

# *Crop Disease and Insect Pest Automatic Monitoring and Reporting System Based on Internet of Things Technology*

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**Keywords:** Internet of Things Technology, Agricultural Crops, Pests and Diseases, Automatic Forecasting System

**Abstract:** It is well known that diseases and insect pests have caused great losses to crops. Diseases and insect pests can cause economic damage to crops, reduce yield and reduce quality. In the past, people used spraying pesticides to solve the problem of pests and diseases. For a long time, due to the extensive use of chemical fertilizers and pesticides, a series of ecological problems such as pesticide residues, soil compaction and environmental pollution have directly threatened human health. Scientific research shows that the occurrence of various diseases such as human tumors, hematological diseases and nervous system is directly related to environmental and food pollution. In order to reduce the cost of prevention and control and reduce environmental pollution, this article deliberately combined with the Internet of Things technology to build an automatic crop disease and pest monitoring system based on the Internet of Things technology. Through a large number of studies and long-term investigations, it is found that the use of automatic measurement and reporting systems can find and control the occurrence of pests and diseases, the accuracy rate and treatment rate have reached more than 99%, and there is almost no recurrence. At the same time, the relevant cost of about 100 yuan per hectare was saved. The automatic monitoring system for crop diseases and insect pests based on the Internet of Things technology has greatly promoted the prevention and control of diseases and insect pests in China. It is hoped that the research in this paper can provide powerful data for the prevention and control of diseases and insect pests in China.

## **1. Introduction**

Since the 21st century, the monitoring and early warning of major plant diseases and insect pests in our country have made great progress with the attention and support of the party and government. Especially after the publication of the 2013 "Opinions of the Ministry of Agriculture on

Accelerating the Construction of Modern Plant Protection System", the national plant protection system thoroughly implemented the spirit of the document, vigorously promoted modern plant protection construction, and modern plant protection system construction has developed rapidly. The national crop major disease and insect pest monitoring and early warning system follows the trend and takes advantage of the situation to seize the opportunity of rapid development of informatization, make full use of modern information technologies such as the Internet +, the Internet of Things, and research and application of new and automated automation and intelligent monitoring tools and major pests and diseases in real time. Bold exploration has been made in the construction of the monitoring and early warning system, and relatively obvious progress has been made.

Prior to this, many people have researched and investigated crop pests and diseases. Through research, S found that the diseases and insect pests of winter jujube in greenhouse are one of the main factors restricting the yield and quality of winter jujube. Timely prediction of jujube diseases and insect pests is a prerequisite for prevention and control of pests and diseases. Traditional mathematical methods and neural networks are difficult to establish accurate models for pest and disease forecasting because of the many complex factors that cause meteorological occurrences to cause diseases and pests of winter jujube, such as temperature, sunlight, humidity, soil conditions (such as moisture, soil heavy metals), and biology Characteristics (eg roots, leaves). In the process of predictive model training, due to the defects of artificial design features and unpredictable complexity in the design process, the accuracy of pest prediction and the efficiency of design features cannot be greatly improved. With the development of agricultural Internet of Things, intelligent camera equipment, high-performance and large-capacity data, it can automatically predict the pests and diseases of winter jujube [1] Junguo found through research that the application of multi-rotor drone monitoring system in forest pest and disease information collection has operating costs Low, flexible operation, easy access to data, high image resolution and other advantages. Collection of pest information. By using the drone system, it is possible to effectively segment and extract the pest images acquired by the multi-rotor drone to calculate the pest ratio in the monitoring sample field. It can provide forest protection experts with evidence to assess pest damage. In order to carry out forest monitoring work and calculate the proportion of pest and disease infestation in the sample field in a more accurate and faster way, this paper aims to solve the problem of poor response time and limited monitoring scope in the existing forestry information monitoring methods. First, the hardware and software system of the multi-rotor UAV is established in this paper. An aircraft equipped with an image acquisition device is used to monitor forest pest insect-infested areas and collect data in the forest [2]. Wang, X. found through investigation that cotton diseases and insect pests seriously affected cotton quantity. Timely and accurate prediction of pests and diseases is very important for crop growers to effectively prevent and monitor cotton pests and diseases. Cotton pests and diseases can be predicted from environmental and weather information. Through various sensors in the Internet of Things, it is easy to obtain many environmental and weather information, and many existing prediction methods, technologies, and systems for cotton have been proposed. However, the occurrence and development of cotton diseases and insect pests involve multiple factors, and their interactions and interactions are complex. The traditional cotton disease and pest prediction model has limited expression ability and generalization ability, and the prediction accuracy is not high. Many existing prediction models cannot meet the actual needs of pest and disease prediction systems. Therefore, the prediction of cotton diseases and insect pests in computer vision is still a challenging problem. In recent years, deep learning networks have won numerous competitions in pattern recognition and machine

