Western European Journal of Modern Experiments and Scientific Methods
Volume 4, Issue 06 June 2026
https://westerneuropeanstudies.com/index.php/1
ISSN (E): 2942-1896 Open Access| Peer Reviewed

THE IMPORTANCE OF MODERN SPRINKLER IRRIGATION IN THE PRESENT DAY

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Abstract: This article highlights the importance, advantages, and efficiency of modern sprinkler irrigation in agriculture. Sprinkler irrigation technology plays a significant role in the rational use of water resources, increasing crop productivity, and maintaining soil fertility. The article also analyzes the advantages of this method compared to traditional irrigation systems, as well as its environmental and economic benefits.
Keywords: sprinkler irrigation, agriculture, crop yield, soil fertility, water resources, irrigation systems, hydrant.

Introduction: Today, the global reduction of water resources and the impacts of climate change require more efficient water use in agriculture. At the same time, the growing population is increasing the demand for food products year by year. Therefore, the introduction of modern irrigation technologies in agriculture has become increasingly important. One of these technologies is the sprinkler irrigation method.

In order to ensure the implementation of the Resolution No. 39 of the Cabinet of Ministers of the Republic of Uzbekistan, dated February 24, 2014, “On Additional Measures to Ensure the Unconditional Implementation of the State Program for Improving the Meliorative Condition of Irrigated Lands and Rational Use of Water Resources during 2013–2017,” a number of measures have been undertaken to improve the efficiency of irrigation and land reclamation activities and to ensure the rational use of water resources.

Sprinkler irrigation is a method of artificial watering in which water is applied over plants and soil through special equipment. When this method is used, not only are the plants moistened through their leaves and stems, but the soil also receives the moisture necessary for proper growth. In recent years, irrigation activities in the republic have faced challenges, and irrigation costs have become increasingly expensive. For example, irrigating one hectare of cotton may require ten or more labor days. In addition, selecting appropriate irrigation equipment and applying water according to established norms through furrow irrigation is often difficult.

Main body: Therefore, sprinkler irrigation offers several advantages:

1.Sprinkler irrigation moistens not only the plowed soil layer but also the plant and the surrounding soil, creating a favorable microclimate.

2.This method can reduce seasonal irrigation requirements by 30–40% while enabling higher crop yields.

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3.In areas where groundwater levels are close to the surface, easily soluble salts are prevented from rising to the soil surface with groundwater.

4.There is no need to construct irrigation furrows and field channels, reducing land-leveling work and making it possible to irrigate uneven terrain more easily.

5.Soil compaction and subsidence are minimized.

6.Irrigation network dimensions can be reduced by using pipes of various sizes instead of permanent irrigation canals.

7.Water flowing through deep channels can be utilized more effectively for irrigation.

8.Crop yields, including cotton and other agricultural products, generally increase because sprinkler irrigation enhances nitrification processes in the soil and prolongs the availability of nutrients to plants

9.Water consumption for irrigation can be reduced by up to 50%, while irrigation rates range from approximately 200–600 m³/ha.

10.Water applied through sprinkler irrigation does not significantly contribute to groundwater recharge, thereby helping to improve the meliorative condition of agricultural lands.

11.Sprinkler irrigation allows for more accurate planning and control of irrigation schedules and water application rates.

Maximum irrigation rate of drip irrigation, expressed in mm/min. (heading continues)

Table 1.

Soil mechanical composition	Slope of the land							
	0,01-0,05		0,05-0,08		0,08-0,012		>0,12	
	With the plant	Without plants	With the plant	Without plants	With the plant	Without plants	With the plant	Without plants
A uniform thick layer of soil	0,75	0,75	0,75	0,64	0,64	0,44	0,42	0,21
A heterogeneous thick layer	0,74	0,64	0,53	0,42	0,42	0,33	0,32	0,19
A uniform layer of light loamy soil	0,64	0,42	0,53	0,34	0,42	0,25	0,32	0,17
A heterogeneous layer of light loamy soil	0,53	0,32	0,52	0,21	0,32	0,32	0,21	0,13

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A uniform layer of loamy soil	0,42	0,21	0,34	0,17	0,25	0,13	0,07	0,09
A heterogeneous layer of loamy soil	0,25	0,13	0,21	0,11	0,17	0,07	0,13	0,04
In heavy loamy and clay soils	0,09	0,07	0,07	0,04	0,05	0,03	0,04	0,03

There are three main types of sprinkler irrigation: conventional sprinkler irrigation, pulse (intermittent) sprinkler irrigation, and mist irrigation under high pressure.

