Research Status and Trends of Agricultural Plant Protection Modernization in Shanxi Province

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Abstract: With the implementation of the strategy of "rejuvenating the country through science and technology", the contribution rate of agricultural science and technology progress in China has increased year by year, and the introduction and promotion of agricultural technology has further promoted the development of agricultural modernization. The level of mechanization of crops in Shanxi Province has been continuously improved, and the contribution of plant protection drones is particularly significant. Plant protection drones have been demonstrated and promoted in Shanxi Province owing to their flexibility, safety and efficiency, and significant pest control effects. This paper mainly summarizes the application situation of plant protection drones in crops and the development prospects in Shanxi Province, and proposes relevant countermeasures and suggestions for the constraints in the promotion process, in order to provide reference for subsequent research and application.

1. Introduction

Plant protection involves China's food security, ecological security and agricultural harvest, and plays a key role in China's agricultural production. China has 1.8 billion mu of farmland, and the annual demand for plant protection is very large. However, the traditional method of application is inefficient and the labor cost is high. With the increasing population and the shortage of rural labor, efficient and economical operation has become the focus of the plant protection industry.

The agricultural plant protection drone has been extensively used in the fields of farmland information monitoring, crop planting, pollination and fertilization. It has the advantages of precise operation, high efficiency and environmental protection, and simple operation in the field of application. It has solved the problem of tall stalk crops and rough ground. The problem of inability to operate the medicine machinery further reduced the burden on farmers and increased the rate of pest control. Plant protection drones are classified into single-rotor plant protection drones and multi-rotor plant protection drones according to the aircraft structure. Although the single-rotor plant protection drone has strong wind resistance, its price is high, the return period is too long, and the after-sales and maintenance cost are high. The multi-rotor plant protection drone adopts modular design, which is extremely convenient to be used and maintain. Flight power is a plant protection drone with the benefits of small overall size, light weight and high efficiency.

In order to understand and master the application of agricultural plant protection drones in Shanxi Province, in 2016, Shanxi Province launched special statistics on the possession and use of cultivated plant protection drones. From the statistical point of view, the number of undeveloped plant protection drones in Shanxi Province has increased year by year, the operating area has expanded year by year, and the types of operations have increased year by year. However, most agricultural plant protection UAV manufacturers have backward research and development technology for processing and assembly equipment, and the aviation regulations are not perfect. The lack of specialized knowledge and skills has restricted the promotion and application of agricultural plant protection drones. In order to promote and improve the level of agricultural mechanization and agricultural production in Shanxi, and to better play the role of this new type of agricultural machinery, this paper puts forward the following suggestions on how to speed up the promotion and application of plant protection drones.

2. Analysis of current status of domestic plant protection drones

In recent years, China has promoted various policies to promote the promotion and application of plant protection drones. Due to the influence of topographical factors in various provinces, the penetration rate of plant protection drones in the north is higher than that in the south, and it is mostly promoted in enormous agricultural provinces and economically developed provinces.

2.1 Plant protection drones for regions and provinces

2.1.1 North is more popular than southern drones

Most of the polar areas are mainly plains, which can achieve large-scale planting. Use of plant protection drones is highly efficient and easy to promote. The small-scale planting area in the south accounts for more than 60% of the total land area, and the terrain is complex. The intercropping of farmland and the growth of crops has largely restricted the promotion of plant protection drones. The picture below shows the proportion of land management scale:

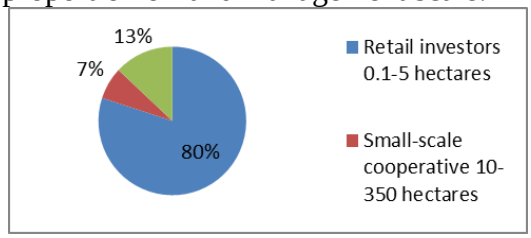


Figure 1 Percentage of plant protection drones in different land management scales

2.1.2 The application of plant protection drones in agricultural provinces is more extensive

At present, advantageous areas for the application and promotion of plant protection UAVs in China are mostly in agricultural provinces or economically developed areas such as Henan, Shandong, Hunan, Zhejiang, Jiangsu and Xinjiang. According to the statistics of 2005, the number of cultivated plant protection drones in East China and Central China is the highest, with a total of 1,608 and 1,164, respectively, accounting for 37.73% and 27.31% of the national total. The picture below shows the number of domestic plant protection drones in the past five years:

