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DRIP IRRIGATION FOR GRAPE VARIETIES WITH SNOW AND RAIN WATER IN THE CONDITIONS OF MOUNTAINOUS REGIONS

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Abstract
This article includes information about that in the mountainous regions of Kashkadarya in the care of varieties of grapes "Kara Kishmish" and "Pushti Toyfi" the pre-irrigation soil moisture of the drip irrigation options with snow and rain water at 70-75-65% relative to the LFMC, as regard to the 5-7 control option of the furrow irrigation for the variety of grapes of "Pushti Toyfi", moreover, the grape yield was 14.7-15.2 tons/ha in the order of 70-75-65% of the pre-irrigation soil moisture capacity relative to the LFMC. Furthermore, it was 19.1-20.8 tons/ha in 6-8 options of drip irrigation of grapes in this method or 4.4-5.6 tons/ha higher in both varieties of grapes when drip irrigation compared to the control option, when in the 3-3-3 irrigation system with the pre-irrigation soil moisture of grapes at70-75-65% relative to the LFMC, it was 200 m^3/ha, the seasonal irrigation standards were 1680 m^3/ha, a maximum income of 38893500 so'ms/ha was taken.

Keywords varieties of grapes "Kara Kishmish" and "Pushti Toyfi", meadow gray soils, weight of soil, water permeability, limited field moisture capacity, drip irrigation, irrigation norm, grape yield.

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INTRODUCTION

The rational use of land and water resources in irrigation of agricultural crops is of particular importance due to the rapid growth of population in the world, increased demand for water. Globally, the area of vineyards is 7.5 million hectares, the main part of which, or 85%, is in the Eurasian continent. Currently, the most developed countries in viticulture are: Spain with 1.2 million/ha, Italy with 875 thousand/ha, France with 870 thousand/ha, USA with 357 thousand/ha, Turkey with 560 thousand/ha, Portugal with 252 thousand/ha, Argentina with 353 thousand/ha while Romania has 250,000 hectares. Consequently, about 65-70% of the grapes grown in these countries are supplied as raw materials for the wine industry. Up to 18.9 million liters of wine are produced annually in China, 48.9 million in Italy, 22.1 million in the United States and 47.4 million in France.

Nowadays conducting research on improving the order and technology of irrigation of crops, increasing the fertility of irrigated lands, obtaining two or more crops per year from one hectare of the field for the efficient use of land and water resources is one of the urgent problems while there is a shortage of irrigation water in the world.

Currently, a number of measures are being implemented in the republic to develop viticulture in the agricultural system, and to establish and expand its plantations with high-quality seedlings. In the Action Strategy of the Republic of Uzbekistan for 2017-2021, "... optimizing the composition of cultivated areas and crops in agriculture, introducing advanced agricultural technologies, increasing yields, increasing volumes of cultivation of fruits and vegetables and grapes ..." it is identified separately as one of the important strategic tasks. In this regard, it is important to expand the scope of research work on the development and implementation of technologies that ensure the cultivation of certified seedlings, taking into account the morpho-biological and economic characteristics of grape plants. The preparation of healthy cuttings based on the restoration of indigenous vineyards with improved phytosanitary status, the development of intensive technologies for the reproduction of rare and valuable grape varieties, as well as the cultivation of grapes with efficient use of water in the mountainous regions of the republic, is one of the urgent tasks.

Level of the study of the problem

Scientists and academicians Mirzaev M.M., Negrul A.M., Kats Ya.F., Kondo G.F., Smirnov K.V., Mikhaylova P.V., Gorbach V.I., Khaydarqulov G.I., Frolov A .I., Molchanov V.L., Molchanova Z.Ya., Ro N.L., Tibiykena A.G., Arzumanov V.A., Tabanali A.X. and famous people's academician Musamukhamedov R., as well as scientists such as Averyanov S.F., Kremenetskiy N.D., Shumakov B.A., Stenley Kindson, Sharov M.A., Lgov G.K., Ivanov N.N., Danilchenkova N.V., and M.S.Grigorov conducted research on the development of water-saving methods in the conditions of water scarcity and development to improve seed production and technology in the development of fruit and viticulture [1,2,3,4,5,6,7,8,9].

