



Research on Irrigation Data of Agricultural Greenhouse by Big Data Analysis Technology

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Abstract. In order to improve the efficiency of agricultural greenhouse irrigation, the research on water-soluble fertilizer proportioning technology for agricultural greenhouse irrigation based on big data cloud platform was put forward. Firstly, the characteristics of irrigation and non-integrated technology were introduced, and then the management mode of water-soluble fertilizer proportioning machine for agricultural greenhouse irrigation technology based on big data cloud platform was analyzed. It adopts the management mode of user+fertilizer dispensing self-service machine+plot soil testing formula database based on GIS+e-commerce platform+fertilizer manufacturer, and adopts the management mode of automatic control, physical measurement, sensor, computer management and other technologies to realize the sales and purchase processes such as self-service ordering, payment and logistics management of the Internet of Things. Through the automatic fertilizer distribution equipment and software system, with the fertilizer distribution cloud platform management system as the core, the farmer information, regional location information, farmland information and crop information are integrated to realize automatic, intelligent and remote management of fertilizer sales and irrigation management.

Keywords: Big data technology; Agricultural greenhouse irrigation; Water and fertilizer integration technology; Fertilizer distribution platform

1 Introduction

Globally, agriculture has been the largest water consumption sector, accounting for about 70% of the total water consumption. Among them, nearly half of the water is wasted in the process of irrigation [1]. According to the statistics of China's water resources bulletin in 2010, the total water resources in China are 3.1 trillion m³, and the per capita water resources are only 2255m³, which is only 1/4 of the world average level. Among them, the total water consumption is 318.22 billion m³, accounting for 10.3% of the total water resources in China. In the total water consumption in 2010, agricultural water consumption accounted for 73.6%, industrial water consumption accounted for 11.2%, domestic water consumption accounted for 12.4%, and ecological and environmental water consumption accounted for 2.8% [2-3]. Therefore, agricultural water consumption is still the most important component of China's

total water consumption. At present, the speed of urbanization is accelerating, and the shortage of water resources is increasing. At the same time, with the transfer of agricultural population to cities, it is also more difficult to hire workers in agricultural development [4].

2 Technical characteristics of water and fertilizer integration

Water-fertilizer integration technology is an agricultural high-tech practical technology that integrates irrigation and fertilization. It is a comprehensive technology that delivers fertilizer solution to the soil surface or soil layer near the roots of crops uniformly, accurately and directly at a small flow rate through the pressure pipeline system and the emitter installed on the last pipeline according to the law of crop water and fertilizer demand and the soil moisture and nutrient status [5].

2.1 Save water resources

Drip irrigation, micro-sprinkler irrigation, etc. are used to drip into crop roots through controllable pipes, so as to reduce water infiltration and evaporation, improve water utilization rate, and usually save 30% ~ 40% water [6].

2.2 Improve fertilizer utilization rate

Directly transporting the dissolved liquid fertilizer to the concentrated parts of the roots of plants can reduce the volatilization and loss of fertilizer and the fixation of nutrients by soil, thus realizing centralized fertilization and balanced fertilization, generally saving 30%~50% of fertilizer.

2.3 Reduce pesticide consumption

The integrated technology of water and fertilizer can reduce the humidity of greenhouse vegetables by 8.5%~15%, reduce the occurrence of diseases and insect pests, and reduce the number of times of ventilation and humidity reduction, so that the temperature in the greenhouse can be increased by 2~4C, so that crops can grow more robustly and enhance their ability to resist diseases and insect pests, thus reducing the amount of pesticides [7-8].

2.4 Improve crop yield and quality and increase economic benefits

Because of the balance of water and fertilizer, the crops with integrated water and fertilizer have full fruit shape and big head, which can usually increase the yield by 10%~20%. In addition, due to the reduction of pests and diseases, the number of rotten fruits and deformed fruits is reduced, the fruit quality is obviously improved, and the economic benefits are increased. Taking cucumber cultivation in protected facilities as an example, the application of integrated water and fertilizer technology re-

duced the number of deformed cucumbers by 21% and increased the yield of cucumber by 4.2t/hm² compared with conventional border irrigation and fertilization. The output value increased by 20.34 million yuan /hm² [9-10].

2.5 Cost saving and efficiency improvement

The traditional irrigation and fertilization method is to dig holes or open shallow ditches for each fertilization, and then irrigate after fertilization. Using the integrated technology of water and fertilizer to realize the synchronous management of water and fertilizer can save the time and cost of artificial furrowing and fertilization and irrigation, and at the same time save a lot of labor force, thus achieving the purpose of cost saving and efficiency increasing [11].

2.6 Improve the soil micro-ecological environment

Water-fertilizer integration technology reduces soil bulk density, increases porosity, enhances the activity of soil microorganisms, promotes the absorption of nutrients by crops, and reduces nutrient leaching, thus overcoming soil hardening and groundwater pollution, and greatly improving the comprehensive productivity of cultivated land.

