at minimum a small amount of moisture throughout the irrigated area is formed microclimate for the more intensive plant growth, therefore, considerably increased yields various kinds of crops. Furthermore, it does not require rigorous planning irrigated area (field) allows dosed irrigation rate, namely, the demand for grown crops these fields to mechanize and automate completely water distribution process, to provide uniform distribution scheme concentration etc.

Low-intensity irrigation is divided into the following types of watering:

1. Pulse irrigation;
2. finely dispersed (aerosol) irrigation;
3. pulse-drip irrigation;
4. drip irrigation;
5. injecting irrigation;
6. subsurface irrigation;
7. mikrodozhdevanie (nadkronovy, and nadkronovy podkronovy, combined et al.);

Irrigation Technology mikrodozhdevaniya fine and will be determined as pulsed irrigation, injection and subsurface irrigation, drip -like. So here it deals primarily with the pulse as a conventional technology, and self-oscillating pulse action, and drip irrigation. The process is characterized irrigation duration and intensity of exposure to the distance and the medium during the growing period of plant development and diurnal cycle. According to the degree of water supply intensity approaching the intensity of water use should distinguish between the following types of irrigation:

Absolute synchronous: Water supply is carried out in full compliance with varying intensity of water consumption for irrigation period and the diurnal cycle;

Synchronized: Water supply is performed monotonically during the day according to the average daily water consumption intensity;

Asynchronous: The intensity of the water supply over the instantaneous and average daily water consumption intensity.

For the following types of irrigation systems differ in the type of distribution:

- alternate irrigation watering individual devices or groups of operating in a single technological cycle;

- water storage volumes in special tanks directly from irrigation devices or water-supply network for irrigation technological process;

- ensuring continuous operation of all devices malorashodnyh irrigation irrigation system. The aim is to provide a low-intensity irrigation comfortable conditions for plants (for example using pulse-dozhdevatelnoy system self-oscillating action) and vlagopodderzhaniya in soil and partially in the surface layer. Direct objects exposure irrigation process are soil, the plants and the surface layer air.

Regulation of water and associated air, heat, water and salt and soil conditions cause the development of physical and chemical and biochemical processes occurring in soil and determining its fertility. Stressful effects of irrigation may lead to the destruction of the soil structure and water-resistance aggregates reduces the fertility of soil. Certain types of irrigation vozdeystie have not only the soil but also on the ground layer of air, and also directly to the plant (controlled its water mode and photosynthesis processes, including through foliar feeding water aboveground plant parts). With drip irrigation water is distributed to drip from the porous portions of the field or humectants mikrovypuskov mainly by capillary action. Environmental irrigation safe for the environment should be based primarily on water-saving technologies. It is necessary to create conditions for the reduction of water losses and dump the soil surface, as well as depth filtration in order to better use of natural precipitation.

Perfection of technological process of watering is one of the most important tasks of scientific and technical progress of irrigated agriculture.

In this direction, in the country a lot of work was carried out under the guidance of scientists G.M.Mamedova, B.G.Alieva et al., Also in the Russian Federation under the leadership of V.F.Nosenko, G.P.Voroninym A. Malyshev, MP .Pisarevym and others. The authors believe that for the proper carrying out of the technological process of watering is necessary to solve a number of challenges to meet the requirements of plants (crops). It is above all the need to establish optimal conditions for the biological development of plants. Ensuring environmentally acceptable levels of soil moisture, and surface air and soil aeration to maintain and improve soil fertility under irrigation on the background of natural small projected on terms of precipitation. Improved irrigation technology should be guaranteed for crop yields, regardless of weather conditions due to the management of water and related air, heat, salt, microbiological and nutritional regimes in the soil. Driving the impact of irrigation on plants and the environment is shown in Fig. 1.

It should also be noted that the formation of the crop has a tremendous impact correct application of irrigation technology. Productivity of plants depends on the water factor.

For maximum yield (Minds) at a certain agricultural background and the meteorological situation favorable conditions (optimal soil moisture, and surface air) should be established for plants.

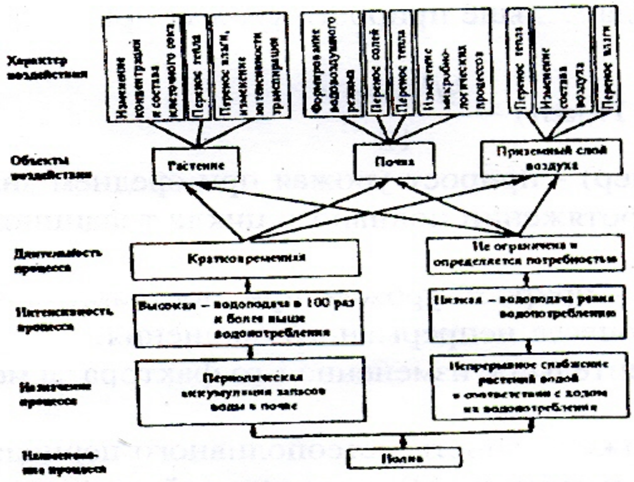


Fig. 1. Scheme of the impact of irrigation on the plant and the environment.