Rizhov S.N., Kostyakov V.A., Kovda V.A., Bezborodov G.A., Hamidov M.H., Ikromov R.K., Isaev S.X., Kenjabekov Sh. and Matyakubov B.Sh. conducted extensive research on the irrigation of agricultural crops and the efficient use of water resources in general, as well as increasing the efficiency of new technologies and achieved the desired results [13,14,15,16,17,18,19,20,21,22].

Today, despite the extensive research carried out in these areas, research work to improve the use of irrigation technologies that do not have an adverse effect on the environment, namely the drip irrigation method for grape varieties with snow and rain water, the system of agricultural measures at the level of requirements presented to this day in the conditions of the mountainous and foothill are not yet completed.

Purpose of the study

It is to determine the scientifically based on the irrigation procedure in the technology of drip irrigation for the "Kara Kishmish" and "Pushti Toyfi" varieties of grapes in the conditions of the mountainous areas with snow water in the meadow, gray and medium sandy soils according to mechanical composition of Kashkadarya region.

Objectives of the study
To determine the effect of snow and rain water on the agro-physical properties of the soil in the care of grapes "Kara Kishmish" and "Pushti Toyfi" in the conditions of mountainous regions;

To study the effect of pre-irrigation soil moisture, irrigation timing, quantity, system, duration, duration and seasonal irrigation norms on the optimal irrigation of grape varieties with drip irrigation with snow and rain water;

To develop the optimal standards of water consumption in drip irrigation for grape varieties with snow and rain water on the growth of plants, distribution by development phases, subsequent and seasonal irrigation;

To study the effects of soil moisture, growth, development, yield accumulation and productivity in drip irrigation for grape varieties with snow and rain water;

To determine the economic efficiency of drip irrigation with snow and rain water technology for grape varieties.

Object of the study
It is the technology of drip irrigation for the "Kara Kishmish" and "Pushti Toyfi" varieties of grapes with snow and rain water in the meadow, gray and medium sandy soils according to mechanical composition of Kashkadarya region.

Subject of the study
It is to determine the characteristics of the collection and use of local flowing water in mountainous regions, to determine vineyards, soil conditions, irrigation methods and technologies, determine their effectiveness, as well as increase the efficiency of drip irrigation and economic efficiency.

Methods of the study
Field research and phenological observations in the course of "Methods of field experiments" of Cotton Breeding, Seed Production and Agrotechnologies Research Institute (CBSPARI, 2007) and hydro-meteorological data were analyzed statistically and statistical analysis of data on productivity using the Microsoft Excel program, Dospexov's methods were used [10,11,12].

Results of the study
It was noted that the field experiments were carried out on the land of "Joyliev Normumin" farm in Yakkabag district of Kashkadarya region**.** It was stated that the mechanical composition of the experimental field was sandy, meadow-gray soils, not saline, with an average depth of groundwater of 3.0 m. In field experiments, the pre-irrigation moisture content of drip irrigation for "Kara Kishmish" and "Pushti Toyfi" varieties of vinegraphes was 60-65-60% and 70-75-65% in relation to LFMC.

The amount of humus in the topsoil (0-30 cm) was 0.865%, in the subsoil layer 30-50 cm 0.763%, the nitrate form of nitrogen in these layers was 18.3-16.1 mg/kg, the mobile form of phosphorus and potassium are 36.6-33.1 and 425-360 mg/kg respectively and low content of nitrate nitrogen, which was a mobile form of nutrients, medium phosphorus and high potassium, it was noted that by the end of the growing season, the amount of humus in the 0-30 cm layer in the control variant of irrigated grapes 0.786 %, and 0.675% in the subsoil 30-50 cm layer, the nitrate form of nitrogen in these layers was 0-30, in the soil layers of 30-50 cm 11.3-9.6 mg/kg, the mobile form of phosphorus was 25.7 -20.1 mg/kg and the mobile form of potassium 356-340 mg/kg, was set to version 030 cm humus layer of 0.757% in the variant of the drip irrigation, the amount of arable ground 30-50 cm layer of 0.633%. The nitrate form of nitrogen in these layers was 0-30, 30-50 mg/kg in soil layers 8.6-6.3 cm, respectively 25.5-20.1 mg/kg in the phosphor-active form and 347-300 mg/kg in the behavior form of potassium. From this it became known that the field of experience is moderately supplied with potassium, low with humus and low with moving phosphorus. In the studies, the norm of mineral fertilizers of grape "Kara Kishmish" and "Pushti Toyfi" varieties of grapes was applied to N-120; P-100; K-30 kg/ha.