learning. Deep trust network (DBN) is one of the most extensive networks [3]. Y. Wei designed and developed an agricultural production management information system in order to solve the problems that data is difficult to save, planting structure diagrams are difficult to draw manually, and the existing management system does not meet the current farm management needs. Based on Web GIS technology, it aims to meet the requirements of agricultural production management of large and medium-sized farms in the mode of "farm + production team". The system was developed by using Java as the development language and using a browser / server software architecture. Considering the multi-level and spatio-temporal characteristics of farm data, the database is designed as an attribute database and a spatial database. The attribute database is created by the MyS QL database management system. The Arc GIS platform is used to build a spatial database and publish maps as services to the ArcG IS Server site. The development environment integrates Spring MVC (Model View Controller), JPA (Java Persistence API) and Hibernate to achieve the effect of layered development. WebG IS front-end development is implemented through the Arc GIS API for Java Script. Use Bootstrap responsive design to support users to access the system through mobile terminals such as smartphones and tablets. The implementation of the system is divided into two steps [4].

This paper analyzes the application status of crop disease and insect pest automatic forecasting system in China, and makes a comparative study of the crop disease and insect pest automatic forecasting system based on the Internet of Things. Through years of comparison and in-depth investigation and summary, it is found that the use of automatic detection systems can well control the occurrence of pests and diseases. In this paper, through comparison of various data, I hope to find the deficiencies and correct them.

## 2. Proposed Method

### 2.1. Automatic Detection Design Method

The automatic monitoring of crop diseases and insect pests comprehensively promotes the sustainable development of agriculture and rural areas, facilitates the daily management of agriculture and corresponding decision-making, and its development has very significant strategic significance. Digital agriculture has a relatively high level in foreign countries. For example, the United States uses a combination of multispectral analysis and pattern recognition to detect pests, which is specifically reflected in the application of computer processing of agricultural data in agriculture, and the use of pest biological characteristics to develop agricultural knowledge engineering and expert systems; China Pest forecasting technology has yet to be developed. The "Tenth Five-Year Plan for the Development of Science and Technology in the Grain Industry" has made great progress. A lot of research has been conducted on integrated pest prediction models to provide a scientific decision basis for integrated pest control. It is of great practical significance to use information technology to construct an automatic system for the monitoring of pests and diseases, and to give accurate information on the types and densities of pests [5].

The combination of information technology and crop disease and pest control work, the promotion and application of pheromone trapping and the combination of information technology and pest detection technology will have considerable social and economic benefits, and achieve the purpose of protecting the environment, natural enemies of pests and ecology. Pest prediction, pesticide use and natural enemy release have effective guiding significance and provide reliable and scientific decisions for integrated pest control.

Construct the layout of extension system + host + computer information release system, where

each extension can connect 4 traps, and the extension and host form a simple network through wireless transmission, making full use of hardware resources and saving total investment. Under the control of computer software, it implements the detection of insects, completes data collection, data zeroing, setting of record numbers, etc., the data is counted and processed by a single-chip microcomputer, and the data is summarized by a computer information processing system and displayed on the panel of the extension Implement SMS sending and decision-making. The extension uses a 7-digit digital tube to display, set the automatic sleep and wake-up function, view the historical records by pressing keys, built-in wireless receiver, and have battery charging protection. In the case of no power supply, the data can be permanently retained, and the computer is supplied with mains power [6-7]. The extension structure design includes an antenna, a power port and a sensor interface. Sensors are used to detect insects. The keys are set to +1, -1, send, confirm, and clear and set keys to complete automatic data collection. The host structure design includes communication port, antenna interface and power interface [8].

## 2.2. Preliminary Plan for Automatic Detection Design

In recent years, R & D personnel have made full use of the Internet of Things technology, and through upgrading, real-time monitoring of diseases and insect pests with video, photos, and automatic classification and counting as the core, have developed a new type of remote monitoring and reporting tool.

(1) Development and application of an automatic pest collection information collection system. On the basis of the original automatic timing switch, automatic infrared insecticidal drying, and automatic day-to-day frame-shifting of the automatic insect detection and reporting lamp, the remote automatic timing photo uploading function was further developed. For forecasters who have some experience, they can classify and count the types and numbers of various types of target pests by checking the pest pictures in the network system every day; with the help of big data and deep learning technologies, new generation systems of automatic classification and counting products have begun to demonstrate Application, thus realizing real-time leapfrogging of various pest occurrences without leaving home [9-10].

(2) Development and application of remote real-time monitoring system for pests and diseases. By remotely controlling the monitoring equipment installed in the field from a computer terminal, the crop condition in the field and the occurrence of pests and diseases on the crop can be observed in real time. Its advantage is that it can become the "thousands of eyes" of the forecaster, perform field video recording, take pictures, and show the field scene for the forecaster in real time, especially suitable for monitoring work in harsh environments.

