Current Situation and Development Countermeasures of Water-Saving Irrigation in Agriculture in China

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Abstract. China is short of water resources, uneven spatial and temporal distribution, and low utilization rate of agricultural water, the development of water-saving agriculture is imperative. This paper briefly reviews the development process of water-saving agriculture in China, analyzes the problems existing in water-saving agriculture irrigation at the present stage in China from the aspects of technology, policy, fund, management, talent and concept, and puts forward the corresponding development countermeasures.

1. Introduction
Water is the lifeblood of agriculture and the lifeblood of the national economy and human development. The state of water resources and the level of utilization have become important indicators for evaluating the sustainable development of a country's economy in a region. China's water resources are scarce. The annual average total freshwater resources is $2.8 \times 10^{12}$ m$^3$, accounting for about 6% of the world's total, but the per capita water resources are only 2300 m$^3$, which is only 1/4 of the world average. It is one of the poorest countries in the world [1]. The arable land resource is 28500 m$^3$/hm$^2$, which is 4/5 of the world average [2]. In addition, China's water resources are unevenly distributed in time and space. In the south of the Yangtze River Basin, water resources account for 81% of the country's total, and cultivated land area accounts for 36% of the country's total. In the north of the Yangtze River, water resources and cultivated area account for 19% and 64%, the rainfall is unevenly distributed throughout the year, mainly concentrated in June to September, and the flood season often occurs in the form of heavy rain. The difficulty of use is low and the degree is low, which leads to frequent floods and droughts in China. The water resources and production are not compatible and uncoordinated. Increasingly prominent [3]. In recent years, China's economy has continued to develop, and water pollution problems have become more prominent. With the acceleration of urbanization and ecologicalization and the improvement of people's living standards, more attention has been paid to water quality requirements. The contradiction between water demand and supply has also intensified. Water shortage in China [4].
Agricultural water accounts for a large proportion in China, reaching about 75%. However, China's water resources are severely wasteful and its effective utilization rate is low. The survey shows that the canal lining rate currently accounts for 3/4 of the irrigated area in China. It reaches about 30%, and the effective utilization rate of water resources is only about 40%. Although the channel irrigation technology, low-pressure pipeline water transfer, small hoe irrigation, sprinkler irrigation, and micro-irrigation are used in well irrigation areas, the utilization rate is only 60%, at present, China produces less than 1kg of grain per 1 m$^3$ of water, while some developed countries produce more than 2kg of grain per 1 m$^3$ of water [5]. The effective utilization rate of agricultural water in these developed countries can reach more than 80%, thus it can be seen that the development degree of agricultural water-saving in China is still relatively low, and there is still a big gap with that in developed countries.

It is predicted that China's population will reach 1.6 billion around 2030, and the grain needs to grow to more than 640 million tons. The corresponding irrigated area needs to grow to more than 9 billion mu to meet People's Daily needs [6]. So the development of water-saving agriculture, improve the utilization of agricultural water resources is the only way to ensure the country's food security is the inevitable requirement, at the same time, we also see the development of water-saving agriculture in China's great potential and broad prospects [7].

2. Current situation of agricultural water-saving irrigation in China

Agricultural water-saving is an important branch of social and economic development in China, and agricultural water-saving irrigation technology is developing continuously with the development of social and economic development [8]. China's agricultural water-saving irrigation technology began in the 1950s, and its development mainly went through the following four stages:

The first stage, early 1950s: China mainly implemented channel lining and small border irrigation, and began to introduce small water-saving irrigation equipment and technology from abroad for demonstration application.

The second stage, the mid 1970s: this stage is early water-saving irrigation industry development in our country, the irrigation mainly adopts the water flooding on the ground, channel lining, low pressure pipeline irrigation mode of development faster, from the developed countries the introduction of water-saving irrigation technology in China is mainly for digestion, absorption, and domestic production of micro-irrigation, sprinkler irrigation products less, weak.

The third stage, the early 1990s: this one phase is China's water-saving irrigation industry rapid development, countries begin to intensify efforts to promote water-saving irrigation technology, and through the establishment of the demonstration zone, policy support, capital support and other means to support and promote the development of water-saving irrigation, industry, domestic enterprises have sprung up water-saving irrigation products, has formed a certain scale.