The bulk density of the soil of the experimental field was determined at the beginning of the growing season in the 1st experimental irrigation control option (in the spring) to a depth of 0-30, 0-50, 0-70 and 0-100 cm; In this regard, the bulk density of the soil was 1.28 g/cm^3 in a layer of 0-30 cm, an average 1.30 g/cm^3 in a layer of 0-50 cm, 1.36 g/cm^3 in a layer of 0-70 cm, 1.41 g/cm^3 in a layer of 0-100 cm according to the options.

In the field of experiment, it was observed that the soil volumetric density in 60-65-60% order-irrigated variants in relation to LFMC was less changed (increased) than in 70-75-65% order-irrigated options in relation to LFMC.

While the soil apparent density of grapes under options was 1.28 g/cm in the 0–30 cm layer at the beginning of the growing season, in autumn this figure was 1.39 g/cm3 in options.

At the end of the growing season, in the case of the variant 1 of the control furrow irrigation, the weight of soil of 0-30 cm and 30-50 cm layers of soil increased by 1.33-1.42 g/cm^3, that is, the bulk density increased by 0.04 g/cm^3 while the 2nd option of the drip irrigation, when the moisture was 70-75-65% relative to the LFMC, the bulk density of 1.35-1.43 g/cm^3 increased by 0.01 g/cm^3.

In 3-option, when the moisture was 70-75-65% relative to the LFMC, the bulk density of the soil was 1.34-1.45 g / cm3 and it was known that the bulk density increased by 0.02 g / cm3. Limited field moisture capacity (LFMC) of the field to a depth of 0-100 cm on each 0-10 cm layer of soil was determined in the 1st decade of March-April before pruning and germination of grape varieties.

In different layers of soil, the indicator of field moisture capacity ranged from 18.5% to 20.2%, depending on the density of the layer. This indicator in 2015 the field moisture capacity was 18.9% in the layer of 0-40 cm, 0-70 cm-19.29% and 0-100 cm-19.0%, in 2016 0-40 cm-19.24%, 0-70 cm-19.53%, 0-100 cm-19.24%.

According to the results from the studies, as a result of the condensation of the soil during the season, its water permeability also decreased. At the beginning of the growing season, the water permeability of the soil in the general background was 1930 m^3/ha for 6 hours, the water permeability of the soil was 535 m^3/ha in the first hour, decreased in the following hours, and the water infiltration was 105 m^3/ha in the sixth hour.

Observations on the water permeability of the soil showed that at the end of the vegetation period, the rate of absorption into the soil on average for 6 hours in the 1-experiment field was 0.31 mm/min in the furrowed-watered control option, while this indicator was 0.42 mm/min in the drip-watered experiment option. In the 2-field experiment, the average soil absorption rate in the furrowed-watered control option was 0.30 mm/min, while in the case of the drip-watered experiment variant this indicator was 0.38 mm/min.

The adopted "Temporary technical guidelines for the design, construction and operation of drip irrigation systems for orchards and vineyards" (Kishinev, 1981) determined irrigation measurements using the following formula.

$$\mathbf{m} = \gamma \frac{\pi D^2}{4} h \cdot K \left(\frac{\beta_{max} - \beta_{min}}{100} \right) \quad \mathbf{1}$$

Here: **m**- irrigation norm, m³/tree;

γ- height of dry soil, t/m³

β_{max}- obtained pre-irrigation soil moisture %

β_{min}- obtained post-irrigation soil moisture %

K- acceptable root system coefficient K=0,8

D- diameter of wetting layers

h- depth of wetting

$\frac{\pi D^2}{4}$ –soil moisture under the tree

calculated by the formula of drip irrigation using "Uzgiprovodkhozom".