(3) Development and application of a spore moisturizing culture monitoring system. By moisturizing and cultivating the germ spores captured by the spore trap, after the germination is promoted, the microscopy and uploading pictures are used to timely observe the field germ spores and analyze and predict the trend of related diseases.

(4) The field microclimate acquisition system was developed and applied. By setting the microclimate meter in the field to automatically collect and upload various field meteorological factors in real time, it laid a foundation for the construction of a farmland microclimate database and the implementation of crop disease and insect pest model prediction. At present, this set of products has been tested and demonstrated in most provinces, autonomous regions and municipalities across the country, and is being promoted and applied as a new generation of measurement and reporting tools [11].

### 2.3. Specific Schemes of Crop Disease and Insect Pest Automatic Detection System

#### (1) Microclimate monitoring system

Climate factors are the basis for monitoring pests and diseases. The microclimate monitoring system performs automatic monitoring in the whole field. It can collect reasonable temperature, wind speed, rainfall, etc. in the field and ensure the accuracy of the data. In order to ensure the accuracy during the data collection process, it is generally controlled to be performed once every 1 hour. In the process of network automatic remote transmission, it provides a variety of statistical and calculation functions for data statistics, and then provides effective parameters for staff. Optimizing and upgrading the system can guarantee the realization of solar power in the process of microclimate monitoring, which can improve the environmental protection of the system, and can prevent the loss of collected data, thereby achieving automatic collection.

#### (2) Remote automatic monitoring system for pests and diseases

In the process of monitoring pests and diseases, the installation of a remote automatic monitoring system for pests and diseases can effectively monitor pests such as pupae. Power supply is realized under the use of solar energy. When trapping pests, they are enticed and killed by sexual attractants. In this process, the quantity can be automatically collected and wireless data transmission and automatic upgrade can be realized. By upgrading the equipment, the system can collect real-time monitoring data and transmit it to the staff's intelligent front end, so that staff can get the latest news. At the same time, the system can also transmit data every 1 hour to ensure that the data is transmitted to the computer system. The application of the remote automatic monitoring system for pests and diseases can effectively capture a large number of pests, and the operation is stable and the accuracy is high.

#### (3) Agricultural pest early warning information platform

With the strong support of the state, the remote automatic monitoring system for diseases and insect pests has developed rapidly and has been effectively improved. Generally, the system and the process of monitoring crops are reported. During the process of monitoring the plants, the technicians hold the equipment in their hands, and collect and photograph the locations and quantities of the pests on the plants under the intelligent operating system. The technicians will transfer the collected data information to the computer, and calculate and process the data and picture information with the application of computer technology, so as to improve the crop prevention effect. At the same time, during the operation of the system, the timely collection and analysis of data can effectively monitor the work of grassroots staff.

#### (4) Emergency warning information release platform

Through the establishment of a dedicated communication group, agricultural technology station technicians, agricultural sales staff, planters, cooperatives and other departments and personnel in this area are included to form an emergency warning information release platform, which is effective for the mass forecast. Pest control content. On this platform, there are special staff members who publish the collected content to their mobile phones and intervene in the release of information. In this way, under the combination of agriculture, some information can be effectively transmitted, and farmers can improve the quality and efficiency of pest control in agricultural activities.

#### (5) Digital monitoring and early warning system for major diseases and pests of crops

Against the background of the rapid development of digital technology, this technology has also been effectively applied in the pest and disease monitoring system. Generally, digital monitoring of some grown-up pests and diseases is carried out to improve early warning capabilities. In the

application of the digital monitoring and early warning system for major pests and diseases of crops in China, by reading some survey data and filling in the information on time, it can enable the higher authorities to effectively grasp the situation of pests and diseases in China, and effectively grasp the occurrence of some major pests and diseases. So as to improve the prevention and control effect of major diseases and insect pests in China.

(6) Automatic insect report lamp

At present, the use of automatic insect detection and reporting lights in many areas in China is generally achieved through light-controlled switches. The lights are turned off during the day and automatically turned on in order to achieve the effect of insect repellent. In the night, the insects are collectively captured by incandescent lamps, and the infrared rays are used to kill the pests. In this process, it is realized by using automatic technology, automatically killing and drying the pests, and finally packed in a bag, and the staff only needs to collect after 7d. After the staff collects the pests in the bag and analyzes and calculates the pests in the bag, the control effect of the crops can be continuously improved.

## 2.4. Systematization and Automation of Pest Detection and Reporting Tools

A number of companies have carried out systematic research on the purification and synthesis of pest attractants, the development of flight behavior and traps, and the construction of monitoring data transmission systems. Other types of major insect pests attractant cores and traps for measuring and reporting major pests have also developed a real-time automatic counting and data reporting pest management information management system, laying a foundation for the implementation of automatic monitoring of major pests.

