Water saving up-to-date irrigation technologies

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Abstract: This article presents the results of field experiments of the authors in theoretical and natural conditions. Field experiments were carried out on the territory of the Hodjayakshaba MFY of Kagan district, Bukhara region. The technology of muddy water irrigation for drip irrigation of gardens has been developed. The implementation of drip irrigation technology in intensive gardens has resulted in a 20-60% reduction in water consumption on arable land, up to 50% on mineral fertilizers and up to 30% on fuel and lubricants. Also, the level of ground water does not rise due to the irrigation water requirements of the plant and excessive water supply, low water evaporation from the soil, as well as uniform moisture throughout the field.

1. Introduction
Strategy of actions on five priority directions of development of the Republic of Uzbekistan for 2017-2021 in the section "Modernization and accelerated development of agriculture" will further improve the reclamation of irrigated lands, the development of melioration and irrigation facilities, intensive methods of agricultural production, modern agricultural technologies. Introduction of high-performance agricultural machinery these are the main tasks. Decree by the President of the Republic of Uzbekistan dated November 27, 2017 No PP-3405 [1, 2]

The decision was mainly aimed at improving the efficiency of irrigated land, the use of low irrigation water, and higher crop yields. The population of Uzbekistan will reach 39 million by 2030. Due to climate change, Uzbekistan's water resources are estimated at more than $ 7 billion. m³ is expected to decrease. At the same time annual water resources amount to 44 bln. cubic meters of water per capita and 1130 m³ per capita. The Decree of the President of the Republic of Uzbekistan dated October 25, 2019 "On Measures for Expanding Mechanisms to Promote the Implementation of Water-saving Technologies in Agriculture" provides for the procedure of state support for introduction of water-saving irrigation technologies from January 1, 2020. The introduction of drip irrigation technology equals to $ 8 million per hectare. Sums will be provided.

2. Methods
Alluvial, mechanically heavy sandy loam soils of Bukhara region, scientifically based on irrigation method for drip irrigation of gardens and vineyards with the level of ground water 1.5-2.0 m, mineralization 1.0-3.0 g/l and their growth. The development of scientific and practical recommendations for the study of the impact on development, productivity and productivity.

Research objectives:
- Determination of soil conditions (type, mechanical composition, water-physical properties and productivity of experimental fields);
- Determination of hydro geological and ameliorative conditions of experimental fields;
- Determination of scientifically based irrigation methods of drip irrigation of gardens and vineyards in the grassy alluvial soils of Bukhara region with mineralization of 1–2.0 m / l of ground water level 1–3 g/l;
- Determining the impact of scientifically based on irrigation regime on drip irrigation of gardens and vineyards on water-physical properties of soil, salt regime, changes in soil surface water and mineralization, their growth, development and productivity.

Field, laboratory researches and phenological observations were conducted on the basis of "Field experiments" (Research Institute of Agro technologies of Crop Breeding and Seed Production) (PITI 2007).

Drip irrigation of gardens and vineyards in muddy water with alluvial, mechanically heavy sandy soils, ground water level 1.5-2.0 m, mineralization 1.0–3.0 g / l in Kagan district of Bukhara region. A scientifically justified irrigation method has been developed and their efficiency in reducing the negative effects of river water shortages and water shortages has been established;

It is important to conserve water resources in conditions of water scarcity, apply drip irrigation technology to increase the efficiency of 1 m$^3$ of river water, to study their impact on the growth, development and productivity of gardens and vineyards [3-5].

3. Results and discussion.

More than 90% of water resources are used in agriculture, primarily in agricultural production, with the aim of ensuring food security of the population [6].

In recent years, the welfare of the population of the country has been improving dramatically, and its number has been increasing year by year. However, water resources per capita are decreasing from year to year due to limited water resources. Analysis shows that over the years, the demand for water is increasing, so we need to use a drop of water and use it wisely (table 1).

| Table 1. Irrigation norms and yield of vineyards |
|------------------------------------------------|
| **Years of research** | Experiment options | Total water consumption, m$^3$/ha | Yield, ts / ha | Water consumption per 1 ts of crop, m$^3$ | Sugar content,% |
|-----------------------|--------------------|-----------------------------------|----------------|------------------------------------------|----------------|
| 3 Year                | Furrow irrigation  | 2580                              | 152,6          | 30,1                                     | 21,8           |
|                       | drip irrigation    | 1365                              | 284,4          | 13,1                                     | 22,1           |
| 5 Year                | Furrow irrigation  | 4150                              | 198,1          | 24,4                                     | 20,7           |
|                       | drip irrigation    | 2850                              | 421,2          | 18,2                                     | 21,9           |

Drip irrigation system is a pressure irrigation system designed to supply the plant with the required amount of water to its root surface in the required amount of time.

