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APPLICATION AND EFFECTIVENESS OF WATER-SAVING TECHNOLOGIES

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ABSTRACT

The article effectively highlights the real importance of water-saving technologies. This highlights their potential to optimize water allocation, reduce wastage and increase productivity in agriculture. In the industrial sector, the introduction of water treatment and reclamation processes, water-saving equipment and practices appear as a means of reducing reliance on fresh water sources and minimizing the impact on the environment. In addition, discussions of household-scale water-saving appliances, low-flow fixtures, and gray water recycling systems provide practical insights for households seeking to reduce water use and lower utility costs. The article effectively highlights the true importance of water-saving technologies. This highlights their potential to optimize water allocation, reduce wastage and increase productivity in agriculture. In the industrial sector, the introduction of water treatment and reclamation processes, water-saving equipment and practices appear as a means of reducing reliance on fresh water sources and minimizing the impact on the environment. In addition, discussions of household-scale water-saving appliances, low-flow fixtures, and gray water recycling systems provide practical insights for households seeking to reduce water use and lower utility costs.

Introduction: Water-saving technologies have emerged as an indispensable tool in the ongoing struggle to conserve our planet's most precious resource - water. As the world faces increasing water scarcity and environmental pressures, the use and effectiveness of these innovative solutions have attracted considerable attention [1-3]. From agriculture to industrial processes and everyday household consumption, these technologies offer not only the promise of reducing water waste, but also the potential to revolutionize the way we interact with and manage our water resources. In this discussion, we explore the multifaceted field of water-saving technologies, exploring their diverse applications and the critical importance of their effectiveness in shaping a more sustainable and water-resilient future [4-7].

In water-saving technologies, efficiency is not just a desirable feature; it is the main criterion that determines their impact on the real world. The effectiveness of these technologies depends on their ability to minimize water use, while providing tangible benefits such as cost reduction, increased productivity, and reduced environmental impact [8-12]. Efficiency in water-saving technologies ensures that every drop of water saved maximizes its impact and offers a serious solution to global water problems [13-15]. This discussion explores the multifaceted applications and the critical role of efficiency in water conservation technologies in various sectors [16–19].

The strategy of sustainable socio-economic development of the Republic of Uzbekistan depends mainly on the development of water management, and the issue of efficient and sustainable supply of water to the territory requires comprehensive and rational use of water resources and improvement of water resources management. As we know, the management of water and water resources in the territory of Uzbekistan is becoming more complicated every year [20-22]. In order to properly and accurately manage water resources, various measures are taken, and it is necessary to choose economically acceptable options, that is, to use options that use less money and make water and water resources management more effective from an economic point of view. In the development of these measures, the climatic conditions and soil of Uzbekistan. it is necessary to take into account the quantity and quality levels of underground and surface water [23-25].

Research objects: The research object depends on irrigation methods tested in farms of Syrdarya region. In this study, researches were carried out on the modeling of the irrigation procedure and the correction of the irrigation procedure within the framework of the automated information-advisory system.

Research methods: Mathematical modeling of water resources management. Conducted on the basis of field research and observations and GIS software.

Results and Discussion: The research was conducted based on irrigation technologies and their testing processes. In addition to wastage, water lost in the field worsens land reclamation. More than half of the irrigated land in Uzbekistan is affected by various degrees of salinity.

In the conditions of increasing water scarcity, it is appropriate to manage surface and underground water in the field. Such management is highly dependent on the performance of drainage facilities. Another important point is that it is necessary to improve the widespread irrigation technology and to apply other advanced water saving technologies.

Currently, we can point out several principles for saving water resources:

1. Reduction of excess water consumption and waste during irrigation (picture).
2. Use less water for salt washing.
3. Controlling the water-salt exchange in the soil.
4. Using the results of the conducted observations, determine and carry out the time of irrigation.

The purpose of watering plants is to supply the plant with the amount of water it transpires for its physiological development. Irrigation should be organized in such a way that the root layer of the plant is moistened in one plane, and transpiration from the soil should be reduced, and a certain amount of water resources should be saved.

If the rise of the seepage water level and mineralization is controlled, there will be no need for salt washing, as a result, the water used for this can be saved and used for irrigation. In addition, using the results of the application of the automated information-advisory system in the farm area, unnecessary irrigations will be prevented by timely irrigation. At the same time, the necessary moisture for the plant is supplied on time.

