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Application of Modern Information Technology in Agrometeorological Service

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Abstract: Meteorological service is the key to China's agricultural field to respond to meteorological changes and improve agricultural production quality. The application of modern information technology in agricultural meteorological services has changed the traditional method of data collection and processing of agricultural meteorological services. Meteorological services have become more accurate and intelligent as the speed and accuracy of meteorological forecasting have also been greatly improved, which can better meet the needs of modern agricultural development. Given this, this paper briefly explains the current situation and development trend of agricultural meteorological services, analyzes the application significance of modern information technology in agricultural meteorological services, and discusses the information technology related to meteorological services. On this basis, the paper puts forward specific application strategies of modern information technology in agricultural meteorological services, hoping to improve the quality of agricultural meteorological services.

Keywords: Information technology; Agriculture; Weather services

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1. Introduction

With the rapid development of modern agriculture, meteorological information plays an increasingly prominent role in agricultural production and has become a key factor to guide agricultural production and ensure food security. The traditional agrometeorological service is limited by the technical level and the information dissemination mode, and it is difficult to meet modern agriculture's demand for meteorological information with high timeliness, precision, and high coverage. The rapid development of modern information technology has provided strong technical support for the transformation and upgrading of agricultural meteorological services. This paper aims to discuss the application of modern information technology in agricultural meteorological services and analyze how to improve the ability of meteorological information collection, processing, transmission,

and application, to provide a strong guarantee for the sustainable development of agriculture.

2. The status quo and development trend of agrometeorological services

2.1. Application status of modern information technology in agrometeorological services

Modern information technology has a wide range of application space in agricultural meteorological services and has achieved certain application results. Specifically, modern information technology has subverted the traditional meteorological data collection and transmission mode. With the help of UAV, remote sensing technology, and other technical means, agricultural meteorological data can be collected in real time and accurately, and quickly transmitted and shared through Internet channels [1]. In addition, with the help of artificial intelligence and big data, massive agrometeorological data can be efficiently stored, processed, and analyzed, to mine more valuable information and provide a more accurate decision-making basis for agricultural practitioners.

2.2. The development trend of agrometeorological services

Meteorological services will become more personalized and precise by combining the power of modern information technology with practical agricultural production. Meteorological services can customize differentiated meteorological services for different regions and crops to accurately respond to the diversified requirements of agricultural production [2]. Intelligence and automation will become the new normal of agricultural meteorological services. With the help of cutting-edge technologies such as artificial intelligence and the Internet of Things, the collection and analysis of agrometeorological data will be automated to provide intelligent early warning and decision-making aid for agricultural production. Agrometeorological services are developing in a more open and shared direction. The establishment of a sharing platform and open mechanism can promote the interconnection of agrometeorological data, promote the co-evolution of services, and enhance overall efficiency. Thus, agrometeorological services will move towards integration and diversification. Based on traditional weather forecasting and meteorological data analysis, multiple agricultural information such as soil moisture and crop growth conditions will be integrated to provide farmers with more comprehensive and integrated services [3].

3. The significance of modern information technology in the application of agricultural meteorological services

3.1. Conducive to the sharing of agrometeorological resources

The information provided by the traditional meteorological service has a lag, which will lead to misleading agricultural producers and indirectly affect the planting and growth of crops [4]. At present, China's agricultural field is changing in the direction of cross-regional development, and agricultural meteorological services urgently need to make adjustments and scientific layout according to the agricultural layout and climate characteristics of different regions, to ensure help and guidance for agricultural production. With the help of the Internet and information technology, the circulation and sharing of meteorological data and products can be realized throughout the country, and the development and progress of a trans-regional agricultural economy can be promoted [5].