(1) Sex pheromone action mechanism and key synthesis technology. Du Yongjun et al. Through research, clarified the moth insect sex pheromone receptors and their mechanism based on the structure of the olfactory system, and found that the sex pheromone component of most agricultural pests is mainly aldehyde-containing substances, which are easy to be found in the natural environment. (Ultraviolet, high temperature) oxidation or decomposition, and this is the technical bottleneck of the application of sex pheromone in pest monitoring and early warning. Based on this, nearly a hundred major pest sex pheromones common in the production of cotton bollworm, *Spodoptera litura*, *Spodoptera exigua*, *Plutella xylostella*, *Pleurotus ostreatus*, rice leaf roller, corn borer, and slimeworm were solved. The key technologies of analysis, purification, synthesis and slow-release have created conditions for the large-scale development and utilization of insect sex pheromones for insect condition monitoring and pest control.

(2) Dedicated cores, traps and field application technologies. Developed a stable and uniform release of special detection and reporting cores, differentiated high-efficiency traps and supporting application technologies, which solved the technical problems of large-scale use of pest sex pheromones. The attractant used for pest forecasting is different from the commonly used attractant for prevention and control. Its difficulty lies in the requirement of uniform daily release, which overcomes the impact of monitoring accuracy due to uneven release. Du Yongjun's team based on the requirements of measuring and reporting the uniform release of pheromone sex pheromone, overcame the technical problems of slow-release materials for sex pheromone release, developed multiple types of stable and uniform release of pesticidal cores, and resolved the technical bottleneck of pest temptation monitoring. By studying the flight behavior of pests, it was found that different pests approached the attracting core in different ways, and thus developed bell jar inverted funnel traps suitable for sting moths, and cylindrical diamond-shaped entrances for night moths



(large). Traps, wing-shaped viscose traps for small insects, and pot traps for fruit flies [8]. These differentiated high-efficiency dry-type (waterless basin) traps have solved the technical problem that the trap structure affects the trapping effect in the monitoring of pest sexual traps, and greatly improved the convenience of field use. Through repeated experiments, the key installation technologies, hanging heights, and installation methods of various pest traps in the field were clarified. Based on this, major technical standards for pest trap detection and reporting were established in the agricultural industry standards to implement pests on a large scale. Sexual seduction monitoring technology provides technical support.

(3) Sexual temptation automation and network monitoring technology. Based on the behavioral characteristics of the pests after entering the trap, multiple teams have developed an automatic infrared counting method based on the type of the trap, and have continued to improve it through repeated experiments for many years, reducing repeated counting, missed records, and random records. And it has obtained good application results in the field monitoring of pests such as cotton bollworm and *Spodoptera litura*; according to the specificity of pest sexual trap monitoring, automation characteristics, and related technical specifications for monitoring and reporting, an intelligent monitoring system for insect sexual traps has been developed, which can be real-time Upload the traps of traps. You can either observe the occurrence of one or more pests at a certain observation site in real time, or use the system network to monitor the same pest or multiple pests at multiple points in real time. Management has created conditions for large-scale promotion and application. Many companies have also developed and introduced a remote real-time monitoring system for pests based on sexual entrapment. Significant progress has also been made in the automatic counting of pests and the construction of information platforms. The technology has gradually become practical and has been demonstrated and promoted in various places. In 2016, on the basis of unified construction standards, the National Agricultural Technology Extension Service Center has officially connected the above systems to the National Crop Major Diseases and Pests Monitoring Information System, and began to use the pest temptation real-time monitoring system to carry out networked monitoring of major national pests in order to promote This technology is applied.

(4) Combination technology of multiple types (sets) of traps. Generally, only one kind of trap is installed in a trap, and only one kind of pest can be detected. According to the actual needs of observing multiple pest objects at the same observation site, Du Yongjun's team researched and developed multiple sets of traps for use under the condition of clearing the safe distance limit of the same pest attractant and ensuring that different pest attractants do not interfere with each other. technology. This technology uses 1 gateway, which can track up to 8 traps, and can choose the type and number of traps according to the number of monitoring objects in the observation field, which better solves the problem of observation of multiple pests at one site, not only improving This improves the practicability of the equipment and reduces the cost of use. At present, cotton bollworm, *Plutella xylostella*, *Spodoptera litura*, *Spodoptera exigua*, corn borer, slime worm, and two chemical species have been carried out in more than 30 observation sites in more than 10 provinces including Inner Mongolia, Shandong, Jiangsu, Sichuan, Guangxi, and Shaanxi. Combined trials and demonstrations of sexual attraction monitoring for pupae and other pests.