The impact of the necessary factors in the life of the plants and crop growth can be expressed by the following relationship:

AP Y = [1 - (1- fi) 2] n (1)

i = 1

where A is the maximum gain (the crop) in optimum conditions;

fi- relative value of i-th factor plant life (the ratio of its quantity to the actual optimal);

n - the number of factors affecting the crop.

The efficiency reduction of water supply and reduction of the intensity irrigation interval can be estimated by comparing increments crop.

After conversion expressions (3.1) and certain assumptions, it was found that the increase in yield from each of the factors in the periodic irrigation ceteris paribus always less crop growth during continuous irrigation.

$$Y_i(\text{nep}) = Y_i(\text{nep}) - \frac{\text{Ei}^2(\text{nep})t}{l_2} \quad (2)$$

where, Yi (nep) - increase of yield with the average value of the i-factor for traditional irrigation irrigation cycle;

Yi (nep) - increase yield at a constant value i-Ch. factor during continuous irrigation;

Ei - The relative change of the i-th factor for Mete irrigation period;

t- Mete duration of irrigation period.

Analysis of the relationship (2) reflecting a quantitative estimate of the periodic transition to continuous irrigation shows that the difference between the increases yield increases in proportion to the square of the duration of irrigation interval. Thus, when using low-intensity irrigation technology can be expected increase in yield compared with conventional irrigation by maintaining soil moisture and surface air at comfortable levels for plants that is provided with synchronously-pulsed system sprinkling.

Properties irrigation technology synchronously-pulsed irrigation concluded that the occurrence of soil moisture deficit in the irrigated areas compensated daily water supply.

Soil moisture reserves active layer moisture exchange during the dry period are maintained continuously at an optimal level without cyclicity inherent in conventional irrigation techniques. The optimal level of moisture reserves set depending on the soil type and phase of development of the crop. By reducing the moisture reserves in the active layer to an optimal level of moisture exchange is carried out irrigation in a pulsed mode. Deficiency of moisture during the billing period is calculated by the equation aqueous balansa- water consumption crops determined by validated for the specific zones. Thus water consumption crops determined by the formula:

Ev = Ed Kb Km (3)

where Ev - a water consumption / crop during the billing period, mm;

Ed - the sum of daily average deficits humidity during the billing period, MB;

Kb - biological factor reflecting the features of plant development;

Km-microclimate factor taking into account the change in the meteorological regime under the influence of irrigation.

The norm of water supply for the settlement period is determined by the dependence;

$$m = \frac{Д_б \quad T \quad K_{см}}{\beta} \text{мм} \quad (4)$$

where Db - the average daily water consumption deficit for the current period, mm / day .;

T - duration calculation period, days.

CSM - coefficient taking into account the cost of wetting of the leaf surface of agricultural plants sprinkling with pulsed accepted to be from 1 to 1.25, depending on the culture, the development phase and the percentage of the irrigated area under crown and leaf surface of plants;

β - coefficient taking into account the loss of water in the rain clouds zone by evaporation under pulsed sprinkling.

Ratio is determined by the formula:

$$\beta = \frac{100 - U}{100} \quad (5)$$

where, U - evaporation of water in the rain clouds sprinkling area with a pulsed, in% of the water supply.

Evaporation of water in the rain clouds sprinkling area under pulse equal to:

$$U = t\left(1 \frac{\alpha}{100}\right)\left(0.15\,V_p + 0.71\right) \ \% \quad (6)$$

wherein, a- relative humidity at the time of irrigation, in%;

t - air temperature at the time of irrigation, a C0

Vp - rated wind speed, reduced to a height of 2 meters above the ground surface, m / s; value which can be determined by the following formula:

Vp = Vsp * 0.7; (7)

where Vsp - average wind speed during the billing period, measured at the height of the wind vane, m / sec.

In order to solve irrigation technology process is necessary to determine the specific consumption.

Calculated specific consumption determined based on the average daily water consumption condition compensation deficit water costs for forming the microclimate and demolition irrigated plot beyond the formula:

$$q = \frac{m}{8.64 \quad T \quad K_{сут} K_a} \quad \text{(eight)}$$

where, q - relative water consumption l / s.ga;

m- vodopadachi rate for the billing period, mm;

T - the duration of the calculation period, days;

CAST-utilization time of day clock at the low-intensity irrigation system is adopted 0.95;

Ka - coefficient reflecting agrotechnical operation determining periodically stopping the system (complex), depending on specific conditions.