$$m_0 = 0{,}67 \cdot W \cdot \frac{\pi D^2}{4} - h \cdot \frac{\beta_1 - \beta_2}{100} \quad 2$$

Here: **m**- irrigation norm, m³/tree;

W- weight of soil, t/m³

β_1- obtained pre-irrigation soil moisture

β_2- obtained post-irrigation soil moisture

h –calculated depth of wetting, m

d –diameter of the plane considered as horizontal wetting

0,67 –rotation coefficient of the wetting area.

$$f = \frac{S}{10000} \quad 3$$

Here: S- the irrigated area per hectare is calculated using the following formula

$$S = M \frac{\pi D^2}{4} \quad 4$$

Here: **M**- irrigation, m³/tree;

d - diameter of the plane considered as horizontal wetting, m

Based on the results of studies conducted in Kazakhstan, drip irrigation work was determined according to the formula calculated by Turuspayev in horticulture

$$V_в = R \cdot H_k^3 \quad 5$$

Here: **$V_в$**- water transmission, m³ for one tree;

H_k- weight of soil, t/m³

$$R = \pi \beta^2 \alpha^{-3} \Delta B \quad 6$$

Here: **$\alpha = H_k/H_я$, $\beta = V_t/V_t$ в**

ΔB- water transmission, m³ for one tree;

$$\Delta B = \frac{H B - B_0}{100} \quad 7$$

Maslennikov V.M. (1982)

$$V_в = 0{,}21 \, (W_{tot} + W_n - 2W_{clus}) \cdot d_v \quad 8$$

Here: **m**- irrigation norm, m³/tree;

W- weight of soil, t/m³

β_1- obtained pre-irrigation soil moisture

β_2- obtained post-irrigation soil moisture

h – calculated depth of wetting, м

d – diameter of the plane considered as horizontal wetting

The formula for determining the irrigation norm:

$$m = V_в \Pi_{вв} \quad 9$$

Here: **m**- irrigation norm, m³/tree;

W- weight of soil, t/m³

$$\Pi_{вв} = \frac{1 \cdot 10^2}{2 \cdot 1 \cdot R^2} pc / ra \quad 10$$

R

$$R = \sqrt{\frac{47{,}6 \cdot V_в}{(W_{tot} + W_n + 2W_{clus}) \cdot d_v}} \quad 11$$

$$m = H \cdot 100 \cdot \Delta W \cdot d_v \cdot \alpha$$

Here: **m**- irrigation norm, m³/tree;

W- weight of soil, t/m³

β_1- obtained pre-irrigation soil moisture

β_2- obtained post-irrigation soil moisture

h – calculated depth of wetting, mm

d – diameter of the plane considered as horizontal wetting

$$m = H \cdot 100 \cdot \Delta W \cdot d_v \quad 12$$

m- irrigation norm, m³/tree;

ΔW- weight of soil, t/m³

d_v- obtained pre-irrigation soil moisture

α- depth of wetting, coefficient of the root layer system

α=0,06…..0,16.

In 2015, in the furrow irrigation the moisture before the first irrigation of grapes was 60-65-60% relative to the LFMC, 11.6% relative to the soil weight, the limited field moisture capacity was 60%, while in the drip irrigation for grapes before the first irrigation soil moisture was 60-65-60%, the weight of the soil was 11.5%, 60% of the limited field moisture capacity. Moreover, in the furrow irrigation for grape vines the soil moisture before the first irrigation was 70-75-65% relative to the LFMC, the weight of the soil was 13.6%, the limited field moisture capacity was 70%, while the moisture capacity of the soil before the first irrigation of drip irrigation of grapes was 70-75-65% relative to the LFMC, the weight of the soil was 13.5%. Moreover, the limited field moisture capacity was 70%.