## **2.5. Real-time Early Warning System for the Prediction Model of Disease and Pest Occurrence**

The research of real-time automatic monitoring and early warning of major crop diseases in

China started earlier and developed faster, especially the monitoring and early warning equipment for some climatic epidemic diseases has matured and entered the stage of promotion and application, providing valuable for the automatic monitoring and research of other diseases and insect pests experience.

(1) Real-time early warning system for potato late blight. In the field of real-time early warning of crop diseases, the earliest experiment, demonstration and promotion of potato late blight real-time early warning system. Beijing Huisi Junda Technology Co., Ltd. and other units use the Potato Late Blight Prediction Model (CARAH) developed by the Aino Agricultural Application Research Center in Belgium to collect real-time meteorological factors such as temperature, humidity, precipitation, and light intensity through a microclimate installed in the field. It was automatically uploaded to the meteorological factor database, and the collected climate factors and prediction models were used for fitting. A real-time early warning system for potato late blight was developed, and real-time monitoring and automatic warning of potato outbreaks in the field were realized. After years of practice, verification and improvement, the model parameters applicable to each ecological zone have been gradually established, and have been widely applied in the disease forecasting of the main potato producing areas in the country. Since 2014, the National Agricultural Technology Extension Service Center has developed a real-time monitoring and early warning system for potato late blight that covers the whole country. As of the end of 2016, more than 400 units have been installed in 12 provinces, autonomous regions, and municipalities across the country for potato late blight. The monitored field climatometers are networked, which can not only monitor the occurrence of disease at each monitoring site in real time, provide early warning and guide prevention and control, but also realize the national potato late blight network real-time monitoring and early warning, and the disease monitoring and early warning can be automated and intelligent. The degree has increased significantly.

(2) Remote monitoring and early warning system for wheat scab. After systematic research by multiple teams, breakthrough research has been made on the pathogenesis and epidemic law of wheat scab in Shaanxi and other regions. The real-time monitoring and forecasting model of bacterial mildew not only can monitor the incidence of bacterial mildew in real time, but also can predict the occurrence of the disease 7 days in advance, based on rolling prediction of the occurrence of the disease, and continuously adjust the degree of prediction. important meaning. Based on this, the team developed special equipment for real-time collection of field climate factors, and assisted in inputting field corn, rice straw and their predictive factors such as the amount of bacteria and maturity, realizing real-time monitoring and early warning of wheat scab. In 2015, the Shaanxi Provincial Plant Protection General Station began to organize experiments and achieved good results; since 2016, the National Agricultural Technology Extension Service Center has organized more than 20 counties (cities, districts) in Shaanxi, Jiangsu, Henan, and Sichuan provinces. Carrying out large-scale experiments, demonstrations and extension work, and constructing a remote real-time early warning system for wheat scab, and realizing networked real-time monitoring and early warning of wheat scab. With the popularization, application and upgrading of this equipment, it will become another successful example of automatic monitoring and early warning of crop diseases.

(3) Other pest and disease prediction models and automatic monitoring tools. Drawing on the successful development and application experience of real-time early warning systems for potato late blight, remote monitoring and early warning systems for wheat scab, and the technical support provided by the Internet of Things technology in recent years, the Hu Xiaoping team at Northwest A & F University has also developed real-time wheat powdery mildew. The early warning system has



been installed for trial operation; the Plant Protection Station of the Sichuan Provincial Department of Agriculture and Beijing Jinhe Tiancheng Technology Co., Ltd. have initially developed a real-time monitoring and early warning system for rice pests, rice blast and other diseases and insect pests, and designed a prototype of the early warning system. After the model is calibrated accurately, it is expected to enter the experiment, demonstration and popularization and application. The continuous development and improvement of multiple monitoring and early warning systems based on disease epidemic models and pest development models has explored new ideas for the automation, intelligence and scientificization of crop disease and pest monitoring and early warning.

### **3. Experiments**

#### **3.1. Test Object**

As is known to all, diseases and insect pests cause great losses to crops. Diseases and insect pests can cause economic damage to crops, reduce yield and reduce quality. In the past, people used spraying pesticides to solve the problem of pests and diseases. For a long time, due to the extensive use of chemical fertilizers and pesticides, a series of ecological problems such as pesticide residues, soil compaction and environmental pollution have directly threatened human health. With the development and continuous improvement of agricultural technology, the combination of agricultural, physical, biological measures and pesticide control methods for crop pest control can not only achieve twice the result with half the effort, but also greatly reduce the cost of control, reduce the amount of pesticides and environmental pollution. In order to reduce the impact of diseases and insect pests on crops and improve crop yields, China has continuously strengthened the application of the Internet of Things process, so as to build an automatic crop disease and pest detection system. This article analyzes the current application status of crop disease and insect pest automatic forecasting system in China, and elaborates the development prospects of crop disease and insect pest automatic forecasting system based on the Internet of Things, so as to achieve sustainable development in rural areas in China, especially in a well-off society. In the decisive year, it is of great significance to realize prosperity and stability in rural areas.