The fourth stage, early 21st century: water-saving irrigation production enterprises have increased significantly, their products have developed rapidly in quantity in a short period of time, and the market competition is fierce. However, most of them have small scale, little capital, low technical level, unstable product quality, and weak innovation ability, which are far behind those of developed countries [9]. Agricultural development in China has gradually changed from scale to quality improvement and efficiency enhancement, with the pursuit of high efficiency in water resources utilization and the improvement of water resources utilization efficiency as the main development goal.

In recent years, China has attached great importance to the work of water-saving in agriculture. The no. 1 document of the central government has been focusing on the importance of water-saving irrigation with ink for many years in the development of agricultural modernization.

Successively promulgated "The regulations on the irrigation and water conservancy", "The national agricultural sustainable development planning (2015 ~ 2030)", "About accelerating the development of efficient water-saving irrigation implementation opinion", "Concerning the contract of water-saving management opinion", "To promote the development of water conservation service industry and the water pollution prevention plan of action", "Much starker choices-and graver consequences-in new 100 million mu efficient implementation scheme of water-saving irrigation area", such as for water-
saving irrigation, the industrial policy of the industry, has launched the northeast water saving food, northwest of water-saving efficiency, water pressure, water saving and emissions reduction, south of north China area scale efficient water-saving irrigation project construction, and cooperate with the policy of funds, the national investment in agricultural development, water-saving irrigation industry is facing new opportunities and challenges, the industry development potential and good prospects [10].

3. Problems existing in agricultural water-saving irrigation in China

(1) Low technical level. The equipment types are few, the quality is low, the craft is backward, for example, the low pressure pipeline system pipe fittings pipe material is not strictly standardized; The durability of sprinkler head and control system is poor and the uniformity is not high. Micro-irrigation equipment is easy to aging, easy to block the filtration system; the matching system of piped-irrigation technology in the field cannot keep up; Drip irrigation plastic film under the membrane is fragile and difficult to recover [11], which brings "white pollution" to farmland, etc. Water-saving irrigation technology adaptation conditions, water-saving mechanism, and optimization of supporting facilities need to be further studied and discussed.

(2) The relevant legal system is not perfect. In recent years, China has introduced a lot of water-saving related regulations and policies, but the legal system is not sound enough. In recent years, although China has introduced a lot of water-saving regulations, the relevant laws and regulations are still not sound and perfect, and the market mechanism of water-saving irrigation is lacking.

(3) Multiple management disorder. At present, most water-saving irrigation tasks are undertaken by water conservancy departments, while water-saving irrigation in agriculture involves many departments. The division of responsibilities between departments is not clear, the coordination and linkage mechanism is not perfect, and the coordination and unified management is lacking. Therefore, the overall progress lags behind [12].

(4) Insufficient capital input. In addition to national policy support, local enterprises and farmers also need their own support. However, at present, social investment capital is more inclined to crops with high economic returns and fast returns, and farmers' willingness is not strong.

(5) There are technical barriers [13]. Water-saving irrigation technology, involving areas such as agriculture, geology, information engineering, chemistry and other disciplines, domestic currently able to provide a full range of services from design - production - construction - maintenance enterprise rarely, coupled with the technology of universality and comprehensiveness, businesses can't short time get enough technical knowledge to provide a high level of service.

(6) Imperfect management and protection mechanism. At present, the government's investment is mainly in the construction and equipment of water-saving projects, but the management and protection mechanism of project operation is not perfect, and the long-term mechanism has not been established. Besides the shortage of funds, the management and protection subject is not clear [14].

(7) Insufficient talent reserve. Water-saving irrigation needs to adapt measures to local conditions, so it requires talents in the industry to have a higher comprehensive quality, not only to master the product mechanism, but also to provide construction technical guidance and follow-up technical services according to the situation. However, at present, China is short of talents in this regard, and there is a big gap.

