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# The Value and Realization of Efficient Water-saving Irrigation in Agricultural Water Conservancy Projects

Jinwen Yang

Lanzhou New District Water Management Investment Group Co., Ltd., Lanzhou, Gansu 730087

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**Abstract:** Efficient water-saving irrigation in agricultural water conservancy projects is an important way to alleviate the shortage of water resources and improve the efficiency of agricultural production. By analyzing the value of high-efficiency water-saving irrigation in improving the utilization efficiency of water resources, increasing the yield and quality of crops and promoting the sustainable development of agriculture, this paper introduces advanced water-saving irrigation technologies such as sprinkler irrigation, micro-irrigation and pipe irrigation, and puts forward some strategic suggestions to realize high-efficiency water-saving irrigation from the aspects of strengthening infrastructure construction, popularizing water-saving irrigation technologies and perfecting management system.

**Keywords:** Agricultural water conservancy; Water conservancy project; Efficient water-saving irrigation

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## 1. The value of efficient water-saving irrigation

### 1.1 Improve the efficiency of water resources utilization

The application of high-efficiency water-saving irrigation technology can significantly improve the utilization efficiency of water resources. The traditional flood irrigation method is easy to cause waste of water resources, and a large amount of water is lost through evaporation and deep leakage on the soil surface, which leads to low utilization efficiency of irrigation water. The advanced water-saving irrigation technologies such as sprinkler irrigation and micro-irrigation can accurately control the irrigation time and water quantity, make the crop root zone fully irrigated, and minimize the ineffective evaporation and leakage loss of water.

The water use efficiency of sprinkler irrigation technology can reach 70%-80%, and the water use efficiency of micro-irrigation technology can even reach more than 90%, which is much higher than that of traditional flood irrigation (40%-50%)<sup>[1]</sup>. This efficient way of water utilization can not only meet the needs of crop growth and development, but also save a lot of water resources and relieve the pressure of water resources in agricultural production. The effect of water-saving irrigation can be further improved by reasonably planning irrigation system, optimizing irrigation parameters and improving field water management. According to the types of crops, growth stages, soil characteristics and other factors, make a scientific irrigation plan to ensure that sufficient water is provided in the critical growth period, while the irrigation amount is properly controlled in other stages. This can not only ensure the normal growth and development of crops, but also maximize the role of water resources and realize the optimal allocation and efficient utilization of water resources<sup>[2]</sup>.

### 1.2 Increase crop yield and quality

Efficient water-saving irrigation can not only save water resources, but also significantly improve the yield and quality of crops. By optimizing the irrigation system and reasonably regulating the soil moisture status according to the different stages of crop growth and development, it can provide the best water conditions for crop growth, promote the healthy growth of crops, improve the photosynthetic efficiency, and thus increase crop yield.

Timely and appropriate irrigation can promote the development of crop roots, enhance the ability of crops to absorb nutrients and improve the efficiency of fertilizer utilization. Adequate water supply can also reduce the accumulation of soil salt and prevent the adverse effects of salt damage on crop growth. Water-saving irrigation technology can also reduce the occurrence of pests and diseases and improve the stress resistance of crops by maintaining suitable soil moisture status, thus ensuring the healthy growth of crops.

## 2. Efficient water-saving irrigation technology and methods

### 2.1 Sprinkler irrigation technology

Sprinkler irrigation technology sprays water evenly on the surface of crops and soil in the form of fog or fine water droplets through nozzles, so as to realize accurate irrigation of crops. Compared with the traditional flood irrigation method, sprinkler irrigation technology

has obvious water-saving advantages, which can improve the water use efficiency to 70%-80%<sup>[3]</sup>. Sprinkler irrigation system is generally composed of water source, water pipeline and sprinkler. According to the type and arrangement of sprinklers, sprinkler irrigation can be divided into fixed sprinkler irrigation, mobile sprinkler irrigation and central supporting shaft sprinkler irrigation. Fixed sprinkler irrigation is to fix the sprinkler in the field, which is suitable for perennial crops such as orchards and tea gardens. Mobile sprinkler irrigation is to install the sprinkler on the mobile pipeline, which can move the irrigation position as needed, and is suitable for field crops; Central supporting shaft sprinkler irrigation is to install the sprinkler on the pipeline rotating around the central supporting shaft, which is suitable for large-area round or square plots.

The quantity and intensity of sprinkler irrigation can be controlled by selecting different sprinklers and adjusting water pressure. According to crop types, growth stages and soil characteristics, scientific sprinkler irrigation system and reasonable arrangement of sprinkler irrigation time and water quantity can meet the needs of crop growth and development and promote high yield and high quality of crops. Sprinkler irrigation can also use water pressure to realize fertilization, which is synchronized with irrigation to improve the utilization rate of fertilizer.