#### **3.2. Design and Implementation of Experiments**

This article observes and compares the crop disease and insect pest automatic monitoring and reporting system with the Internet of Things technology and the common treatment methods of crop pests and diseases. Through the comparative study of the two methods to find a more appropriate treatment, find the shortcomings. This article summarizes and analyzes the degree of treatment of pests and diseases, the recurrence rate, and the degree of satisfaction of farmers after use, and provides powerful data to promote China's agricultural development.

### **4. Discussion**

#### **4.1. Comparison of Detection Accuracy**

In the process of agricultural production, diseases and insect pests have a great impact on the yield and quality of crops, which has reduced the income of farmers and has greatly hindered the stability of our rural status. So faster and more effective detection is essential. As can be seen from

Figure 1, with the continuous improvement of China's technological level, the accuracy of automatic detection technology has greatly improved. From 90% in 2016 to 99% in 2018, which is two percentage points higher than ordinary manual detection technology.

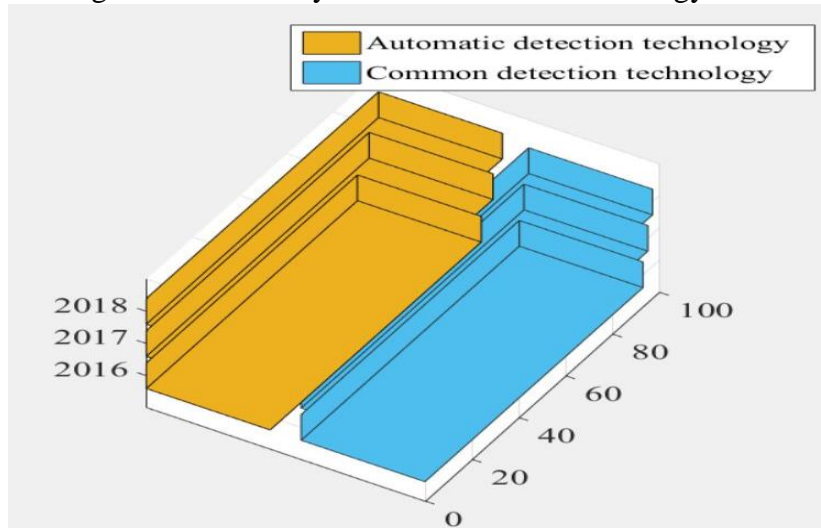


Figure 1. Comparison of detection accuracy between automatic detection technology and common technology

#### 4.2. Comparison of Treatment Effects

Through automatic detection technology, pests and diseases can be accurately and effectively found in advance, and large-scale outbreaks of pests and diseases can be prevented through treatment in advance. It can be seen from Figure 2 that by 2018, the effect of pest and disease treatment has reached 99.5%, and the impact of pests and diseases on crops has been basically controlled.

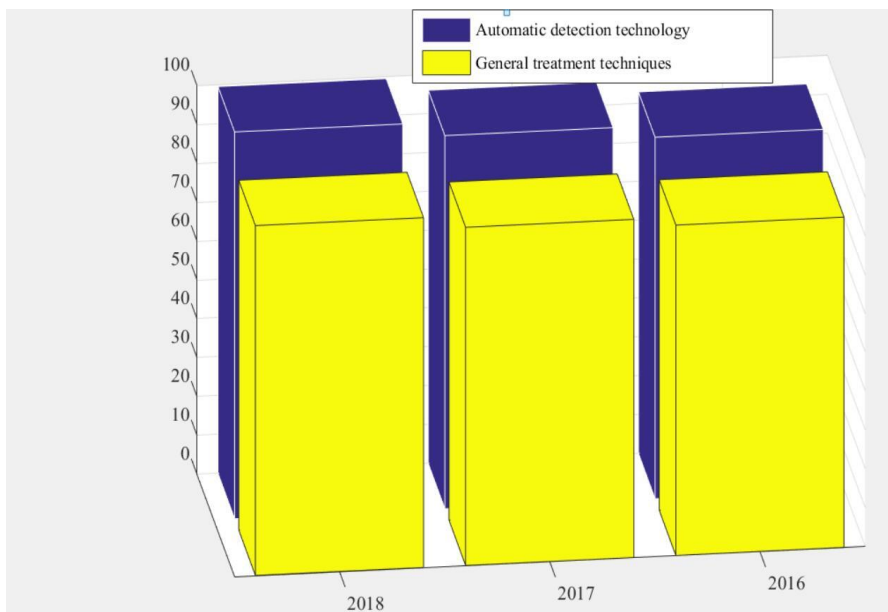


Figure 2. Comparison of automatic detection technology and common technology detection and treatment effect

### 4.3. Repeat Rate Comparison

Because ordinary control methods cannot accurately check whether there is still a pest and disease crisis, it is very likely to cause recurrence. It can be seen from Figure 3 that the recurrence rate through automatic detection technology has been around 3% by 2018, while the repetition rate of other methods is around 14%, which is very likely to occur repeatedly.