Consequently, it can be seen that when water is supplied to moisten 0-50 cm of the field area where grapes are grown in the spring, that is, at the beginning of the growing season, the moisture capacity in the soil should be about 17.9% by weight while 18.1% in the 0-100 cm layer. In the recommended irrigation regime, irrigation was carried out with a decrease in soil moisture from 0-50 cm to 80%, also the irrigation time was determined based on data from the Shakhrisabz meteorological station by using Shtoyko's formula.

$$E_в = \sum t\left(0{,}1\bar{t}_c - \frac{\bar{a}}{100}\right); \qquad 13$$

$$E_в = \sum t\left[0{,}1\bar{t}_c + \left(1 - \frac{\bar{a}}{100}\right)\right]; \qquad 14$$

$E_в$ – the evaporation of culture for the period, $\bar{t}_c$ and $\bar{a}$ – the average daily temperature and humidity for the period, $\sum t$ – the sum of the average daily temperature in the period. The mopinimum moisture capacity of the soil in the 0-50 cm layer while the 0-100 cm layer is 25.3% and 24.4% respectively, the weight of soil is 1.19 and 1.34 g / cm3, respectively.

The exact level ($m_н$) of irrigation was determined by the following formula:

$$m_H = (W_{HB} - W_{пп}) \cdot ⍰\Delta \cdot 100; \qquad 15$$

Here; $\boldsymbol{W_{HB} - W_{пп}}$- minimum moisture capacity and optimal irrigation humidity,% of the mass of dry soil; **h**- calculated wetting layer, m; **Δ** - volume mass of the calculated wetting layer, g/cm^3.

$$m_H = (20{,}3 - 16{,}2) \cdot 0{,}5 \cdot 1{,}19 \cdot 100 = 250\ м^3/⍰га$$

It was calculated by the following formula of S.N. Rijov:

$$M = 100 \cdot ⍰ \cdot d \cdot (W_n - W_m) + K \quad м^3/га \qquad 16$$

Here:

W_n –limited field moisture capacity relative to soil weight, %;

W_m- absolute pre-irrigation moisture relative to soil weight, %;

h- depth of wetting of the irrigating area, m;

d- volume mass of the calculated area of the irrigating area, г/см^3;

K- coefficient of water consumption for evaporation during irrigation (10-15% of the lack of moisture in the calculated layer)

Furrow irrigation and drip irrigation for grape vines “Kara Kishmish” and “Pushti Toyfi” were carried out in accordance with the rules of soil moisture 60-65-60 and 70-75-65% in relation to LFMC.

Irrigation of grapes was carried out in 2015, the irrigation received soil moisture in the order of 60-65-60% relative to the LFMC and the seasonal irrigation norm was 1800 m^3/ha, in the same way drip irrigation was given to 1120 m^3/ha or 680 m^3/ha less than the control option, grape irrigation received seasonal irrigation norm 1950 m^3/ha in the control option, in the order of it was found that water was consumed less than 1530 m^3/ha or 420 m^3/ha relative to the control option.

In the first variant, pre-irrigation soil moisture in the order of 60-65-60% in relation to the LFMC and the average seasonal irrigation standard for three years is 1910 m^3/ha, in drip irrigation 1283 m^3/ha or 627 m^3/ha water less than in the control. Furthermore, in the control variant of pre-irrigation soil moisture in the order of 70-75-65% relative to the LFMC, the average seasonal irrigation standard for three years was 2037 m^3/ha, in this method the drip irrigation of grapes was 1680 m^3/ha or 357 m^3/ha water less than the control.

In 2015, when the pre-irrigation soil moisture of the first and second variants of the furrow irrigation of the varieties of grapes “Kara Kishmish” and “Pushti Toyfi” with snow and rain water irrigated in the order of 60-65-60% relative to the LFMC, the budburst was April 6, the flowering was May 15, the period of ripening of the clusters was July 25, the duration of the period from budding to ripening was 123–125 days.

The weight of the buds in increasing the yield of grapes will depend on the number of buds on the grape cluster and the following results were obtained in the studies conducted on the irrigation procedures of the varieties of grapes “Kara Kishmish” and “Pushti Toyfi” with snow and rain water, table 1.