3.2. It is conducive to the development of diversified agrometeorological services

With the rapid development of science and technology, relevant researchers need to devote themselves to in-depth research on meteorological services and rely on efficient data analysis and accurate monitoring equipment

to achieve the goal of efficient collection and processing of meteorological information [6]. Remote sensing technology can provide agricultural resources and environmental information, such as moisture, soil, etc., as well as meteorological information required by various agricultural fields, such as cloud cover and temperature, and so on, to provide technical support for agricultural production planning and meteorological disaster early warning and evaluation. At the same time, the intelligent information processing system can process meteorological data more conveniently, and then assist farmers in formulating scientific and effective production plans in time, and effectively enhance the ability to resist natural disasters [7].

3.3. It is conducive to enhancing the accuracy of meteorological prediction

The growth and development of crops will be affected by the change of climate and the change of seasons, and abnormal climate will lead to the reduction of crop yield and even the occurrence of diseases and pests. To ensure the timely and accurate transmission of meteorological information, farmers can accurately grasp the sowing time and provide an implementation basis for subsequent fertilization and irrigation operations [8]. In the busy farming season, farmers pay special attention to all kinds of meteorological information, especially extreme weather conditions such as frost, strong wind, and precipitation. Thanks to the strong support of modern information technology, the accuracy and science of meteorological information have been greatly improved, so that agricultural practitioners can carry out scientific planting, and thus improve the yield and quality of crops.

4. The key technologies of agricultural meteorological service application based on modern information technology

4.1. Data collection and processing technology

Advanced sensors and monitoring equipment, such as temperature sensors, rainfall sensors, and so on, enable real-time monitoring of key meteorological elements such as temperature and rainfall in the environment. The integration of these sensors and the Internet of Things technology can improve the accuracy of data acquisition and analysis, and reduce the error caused by human factors [9]. Through high-speed wireless communication technology, such as TPUNB technology and LPWA technology, it can provide suitable field operation environment data transmission technology, to provide the whole process of crop growth detection, and realize integrated water and fertilizer management. The cloud computing platform can quickly store and analyze the massive raw data generated by various farmland equipment, and extract valuable information to provide guidance for agricultural production. In addition, artificial intelligence, especially the application of machine learning algorithms, can automatically analyze, learn, and predict future meteorological trends based on historical meteorological data, improving the accuracy of meteorological forecasts [10].

4.2. The application of information technology in meteorological forecasting technology

In terms of meteorological monitoring, remote sensing technology is also being used to monitor meteorological changes. Modern meteorological forecasting uses remote sensing technologies, such as sounding and satellites, to monitor farmland environment and obtain meteorological data such as atmospheric temperature, cloud cover, and precipitation, providing information support for meteorological forecasting, climate change, and disaster early warning [11]. This data information will be transmitted to the meteorological processing center, through the computer system for processing and analysis. Weather forecasting models are used by meteorological departments to simulate and predict weather changes, providing additional assurance for agricultural decisions. Finally,

by using visualization technology, the complex forecast results are transformed into concise weather forecast information and transmitted to farmers.

4.3. Agricultural expert system

The main purpose of agricultural expert systems is to use the knowledge of human experts to solve problems in the field of agriculture. It carries a large amount of expert-level agricultural knowledge, through the collection of crop growth information and farmland meteorological information analysis, combined with a large amount of experience and knowledge in the system and imitates human problem-solving strategies, to generate targeted agricultural decision-making guidance suggestions. It provides detailed guidance for farmland management and crop planting timing, irrigation amount, and fertilizer amount to assist farmers in planning scientific and reasonable agricultural production programs [12].

4.4. Internet of Things technology

With the help of sensors and monitoring devices, real-time farmland meteorological data can be collected, and these data can be uploaded to the cloud platform through the Internet of Things technology, so that farmers can obtain the latest farmland meteorological information immediately through smart mobile devices, to achieve remote monitoring of farmland [13]. In addition, by connecting farmland equipment with the Internet of Things, such as the greenhouse control system and the Internet of Things, the system can automatically adjust temperature parameters according to the real-time meteorological data and the actual needs of crops, effectively saving farmers' labor costs and time costs.