The application of sprinkler irrigation technology can not only save water resources, improve irrigation efficiency, but also improve the growing environment of crops. Sprinkler water drops directly act on crop leaves, which can reduce crop body temperature and alleviate heat damage; Spraying water mist can also increase air humidity, reduce soil moisture evaporation and create a good microclimate environment for crops. Sprinkler irrigation can also be used to prevent frost, by spraying water mist to form an ice layer on the surface of crops, to prevent frost damage to crops.

### **3. Strategies to realize efficient water-saving irrigation**

#### **3.1 Strengthen infrastructure construction**

Water source project is the lifeblood of farmland irrigation, which is related to the quantity and quality of irrigation water. To strengthen the construction of water source projects, it is necessary to develop and utilize various water sources such as surface water, groundwater and reclaimed water according to local conditions, and build water storage facilities such as reservoirs, mountain ponds and water cellars to improve the storage capacity of water resources. Repair and reform the existing water source project, reinforce the dam, dredge and dredge, improve the safety and water storage capacity, and extend the service life of the project.

Water transmission and distribution project is the backbone project to transport water sources to irrigation areas, including channels, pipelines, pumping stations and other facilities. The aging and disrepair canals need lining seepage prevention to reduce the leakage loss in the process of water delivery; In flood irrigation area, it is necessary to carry out pipeline transformation, develop pipeline water delivery and improve water delivery efficiency; Pumping stations should be renovated and equipped with efficient and energy-saving pumps in the pumping irrigation area to reduce the energy consumption of pumping water. Accelerate the development of rural power grid, improve the reliability of power supply, and provide stable power guarantee for irrigation and water pumping.

Farmland infrastructure construction should be matched with field projects, promote farmland improvement and land leveling, and improve field production conditions. Build high-standard farmland, implement land leveling and soil improvement projects, improve farmland quality and promote water-saving irrigation. Build a shelterbelt network around farmland to reduce wind erosion and water evaporation in farmland. Renovate terraces and build water retaining ridges to enhance farmland water storage and moisture conservation capacity and prevent soil erosion.

Strengthening infrastructure construction is the basic work to realize efficient water-saving irrigation. It is necessary to take the construction of farmland water conservancy infrastructure as the top priority of water-saving irrigation, improve the engineering facilities of water source, water transmission and distribution, field irrigation and other links, and improve the degree of farmland water conservancy. Increase investment, innovate investment and financing mechanism, and raise construction funds through multiple channels.

#### **3.2 Promote advanced water-saving irrigation technology**

Water-saving irrigation technology is the key to realize efficient agricultural water use and improve irrigation efficiency. In recent years, China's water-saving irrigation technology has been continuously innovated and developed, and a number of advanced and practical technical models have been formed, which has provided strong support for agricultural water-saving and efficiency-increasing. But on the whole, the popularization and application of advanced water-saving irrigation technology is not popular enough, especially in some agricultural provinces and traditional irrigation areas, the level of water-saving irrigation is still relatively backward, and it is a long way to go to popularize advanced water-saving irrigation technology.

To popularize advanced water-saving irrigation technology, it is necessary to strengthen the promotion of science and technology and establish and improve the technology promotion system. Agriculture, water conservancy, science and technology departments should strengthen

cooperation, jointly tackle key problems, strengthen research on key technologies of water-saving irrigation, and break through technical bottlenecks that restrict the development of water-saving irrigation. It is necessary to sum up and popularize successful experiences and advanced practices in typical areas and accelerate the transformation and application of advanced and practical technologies.

Water-saving irrigation should be combined with agronomic water-saving measures to achieve efficient utilization of agricultural water resources. Popularize agricultural water-saving technologies such as plastic film mulching, straw returning and subsoiling tillage to reduce soil moisture evaporation and improve soil water storage and moisture conservation capacity. Optimize crop planting structure, select and popularize drought-resistant and water-saving varieties, and improve crop drought tolerance and water use efficiency. Rational distribution of crops, adjustment of planting system, and optimal allocation of water for agricultural production.

#### 4. Conclusion

Efficient water-saving irrigation is an important development direction of agricultural water conservancy projects, which is of great significance for alleviating water shortage, improving agricultural production efficiency and promoting agricultural sustainable development. To realize efficient water-saving irrigation, the government, society, farmers and other parties need to work together, increase investment in infrastructure, vigorously promote advanced and practical technologies, improve the management system and incentive mechanism of water-saving irrigation, optimize the allocation of regional water resources, and improve farmers' awareness and ability of water saving.

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