(8) Weak sense of water-saving. The majority of the people have a poor understanding of water conservation and a lack of crisis awareness. They believe that water is inexhaustible, and they seriously lack the awareness and concept of conservation. They are resistant to carrying out water-saving irrigation and do not cooperate with it.

4. Development countermeasures of agricultural water-saving irrigation in China

(1) Establish a scientific pricing mechanism for water. At present, China's rural water use is very preferential, whether it is domestic water or agricultural irrigation water price is too low, underestimate the benefit of agricultural water-saving, promote the waste of water resources utilization,
and restrict the development of water-saving agriculture. The establishment of a scientific and reasonable water pricing mechanism enables farmers to realize the scarcity of water resources and their role in agricultural production.

(2) Strengthening the focus of water-saving agriculture. At present, the focus of water-saving agriculture in China is on engineering equipment, but the focus of water-saving agriculture is ignored in the field, whether it is irrigated area or dry area, we should pay equal attention to development. Through a variety of measures, reduce unnecessary evaporation, further improve the efficiency of water resources.

Strengthening project management and personnel training. The state should introduce the corresponding standards for water-saving irrigation projects, determine the level and qualification of enterprises, and strengthen the supervision of enterprises and projects. The state and enterprises should also strengthen the cultivation of talents in the direction of water-saving irrigation, learn and train relevant knowledge, and strengthen the construction of talent team.

(4) Increase publicity, policy support and capital input. Countries publish relevant policy to promote the construction of water-saving agriculture, late for water-saving irrigation equipment, training, consulting services, etc, capital investment, governments at all levels as the leading factor, adopt diversified financing mechanism, the significant water conservation policy at the same time, arouse the enthusiasm of social participation, and guide the social investment, farmers capital contribution, and train the people to develop water saving consciousness. At present, China's water rights and water pricing system is not perfect. Adopting the PPP model can not only solve the problem of "re-establishment and light management", but also provide services for the construction of water-saving agriculture with social capital and resources [15].

(5) Develop irrigation technology according to local conditions. According to the geology of different areas and the situation of crop planting, develop the water-saving irrigation technology. After years of research and summary, the arid and hilly areas suitable for the development of drip irrigation, arid and semi-arid areas to use more rainwater collection technology, well irrigation area suitable for the use of low-pressure pipeline water transfer technology, river irrigation area suitable for the promotion of channel anti-seepage technology, vegetables and other cash crops suitable for the development of micro-irrigation drip irrigation infiltration technology [16].

(6) Improving water-saving irrigation systems. Develop a reasonable and scientific crop irrigation system in the region to ensure the effective use of water resources during the critical growing period of crops and in the dry season to ensure the minimum water demand, ensure the stable crop yield, and realize the effective use of irrigation water. We will establish a multi-level water-saving model for irrigation and let farmers choose their own irrigation based on the actual situation.

(7) Increase innovation in water-saving equipment. At present, China's agricultural water-saving irrigation develops rapidly, but the innovation intensity is not enough, so we should increase the investment in innovation research and development, research and development of more intelligent, automatic, accurate products, and further improve water efficiency.

(8) Establishing a reward and punishment mechanism for agricultural water-saving. The government has introduced relevant policies, coordinated and coordinated the responsibilities of various departments, strictly implemented the quota standards for agricultural irrigation water, established a joint assessment and supervision mechanism of departments, and imposed a certain proportion of punishment for those exceeding the quota and a certain proportion of stepped rewards for those not exceeding the quota. We will stimulate the enthusiasm of farmers and promote the development of water conservation in agriculture.

(9) Strengthening the management and protection mechanism in the later stage of water-saving system. The management and protection of water-saving system in the later stage is the key to realize water-saving agriculture. To ensure the "construction of a project, implementation of a set of mechanisms, the formation of a model for the benefit of the people" [17].

(10) Raising farmers' awareness of water conservation. We will increase education, publicity, and guidance so that farmers can realize that water resources are non-renewable and very valuable, and
that saving water can not only increase incomes but also protect the ecological environment [18]. In the establishment of efficient water-saving agriculture, through the adjustment of planting structure, subsidies to farmers, increase farmers' income.

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