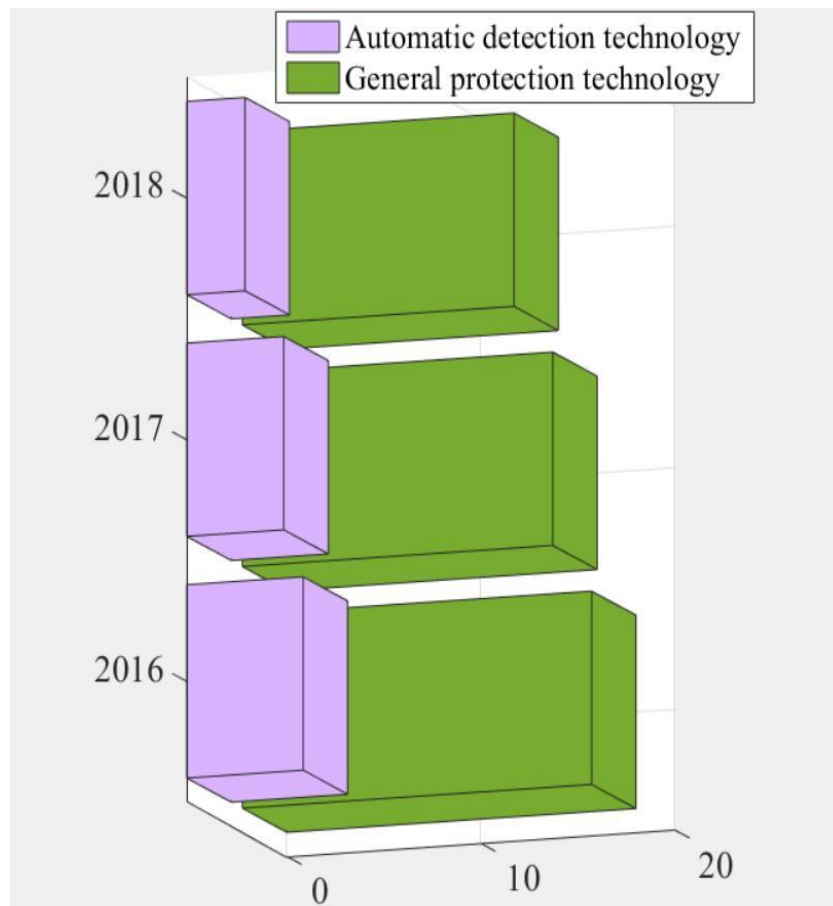


Figure 3. Comparison of the repetition rate between automatic detection technology and common technology detection after treatment

### 4.4. Using Effect Feedback

As the automatic detection technology has not been perfected before, farmers need an adaptation stage for some high-tech. So the early praise rate is not too high. As can be seen from Figure 4, it was only 60% in 2016. With the relative improvement of technology and the vigorous promotion of the government, the praise rate reached 97% in 2018. Because the automatic detection technology can prevent the detection of diseases and insect pests in advance, it prevents large-scale outbreaks and saves a lot of costs for it. As can be seen from Table 1, by 2018, the cost per hectare was about 70 yuan, saving about 100 yuan year-on-year.