3 "Water-soluble fertilizer dispenser for agricultural greenhouse irrigation based on big data cloud platform"+"fertilizer dispensing cloud platform management system" management mode

Figure 1 shows the management system of water-soluble fertilizer dispenser+fertilizer dispensing cloud platform for agricultural greenhouse irrigation based on big data: cloud platform [12]. The system includes hardware equipment and software management system. The localized intelligent equipment has powerful monitoring and management functions, real-time acquisition, timely display of operating conditions and related data, vivid images and strong dynamics. Self-check and alarm system for failure can automatically display or print the time, nature and location of failure, and give audible and visual alarm; Its control mode can be divided into remote automatic mode, local automatic mode, local manual mode and local instrument control mode. The control system has interlocking protection function [13]. The software management system collects a large number of regional soil characteristic parameters to provide reliable basis for fertilizer proportioning; The whole system adopts modular structure, with good openness, easy expansion, stable and reliable performance; It also has mobile phone software, which includes a series of value-added services such as communication, expert consultation, appointment and arrangement, fertilization guidance, planting guidance, and product consignment. It makes the most important water and fertilizer factors in agricultural production scientifically and intelligently managed, and has the function of collecting big data of agricultural production, accu-

mulating the most valuable first-hand data for further upgrading of agricultural modernization. As shown in Table 1 and 2, the functional modules of intelligent irrigation system are introduced [14-15].

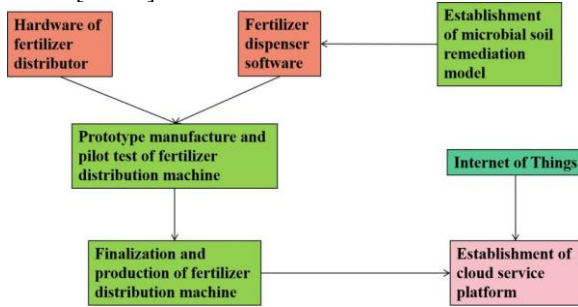


Fig. 1. Intelligent water-soluble fertilizer dispenser+fertilizer dispensing cloud platform management system based on big data cloud platform

Table 1. Introduction of functional modules of sensing layer and transmission layer of intelligent irrigation system

Key points of design	Main design contents	
Perception layer	Using Zigbee technology, the wireless sensor network of the basement is constructed to collect and adjust environmental information.	
	Coordinator module	Wireless communication with router, serial communication with wF module
	Road device module	Wireless communication with Zigbee terminal node and wireless communication with coordinator
	Acquisition module	Zigbee terminal nodes are connected with various sensors to collect and transmit environmental parameters.
	Control node module	The Zigbee terminal node is connected with the control device, receives the control instruction and executes the corresponding operation.
	Video surveillance	The camera takes pictures regularly to record video.
transport layer	WiFi network transmission	The gateway wirelessly transmits data to the server management system through the Internet TCPMIP protocol. 8 The service management system analyzes and processes the received data. The control instruction is sent to the gateway through TCPIP protocol, and the gateway sends the control instruction to Zigbee coordinator through the interface.
	GPRS network transmission	Using CPRS network to realize remote transmission of information in WiFi-free environment

Table 2. Introduction of application layer functional modules of intelligent irrigation system

Key points of design	Main design contents	
Application management	Multiple control and management modes for users to operate and manage anytime and anywhere; Applying the big data strategy, data analysis and processing, and based on the weather forecast information of the National Meteorological Administration, prompting the adjustment of sprinkler irrigation strategy.	
	Desktop version management system	The PC-side management software of the monitoring center saves the collected information to the database, and sends control instructions to automatically adjust the environmental parameters according to the strategy of agricultural experts.
	Mobile end wall management system	Based on Android platform, it uses asynchronous multithreading to interact with Webservice server, which allows users to view the environmental parameter well through smart phones anytime and anywhere for intelligent management.
	Web version management system	Based on ASPNET platform, it uses SOAP protocol to interact with Webservice server, which allows users to view environmental parameters and manage them intelligently through any networked computer.
	Voice control mode	Through voice recognition technology, the home-style balcony garden can be controlled by user voice.

Technical innovation: Cloud service platform for fertilizer distribution in agricultural greenhouse irrigation [16-18]. Cloud service platform for fertilizer distribution in agricultural greenhouse based on Internet of Things and agricultural big data, making full use of the advantages of information technology, to achieve accurate management and instant service in the whole process of fertilizer distribution; The model of liquid microbial soil remediation agent enables the software system of fertilizer dispenser to give the best dosage and application method of liquid microbial soil remediation agent according to soil parameters, crop parameters and fertilizer allocation parameters, so as to realize equal emphasis on chemical fertilizer reduction and soil remediation and sustainable development of land. Taking a variety of field crops and greenhouse crops as target crops, research and develop the most suitable formula of powdery water-soluble fertilizer and microbial soil remediation agent; Popularize the fertilizer dispenser of water-soluble fertilizer in agricultural greenhouse irrigation based on big data cloud platform, promote the sustainable development of land and increase crop yield, provide farmers with convenient fertilizer purchase experience, and reduce farmers' fertilization costs [19-20].

4 Conclusion

Based on the advantages of water-fertilizer integration technology of greenhouse tomato under agricultural big data, this paper introduces the management mode of "water-soluble fertilizer dispenser for agricultural greenhouse irrigation based on big data cloud platform"+"fertilizer distribution cloud platform management system". Because the application of water-fertilizer integration technology in agricultural greenhouse based on agricultural big data has many advantages introduced in this paper, it is worth popularizing and applying in current planting. In addition to meeting the general requirements of watering and fertilization introduced in this paper, we should do a good job in assembling and planting the system, carry out specific operations according to the requirements of irrigation and fertilization, and do a good job in maintaining the system to ensure its full play.

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