Table 1The effect of drip irrigation regimes on grape varieties with snow and rain water on the number of attacks and their weight

Op.	Weight of 100 buds, g				Number of buds on the head of grape clusters, pieces			
	2015	2016	2017	**overall**	2015	2016	2017	**overall**
60-65-60 relative to the LFMC								
1	185	172	176	178	220	223	227	223
2	186	178	176	180	222	225	229	225
3	170	160	162	164	212	219	225	219
4	189	175	178	182	218	222	227	222
70-75-65 relative to the LFMC								
5	180	170	174	175	222	224	226	224
6	190	180	186	185	224	226	228	226
7	180	170	174	174	218	223	225	222
8	200	190	195	195	221	225	230	225

In the control option the 60-65-60% of pre-irrigation soil moisture capacity of varieties of grapes “Kara Kishmish” and “Pushti Toyfi” relative to the LFMC irrigated by furrowing, the average weight of 100 buds of grapes was 164-178 grams, in the case of drip irrigation it was 180-182 grams, when the varieties of grapes irrigated by dripping in the 70-75-65% of pre-irrigation soil moisture capacity relative to the LFMC, it was 174-175 grams and 185-195 grams in the case of drip irrigation. Furthermore, in the control option it was 10-20 grams higher than others. Thus, the dependence on the weight of the grape cluster, as well as on the yield of the crop yield for determining the yield was observed in the studies.

In the control variant, the 60-65-60% of pre-irrigation soil moisture capacity of varieties of grapes “Kara Kishmish” and “Pushti Toyfi” relative to the LFMC irrigated by furrowing, It was found that the average weight of a grape cluster was 423 grams, in the case of drip irrigation, it was 452 grams, 402 grams in furrow irrigation for three years, 410 grams in drip irrigation or 8-29 grams higher than in the control option, and similar data were obtained for drip irrigation of “Pushti Toyfi” variety with 9–25 g higher than in the control variant, table 2.

The grape yield at 70-75-65% of the pre-irrigation soil moisture in the 5th-7th options of the irrigation with furrows for grape in relation to the LFMC was 14.7-15.2 tons/ha, in the 6th-8th options

of drip irrigation for grapes was 19.1-20.8 tons/ha or additional yields of 4.4-5.6 tons/ha were achieved from both grape varieties when drip irrigation was compared to the control option.

Table 2The effect of drip irrigation for grape varieties with snow and rainwater on yields

Op.	Weight of grape cluster, g				Vine yield, kg				Productivity, t/ha			
	2015	2016	2017	**Ov.**	2015	2016	2017	**Ov.**	2015	2016	2017	**Overall yield,**
60-65-60 relative to the LFMC												
1	430	404	435	423	29,2	16,2	17,8	21,0	13,5	12,4	13,8	13,2
2	460	433	464	452	31,2	17,3	19,0	22,5	16,6	16,5	16,3	16,5
3	407	390	409	402	27,7	15,6	16,8	20,0	13,3	13,5	13,4	13,4
4	415	397	417	410	28,2	16,1	17,2	20,7	17,4	17,8	17,9	17,7
70-75-65 relative to the LFMC												
5	410	394	412	405	27,9	15,8	16,9	20,2	14,4	14,7	14,9	14,7
6	420	400	422	414	28,9	16,0	17,3	20,7	18,8	19,0	19,4	19,1
7	377	375	372	369	26,3	14,9	16,0	19,0	14,4	15,8	15,4	15,2
8	400	380	402	394	27,2	15,2	16,5	19,6	19,8	21,2	21,3	20,8

In the cultivation of grapes, the volume of water was used in accordance with the period of flowering, ripening and development of plants. The total amount of irrigation given during the season was determined by the following formula:

$$\boldsymbol{M = \sum E - (W_n + P + \Gamma) + W_k \quad m^3/ha} \qquad \mathbf{17}$$

Here: **M**- general irrigation standard, the norm of water given per hectare of land during irrigation, m³/ha;

$\sum \boldsymbol{E}$ – gross water consumption of crops per hectare, m³/ha;

$\mathbf{W_n}$ – moisture in the calculated part of the soil until the time of planting, m³/ha.

$$\boldsymbol{W_n = 100 \cdot H \cdot d \cdot \beta_H \quad m^3/ha} \qquad 18$$

P –amount of precipitation during irrigation, m³/ha;

Γ - amount of water absorbed from the groundwater into the calculated soil layer at the end of the irrigation period, m³/ha.. The amount of "G" was calculated by using the formula of S.F.Averyanov:

$$\boldsymbol{\Gamma = \sum E\,(1 - \frac{h_r}{h_n}) \quad m^3/ha} \qquad 19$$

Here: $\mathbf{H_r}$- depth of groundwater, m.