Table 1 Elements of agricultural crop irrigation techniques

slope	Water consumption in Egat, l/s	Irrigation rate, m3/ha		Egata length, m	FIK in irrigation
		Gross, m3/ha	Netto, m3/ha		
Barren fields					
0,005	0,086	1023	900	87	0,88
0,002	0,157	1064	900	226	0,85
Gray grasslands					
0,005	0,284	1550	1210	100	0,78
0,002	0,362	1442	1200	150	0,83
Grassy fields					
0,005	0,471	1282	1000	209	0,78
0,002	0,389	1126	950	150	0,84
Grasslands					
0,005	0,600	1045	850	225	0,81
0,002	0,257	809	750	245	0,83

Land leveling is considered one of the most important and first-priority activities in the improvement of irrigation techniques and agrotechnics in irrigation from the surface of the land.

When carrying out this activity in low-slope fields, a small amount of soil laying and a small amount of cutting are designed. In order to create a certain slope in the direction of irrigation, a leveler equipped with "Rugby 100LR" laser equipment is used. This system works automatically.

Before starting land leveling works, the slope of the area planned to be irrigated is determined as a result of topographical surveying using laser equipment.

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Figure 1. The process of topographic surveying and land leveling using laser equipment

In discrete (stretchable) irrigation, the length of the irrigation system and the water consumption in the irrigation systems are greater than in constant flow irrigation. (see table). Such increased flows can be used in 20-25 cm deep egates with an egate interval of 90 cm. The use of increased flow reduces irrigation time, ensures uniform wetting of egates and increases the FIK of the irrigation technique.

Sprinkler irrigation is one of the methods of irrigating crops, in which water is brought into the form of artificial rain with the help of a special machine and sprinkled on the soil and plants. Watering is carried out using a fixed structure. Sprinkler irrigation is widely used in the cultivation of political, technical, food, grain and fruit crops, especially in regions with unstable humidity. Sprinkler irrigation cannot be used on highly saline soils, as it increases the salinization process. Sprinkler irrigation has a number of advantages over other methods of surface and surface irrigation:

- Conditions for crop growth and ripening are improved.

- Humidity of soil and surface air increases and temperature decreases, water loss to evaporation and transpiration decreases.

Figure 2 Drip irrigation

Based on the results of research on the technology of irrigation, laying polyethylene film between cotton rows has the following advantages:

- uniform soil moistening is ensured in long egates;
- processing between the rows is minimized, and thus the cost of production is saved;
- soil and mineral fertilizers are prevented from being washed away during watering;
- the seasonal amount of water and cotton's demand for water decreases;
- evaporation of soil moisture after watering is reduced;
- the death of weeds is observed due to the fact that sunlight does not fall under the black polyethylene film;
- the level of compaction does not occur due to the fact that the crops cultivated between the rows do not move the working bodies of the cultivator, favorable conditions are created for the rapid development of the root system due to the high-quality moistening of the fertile 0-40, 0-50 cm layer of the soil as a result of watering at low standards;
- the number of soil microorganisms and the amount of mineralized nitrogen in plant residues will increase due to the creation of an optimal irrigation and nutrient regime;
- as a result of the acceleration of biochemical processes in the soil, its biological and enzymatic activity increases

Conclusions: Water-saving technologies are an important tool in solving the problem of increasing global water scarcity and promoting sustainable water management practices. These technologies include a wide range of innovations and approaches to reduce water use in a variety of sectors, including agriculture, industry and domestic use. Water-saving technologies in agriculture include drip irrigation systems, rainwater harvesting, and precision farming methods. These methods optimize water distribution, reduce wastage and increase productivity. By using these technologies, farmers can significantly reduce water use while maintaining or even improving yields. Efficiency is a key aspect of these technologies as it maximizes water conservation measures. Efficient water-saving technologies not only minimize water use, but also make it cost-effective, making them practical and attractive to a wide range of users. Factors such as technology reliability, ease of implementation, and long-term sustainability should be considered to improve efficiency. In addition, public awareness and education are essential so that users understand and use these technologies effectively. In general, water-saving technologies play a crucial role in alleviating water scarcity and promoting responsible water use in agriculture, industry and households. Their effectiveness is important in ensuring the effective conservation of water resources, which leads to economic, environmental and social benefits.

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