1.Conventional Sprinkler Irrigation This method involves spraying water in the form of droplets, taking into account a soil layer depth of 0.4–0.6 meters, until the air reaches full humidity saturation. The purpose is to provide the necessary moisture to both the soil and the surrounding atmosphere.

2. Pulse Sprinkler Irrigation. The main difference between pulse sprinkler irrigation and conventional sprinkler irrigation is that it primarily moistens the plant and the upper layer of the soil. Unlike the conventional method, water is applied continuously at regular intervals. Pulse irrigation is carried out using special devices in which water is first collected in a chamber and then sprayed into the atmosphere under high pressure. This process is repeated every 4–6 seconds (pause interval), while the spraying period lasts 1–2 seconds. The spraying radius is 25–30 meters, and the application rate ranges from 0.02 to 0.8 mm/min. Various types of these devices and their operating principles are described below.

3.Mist Irrigation this method is mainly intended for areas with high temperatures and low humidity. Special equipment is used to spray water under high pressure, producing a fine mist. For mist formation, relatively small sprinkler devices are used, with a water discharge rate not exceeding 0.03 L/s. Depending on atmospheric conditions, water can be sprayed over a distance of 200–300 meters. Compared with other irrigation methods, mist irrigation not only provides moisture but also creates a favorable microclimate and prevents soil aggregates from breaking down into smaller particles.

The sprinkler irrigation system is established at the water source and consists of both permanent and temporary irrigation equipment. A permanent sprinkler irrigation system is installed firmly on irrigated land using special closed pipelines. It remains in one location and can be operated for many years. A temporary sprinkler irrigation system, on the other hand, is installed using portable and detachable equipment. After irrigation is completed, the equipment is dismantled and stored for future use. Irrigation networks can be constructed as open, semi-open, or closed systems. Open irrigation networks are built using open concrete-lined canals

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or flumes. Semi-open irrigation networks may also be constructed with concrete structures; however, inter-farm irrigation channels are equipped with special sprinkler irrigation machines for water distribution. Closed irrigation networks are constructed using special pipelines. According to their operational characteristics, sprinkler irrigation systems are classified into stationary, semi-stationary, and mobile systems. In a stationary system, all components—including pumping stations, pipelines, and sprinkler devices—are installed permanently. In such systems, sprinklers should be installed in specially designed wells so that water can be distributed over long distances under high pressure. After irrigation is completed, the hydraulic pressure within the wells should be reduced because excessive water

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pressure may cause undesirable consequences and damage to the system. In a semi-stationary irrigation system, pumping stations and inter-farm distribution valves are permanently installed and remain in operation for many years. Irrigation machines can be dismantled or moved to other locations when necessary, while the sprinkler units remain fixed in place. Today, this method is widely used in agriculture. Machines such as DDN-70, DDN-100, DDA-100M(A), Fregat, Volzhanka, Dnepr, and Kuban are considered among the most efficient and compact sprinkler irrigation systems. A mobile sprinkler irrigation system consists of components that can be assembled, disassembled, and transported more easily than other irrigation systems. These systems are commonly used in pastures and vegetable-growing areas where water demand is relatively low. At the end of the growing season or at the end of the year, the equipment is dismantled and removed.

Artificial sprinkler irrigation devices, depending on their design and installation conditions in irrigation areas, are divided into sprinkler irrigation units, machines, and installations. Below, each of these types is described separately. A sprinkler irrigation unit is a movable device that can be relocated on-site, on which a sprinkler machine is installed. A sprinkler irrigation machine is also a mobile device that can be moved from one place to another. However, unlike irrigation units, its pressure-generating pumps are separate from the sprinkler machine itself. A sprinkler irrigation installation is a fixed system that is not moved from place to place. Water is supplied to the sprinklers through pressurized irrigation networks or pumping stations. A sprinkler nozzle device is a mechanism that sprays water in a fine mist form. It is installed on a hydrant. A hydrant is a device that takes water from the irrigation source or water supply system and delivers it to the irrigation equipment.

Conclusion: In conclusion, modern sprinkler irrigation is one of the most promising technologies for the efficient use of water resources in agriculture. This method is important for saving water, increasing crop yields, preserving soil fertility, and ensuring environmental sustainability. In addition, sprinkler irrigation can be effectively used in areas with uneven terrain. The uniform distribution of water ensures normal growth and development of crops, resulting in higher yields. Moreover, it allows for the application of mineral fertilizers together with irrigation water, which improves plant nutrition. In the future, the wider implementation of sprinkler irrigation technologies will significantly contribute to the development of agriculture in our country.

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