$\mathbf{h_n}$- depth of the final rising of the capillary groundwater,

$\mathbf{h_r}$ =3,0 m.

$\mathbf{W_к}$ - amount of water in the calculated ground layer at the time of harvest, m³/ha.

$$\boldsymbol{W_k = 100 \cdot H \cdot d \cdot \beta_k \quad m^3/ha} \qquad 20$$

We can find the amount of water used for irrigation by the following formula of A.N. Kostyakov.

$$\boldsymbol{m = 100 \cdot H \cdot d \cdot (\beta_{нв} - \beta_o) \quad m^3/ha} \qquad 21$$

Here: **H** – calculated ground layer, m.

d – weight of soil, tons/m³

$\boldsymbol{\beta_{нв}}$ - maximum amount of moisture in the soil, %.

$\boldsymbol{\beta_0}$ - minimum amount of moisture in the soil, %.

$\boldsymbol{\beta_0}$= (0,6÷0,7)·$\beta_{нв}$ – in the furrow irrigation

The total water consumption of the crop was determined by using the formula of A.M. Alpatev and S.M.Alpatev.

$$\sum \mathrm{E} = H_o \cdot K_б \cdot K_k \quad m^3/га \qquad 22$$

Here: $K_б$ – 0.82 amount of biological coefficient,

$K_к$ – 0.78 amount of microclimate coefficient,

determined by the formula of Ivanov N.N.,

$$\boldsymbol{E_o = 0,018 \cdot (100 - \alpha) \cdot (25 + t) \quad m^3/ha} \qquad 23$$

$$\boldsymbol{\Delta\alpha = (100 - \alpha) \quad m^3/ha} \qquad 24$$

$$\boldsymbol{H_o^{month} = \frac{\Delta\alpha(25 + t)^2}{55,5} \quad m^3/ha} \qquad 25$$

$$\boldsymbol{H_o^{pd} = \frac{\Delta\alpha(25 + t)^2}{1695} \quad m^3/ha} \qquad 26$$

$$\mathbf{H_o} = \boldsymbol{H_o^{сут} \cdot T \quad m^3/ha} \qquad 27$$

Since the empirical coefficients in the computational method are determined as a result of direct observations, this method is a more accurate method. One such determination formula is the formula of A.N.Kostyakov.

$$\boldsymbol{E = K_w \cdot Y} \quad m^3/га \qquad 28$$

here: **E**- water consumption, m³/ha;

$\mathbf{K_w}$- coefficient of the water consumption, m³/ha;

Y- planned productivity, t/ha.

This requirement can be met by bioclimatic method (Alpatev S.M.), including:

$$\boldsymbol{E = K_b \cdot \sum d \quad m^3/ha} \qquad 29$$

here: **E –** water consumption, m³/ha

K_b- biological coefficient, mm/mb;

d- sum of the average perennial moisture deficits of the air, mb.

In determining the total water consumption of agricultural crops in arid regions, the following formula of N.N. Ivanov based on evaporation was used:

$$\boldsymbol{E_0 = 0,0018 \cdot (25 + t^0)^2 \cdot (100 - a) \cdot 0,8 \quad mm}, \qquad 30$$

here: E_0- monthly evaporation, mm;

t^0 – average monthly air temperature, ^oC;

a- average monthly relative humidity mm.