5. The application measures of modern information technology in agricultural meteorological services

5.1. Establishing a complete meteorological forecasting system

The level of meteorological service directly affects the effect of agricultural disaster prevention and reduction. To effectively resist natural disasters, it is necessary to strengthen meteorological monitoring and keep track of climate change, detect climate anomalies in time, and take effective preventive measures to ensure the steady progress of agricultural production [14]. In this regard, it is necessary to strengthen the management of meteorological work, build a perfect meteorological monitoring network, follow the established norms to operate, and fully grasp the actual situation of climate. At the same time, weather forecasts should be released through diversified information channels, so that farmers can take appropriate disaster prevention measures in advance.

5.2. Information sharing promotes the development of new agriculture

With the development of modern agriculture, the traditional meteorological service system has limited agricultural production, and its support for the agricultural field is inadequate. At the same time, in terms of concept and technology, the traditional weather forecast business also has certain limitations. With the development of the information age, the weather forecasting business is also ushering in new development opportunities. With the help of modern information technology, farmers can obtain more diversified and detailed weather information, which provides more complete weather data for China's agricultural development.

5.3. Establishing a meteorological service platform

Through various media channels such as websites, new media, and television, service sites can be established in each region to build a comprehensive professional service platform. In addition, for different types of natural disasters, it is necessary to establish a systematic management system and formulate corresponding coping strategies according to specific problems to improve the efficiency of emergency response.

Relevant departments should build agricultural meteorological service platforms based on local conditions and release meteorological information in a timely and accurate manner. The platform should also provide agricultural producers with scientific planting suggestions and disaster prevention and reduction programs to further expand the field of agrometeorological services. In the process of construction of the platform, modular service items should be provided on the website according to different needs, so as to provide agricultural producers with more high-quality and convenient meteorological information services.

5.4. Innovative meteorological service means and models

Meteorological monitoring and forecasting play an important role in the traditional agrometeorological system. With the progress of modern science and technology, agroclimatic service needs to highlight its unique media attributes of the times and optimize and improve the traditional media service to provide high-quality public climate service to agricultural production and economic growth [19]. In addition, the continuous optimization of 5G network technology and the continuous innovation and progress of all media make people prefer to obtain all kinds of information through mobile devices. Therefore, agrometeorological services should also keep up with the pace of the times, combine the actual needs of different agricultural production, and formulate personalized information push models. To provide more accurate and scientific guidance and reference for agricultural production.

5.5. Improve disaster reporting and real-time information feedback mechanisms

To build a comprehensive information feedback system, disaster reports can be compiled to create favorable conditions for the benign interaction between the people and the grass-roots meteorological bureau, to effectively avoid the simplification of the weather forecast service system. In addition, the system can integrate weather information provided by the public with expert analysis, to make more accurate forecasts and disseminate them in time. For example, a volunteer team of meteorological disaster reports can be organized to promote the prevention and control technology of meteorological disasters. At the same time, a special hotline can be set up to collect all kinds of weather and disaster information in time and store it in the corresponding database after pretreatment, to improve the ability of the agricultural defense system to seek advantages and avoid disadvantages.

6. Concluding remarks

In a word, meteorological service can provide a guarantee for the safety and stability of agricultural production, reduce the loss caused by meteorological disasters, improve the quality and level of meteorological service, and provide a basis for agricultural production decision-making, which is the application significance of modern information technology in agricultural meteorological service. Through big data analysis, agricultural producers can grasp the laws of climate change more accurately and make scientific planting plans. The application of the Internet of Things technology can monitor the farmland environment in real-time and regulate farmland equipment intelligently. The integration of artificial intelligence further improves the intelligent level of weather forecasting and the accuracy of disaster warnings. In the future, with the continuous progress of technology and

integrated innovation, modern information technology will play a more important role in the field of agricultural meteorological services, help agriculture develop in a greener, smarter, and more efficient direction, and contribute more to the increase of farmers' income and the prosperity of rural areas.

Disclosure statement

The authors declare no conflict of interest.

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