Daily, daily water supply water with the costs of creating a microclimate (m gross) and duration of operation of the system (T) pulse sprinkling in a simplified form can be determined by the formula:

Mbrutto - (webpage - kN) 10; (nine)

$$T = \frac{m \quad T_ц}{3{,}6\,n \quad V_в} \quad \text{(ten)}$$

where webpage - evaporation from the water surface for the previous day, mm;

h - precipitation, mm;

K - utilization of precipitation;

IDB - daily water supply, m / ha;

TN - cycle time of the system, with;

3.6 - conversion factor;

n - the number of sprinklers per hectare, pcs / ha;

Vc - volume splash pulse dozhdevatelnogo apparatus l.

When studying the process of irrigation sprinklers, the total water consumption of the plants should be determined by the existing method, in which water balance method is used.

Ev = m + kh + Δ W + z (11)

where Ev - total water consumption root layer, mm;

m - Received moisture in the layer of soil settlement due to watering during the reporting period, mm;

k - the coefficient of use of precipitation;

h - precipitation, mm;

ΔW = w1 - w2 respectively supply of moisture in the soil at the beginning and end of the period, mm;

z - moisture exchange with the deeper layers of soil, mm.

If the groundwater is located at a depth of more than three meters have no effect on the moisture exchange root layer of soil, the Z component of the formula in the following calculation does not take into account that

Ev = m + kh + Δ W (12)

It should be noted that productively used for precipitation of the water supply are of great practical importance. To date, no single method of determining productively used precipitation, are acceptable for the purposes of practical application in the irrigation process. This part of the precipitation into account when calculating irrigation rates and is its integral part, characterized productively used rainfall precipitation utilization factor, the numerical value of which is determined by the formula:

$$K=\frac{W_2-W_1+\Sigma E_{исп}}{h} \quad (13)$$

where Eisn - evaporation from the water surface during the period, mm;

W1 - supply of moisture in the soil before precipitation mm;

W2- supply of moisture in the soil after rain, mm;

h- precipitation, mm;

K - utilization of precipitation.

The stock W, before the rain moisture is known, determined by a previously measured soil moisture β, and the moisture supply W2 determined after soil moisture precipitation β, measured 1-3 days after rain. For convenience, the calculation of process parameters into crop synchronously-pulsed and pulsed mode implemented self-oscillating sprinkler action, we developed a nomogram to determine a daily norm of water supply (Fig. 2)

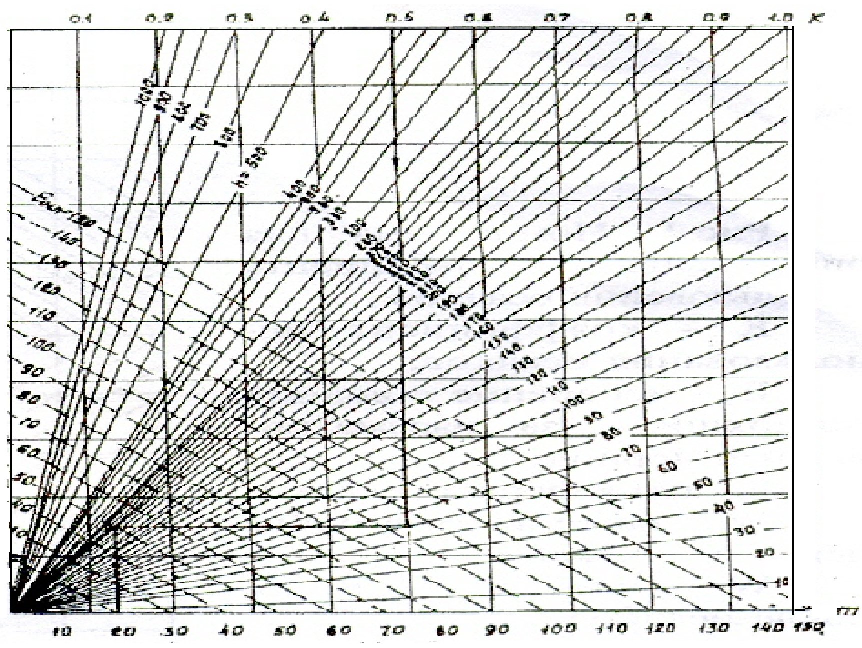


Fig. 3.1. Nomogram for determining irrigation norms

h- precipitation, mm;

E- evaporation from the water surface, mm;

K - utilization of precipitation.

Detection processing rules and irrigation timing based on measurements of soil moisture after rain, is a time consuming process, and such a possibility can have a limited number of households.

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