With the introduction of drip irrigation, water use and crop irrigation have a number of advantages. With the introduction of technology, the main goal is to save water for drip irrigation, water is only given to the root zone of the field, and other areas remain dry. The irrigation regime is appropriate for the water demand of the plant and is not supplied with excessive water, with low evaporation from the soil and water does not disperse across the field.

To date, M.Khamidov, B.Matyakubov, M.Sarimsakov, Sh.Azizov, SA Mamatovs are doing research on the use of drip irrigation technology [7-14]. They were used only when muddy water was discontinued, and we had direct use without interrupting muddy water.
The implementation of drip irrigation technology of intensive orchards on the area of 3 hectares in the educational and scientific center of Bukhara branch of the Institute for Drinking Water. Given that till now drip irrigation is only used with clean water, direct drip irrigation with muddy water is practiced for the first time.

During the experiments, water savings were up to 40%, while in conventional irrigation water consumption was 4200 m³/ha, and for drip irrigation the water consumption was 2500 m³/ha (Figure 1). Fertilizers saved 52% compared to usual. At the beginning of the vegetation season, the average ground water level was 194-198 cm, and in the middle of the growing season, between July and August, groundwater levels were about 175-181 cm. The soil weight was 1.31 g/cm³ in 0-30 cm of plowed soil, 1.39 g/cm³ in subsoil (30-50 cm) and 1.40 g/cm³ in 0-100 cm layer.

![Figure 1. Watered condition of the vineyard](image)

- **Water consumption per 1 ts crop, m³/ha**
  - Irrigation: 152.6, 4, 198.1
  - Drip irrigation: 30.1, 13.1, 24.4

- **Yield, ts/ha**
  - Irrigation: 152, 4, 198
  - Drip irrigation: 284, 1, 2

Figure 1. Watered condition of the vineyard
According to the results of the limited field moisture content of the soil, in the 0-50 cm layer of soil it was 19.5% of the soil mass, while the limited field moisture content in the 0-100 cm layer was 19.8% of the dry soil weight. Drip irrigation was performed 10 times, irrigation rates were set at 240-260 m$^3$/ha, seasonal irrigation rate was 2450 m$^3$/ha, or less than 1550 m$^3$/ha was used as a control.

According to soil salinity data, at the beginning of the growing season, the chlorine ion was 0.025% at the beginning of the growing season and 0.021% at the end of the growing season, and 0.021% and 0.012% in the 0-100 cm layer, respectively. At the beginning of the growing season the dry residue in the plowed layer was 0.526%, at the end of the growing season it was 0.297%.

4. Conclusion
In the active soil layer, it was 0.479% and 0.282%, respectively, and the seasonal salt accumulation coefficient was 1.79 in the deposition layer, 1.77 in the dry residue, and 1.76 in the 0-100 cm layer, respectively. Was 70. Based on the observations of the experiments and laboratory analyzes, we can conclude the following. It is recommended to apply drip irrigation and to irrigate the soil with irrigation norms of 240-260 m$^3$/ha and seasonal irrigation norms of 2450 m$^3$/ha, keeping 70-80-60% of pre-irrigation soil moisture.

The soil layer keeps the soil soft. There is no loss of water for sewage and filtration in the field, uniform soil moisture is maintained on different slopes. Even with minimal irrigation, the growth and development of seedlings is accelerated.

Increased demand for water resources requires the efficient and rational use of water resources to mitigate the negative effects of water scarcity, achieve high yields and ensure food security. To date, research has been conducted on the development of new water-saving irrigation technologies based on scientific research, which shows that high levels of mineralization are maintained by drip irrigation. Economically, 50% of the cost will be lower and positive results will be achieved.

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