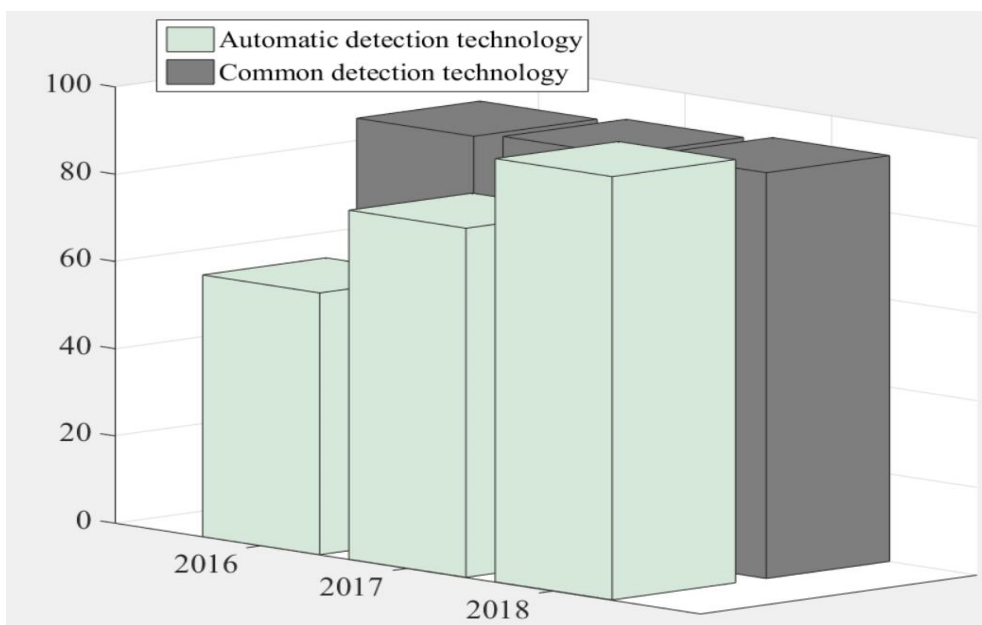


Figure 4. Comparison of praise rate between automatic detection technology and common technology detection

Table 1. Annual cost of crop diseases and insect pests per hectare of land

Years	Automatic detection technology cost(yuan)	Common technical cost(yuan)
2016	100	200
2017	85	180
2018	70	170

## 5. Conclusion

In recent years, although great progress has been made in the development and application of modern plant disease and insect pest forecasting tools, overall there are still problems such as insufficient research investment, low technological maturity, and slow advancement, which affect the overall development level of new forecasting tools. The R & D cycle is long and the input cost is large. Research on forecasting tools often requires a long period of time. For example, the research of automatic pest forecasting tools has been more than 10 years. A large amount of human and financial resources have been invested. After many improvements, many key technologies have been solved, but they still cannot cover all Conventional pests. Small market share and low return on investment. The forecasting tools are different from ordinary control products. Generally, there are only a few (sets) in a county, which not only has a small market share, low returns, but also slow returns. Less government input and insufficient research guidance. In the research of forecasting tools, it is mainly related to the investment of related enterprises. The investment from financial and scientific research projects is relatively small. The support and leading role of scientific research is not enough. The speed of key technological breakthroughs and product launches is relatively slow.

In the future, efforts should be made to strengthen the development and application of new measurement and reporting tools from the following aspects. Raise ideological awareness. The

development and application of modern new forecasting tools is the fundamental way to improve the ability of monitoring and early warning of major pests and diseases. Advanced and practical automatic intelligent forecasting tools not only condense modern science and technology, but also integrate effective forecasting methods. The main means of the situation such as decline, insufficient survey scope and insufficient representativeness of monitoring data. Increase promotion and application. Due to the long research and development cycle of modern new-type forecasting tools, it is necessary to adopt tactics of research, experiment, demonstration, and promotion for directional and nascent products, increase support, and promote scientific and technological progress and product maturity. Strengthen project support. For products that have been tested and demonstrated mature, they should be used as procurement catalog products in the project construction to increase support and promote the upgrading of test equipment. In 2017, the state launched a new round of plant protection engineering construction projects-the improvement of animal and plant protection capabilities. Among them, plant protection will focus on the construction of field disease and insect observation sites (points). Plant protection agencies at all levels should take this as an opportunity to strengthen project design and accelerate the application of the remote monitoring of crop diseases and insect pests through the addition of advanced and practical new monitoring tools. New pest detection technology and equipment such as real-time pest monitoring system and real-time early warning system for crop diseases, gradually transforming the monitoring of pests from people to mainly relying on machinery and equipment", the test report is no longer hard" to lay the foundation.

This paper makes targeted improvements based on the current weak link of the crop pest monitoring and reporting system. The latest electronic and network technologies are used to study and practice the technology in this field, and a corresponding physical device is designed. After actual tests, the effect is good, it can correctly report the current pest reproduction situation, and after the summary processing, it provides basic data for the forecasting work. The automatic monitoring system for crop diseases and insect pests can effectively improve agricultural yield and quality, reduce agricultural losses due to pests and diseases, increase the scientific and technological content of digital agriculture, and bring very significant economic and social benefits. As far as the project technology is concerned, its technical ideas and control strategies can be applied to data statistics, forecasting and forecasting of various products with broad application prospects. By continuously strengthening the construction of forecasting stations and information systems, increasing the strength of forecast release, strengthening research on forecasting techniques, simplifying the methods of surveying and forecasting, modernizing equipment, informatizing forecasting methods, diversifying forecasting releases, modeling forecasting methods, and practicalizing survey content The professional team of forecasting and forecasting will make the work no longer hard, and let the forecasting and reporting become a glorious cause that everyone is willing to do, and promote the healthy development of crop disease and pest forecasting in China.

### **Funding**

This article is not supported by any foundation.

### **Data Availability**

Data sharing is not applicable to this article as no new data were created or analysed in this study.

## Conflict of Interest

The author states that this article has no conflict of interest.

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