In the process of maintenance of the varieties of grapes "Kara Kishmish" and "Pushti Toyfi" in 2015, the total amount of water consumed per 1 cwt of grapes when irrigated in the order of 60-65-60% relative to the pre-irrigation soil moisture capacity of options 1-3 of irrigation control with snow and rain water was 0.133- 0.135 m^3/cwt, the amount of seasonal water consumption per 1 cwt of grapes was 7.39-7.50 m^3/cwt. Furthermore, the total amount of water consumed per 1 cwt of grapes when irrigated in variants 2-4 of drip irrigation in the same way was 0.064-0.067 m^3/cwt, the amount of seasonal water used for grapes was 14.82-15.54 m^3/cwt, 5-7 for irrigated grapes and the total amount of water used for 1 cwt of grapes was 0.130-0.135 m^3/cwt, the amount of seasonal water used for 1 cwt of grapes was 7.71-7.50 m^3/cwt, when the soil moisture was irrigated in the order of 70-75-65% relative to the LFMC. In the case of drip irrigation of grapes in 6-8 options, the total amount of water used for 1 cwt of grapes was 0.081-0.090 m^3/cwt, the amount of seasonal water used for 1 cwt of grapes was 11.11-12.40 m^3/cwt or for drip irrigation of both grapes compared to the control option and 4.4-5.6 tons/ha of additional yield was obtained from the variety.

Mathematical modeling and computer programs of irrigation methods for drip irrigation of grape varieties with snow and rain water have been developed. Based on the program of mathematical modeling of irrigation management by roughing the varieties of grapes "Kara Kishmish" and "Pushti Toyfi" were irrigated with variants 1-3 at the soil moisture varieties in the order of 60-65-60% relative to the LFMC, the grape harvest was 13.2-13.4 tons/ha, with this method yielded 16.5-17.7 tons/ha in options 2-4 of grape drip irrigation or 3.3-4.3 tons/ha in both grape varieties with drip irrigation compared to the control variant was a higher level of soil moisture provided.

In the pre-irrigation soil moisture of the control options 5-7 of the furrow irrigation for grapes at 70-75-65% in relation to the LFMC, grape yield was 14.7-15.2 tons / ha, in the options 6-8 of drip irrigation for grape, it was 19.1-20 , 8 tons/ha or 4.4-5.6 tons/ha of additional yield was obtained from both grape varieties with drip irrigation compared to the control option, or the highest yield was obtained by irrigating grapes of "Pushti Toyfi" variety with 70-75-65 % soil moisture relative to the LFMC was found to be 50.8% in the variant 8 irrigated by drip irrigation.

CONCLUSIONS

In order to alleviate water shortages in the context of global climate change, it was found that insufficient research has been conducted on the introduction of drip irrigation with snow and rain water in the meadow gray, medium sandy soils of the mountainous regions of Kashkadarya.

- it is advisable to choose drip irrigation regimes by collecting local runoff (snow and rain) in the cultivation of grape varieties in the mountainous areas.
- the slope of irrigation areas in the mountainous regions i=0,4; length l=20 m; distance between grape vines 3x2 m; water consumption in drop q=4 l/h, t =8-12 hours according to the norm of irrigation time, irrigation technical elements were determined.
- positively affecting the water physical and agro-chemical properties of the soil in the cultivation of grape varieties in the mountainous regions, the volume mass of the topsoil in the field of experiment was 1.40-1.39 g/cm^3, as a result of which it was determined that there was an opportunity for active development of the grape root.
- in the cultivation of the varieties of grapes in the mountainous regions, the content of humus and nitrogen in the driving layer increased by 0.11-0.2%. It has been scientifically proven that the same property is maintained in terms of total phosphorus and total potassium content.
- when drip irrigation in the mountainous areas with pre-irrigation soil moisture was 60-65-60% relative to the LFMC, the irrigation was 7 times in 2-3-2 scheme, the irrigation norms were 170-200 m^3/ha and seasonal irrigation norms are 1283 m^3/ha which is 627 m^3/ha less than the control, or 33% of water resources.
- the irrigation of grape drip irrigation procedures in the mountainous regions received the highest yield of grape from the "Pushti Toyfi" variety was reached to 70-75 t/ha when soil moisture was 65-20% compared to the LFMC and this was achieved to 5.6 t/ha or 24% higher than the cultivated irrigated control option.
- -in the mountainous regions, irrigation of grapes with drip took place irrigation 200 m^3/ha of soil moisture at 70-75-65% relative to the LFMC in the irrigation system 3-3-3, when seasonal irrigation standards were irrigated to 1680 m^3/ha, the opportunity to earn a maximum of 38893500 so'ms/ha was developed.

Gratitude

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