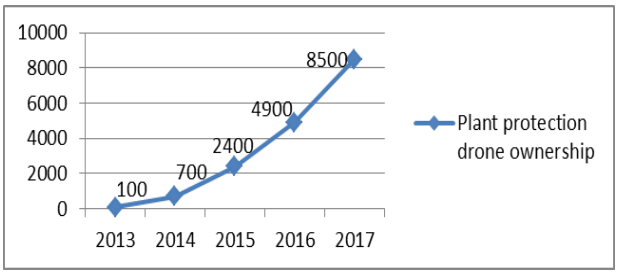


Figure 2 Plant protection drone ownership

2.2 Status of domestic policy of plant protection drones

In the 1950s, China began to conduct research and application of aviation application technology. In 2004, the 863 Program of the Ministry of Science and Technology began research and promotion of drone plant protection. In 2014, the Party Central Committee "strengthened agricultural aviation construction" as the central government. Document No. 1 has become an important part of promoting agricultural science and technology innovation; in 2015, the “Action Plan for Zero Growth of Pesticide Use Rate by 2020” was issued, which clarified the work of strengthening the promotion of crop plant protection, requiring the phasing out of traditional spraying tools and promoting the production of major crops. Mechanized operation; in 2016, we will focus on promoting efficient plant protection equipment in 500 pilot counties across the country.

Table 1 The subsidies for plant protection drone pilots

Province	Sub-file name	Subsidy amount (yuan)	Pilot fund size (ten thousand yuan)
Gansu Province	Electric multi-rotor plant protection drone	16000	1000
Hubei Province	10-20L electric multi-rotor plant protection drone	15000	1000
Chongqing	multi-rotor plant protection drone	16000	
	Single rotor plant protection drone	29000	
Shandong	multi-rotor aircraft (10L ≤ drug loading <15L)	10000	
	Multi-rotor aircraft (drug loading ≥15L)	16000	1000
	Single rotor aircraft (drug loading ≥10L)	30000	
Jiangxi Province	10-15L electric plant protection drone	15000	1000
	15-20L electric plant protection drone	20000	
Jilin Province	Plant Protection UAV	15000	1000
Hunan Province	Electric Multi-rotor Remote Control Flight Plant Protection Machine	16000	1000
Zhejiang Province	Electric Single Rotor Plant Protection UAV	30000	
	Electric multi-rotor plant protection drone	17000	
	Electric multi-rotor plant protection drone (equipped with centimeter-level positioning module and ancillary equipment)	20000	
Guangdong Province	10-15L electric plant protection drone	14400	1000
	15-20L electric plant protection drone	21200	
Anhui Province	Electric multi-rotor plant protection drone with a drug loading of 10L and above	16000	

3. Status of the operation and promotion of plant protection drones

With the promotion of financial subsidies, the number of drones, service areas, service crop varieties and service areas in Shanxi province have increased year by year in recent years. The promotion and application of drones have further promoted the development of agricultural mechanization and modernization in Shanxi Province.

3.1 Introduction of the main types and parameters of plant protection drones

According to the special statistics of agricultural plant protection unmanned aerial vehicles carried out by the Agricultural Bureau of Shanxi Province and the Agricultural Department of the Provincial Department of Agriculture, as of December 30, 2017, the number of agricultural plant protection unmanned aircraft in the province reached 92, mainly based on 8 rotorcraft. At the same time, the operating area reached 20,300 hectares. Agricultural plant protection unmanned aircraft are loaded between 5 and 20 L, of which 10 L or more (including 10 L) accounts for 72.1%, and the spray width is about 5 m.

3.2 Basic situations of plant protection drone purchase

Looking at the statistics of the Shanxi Provincial Department of Agriculture, we can see that the

increase in the number of agricultural plant protection unmanned aircraft is mainly driven by financial subsidies. In 2014-2016, Shanxi province planted agricultural plant protection unmanned aircraft project totaling 4.4 million yuan, and arranged 20 counties to undertake drone pilot demonstration projects, and each county arranged promotion project funds between 120,000 and 300,000. About 70% are used for subsidies for the purchase of agricultural plant protection unmanned aircraft, and about 30% are used for the promotion, demonstration and demonstration of agricultural plant protection unmanned aircraft.

3.3 Plant protection unmanned aircraft operation service situations

Service area is increasing year by year: According to statistics, in 2015, the area of cultivated plant protection unmanned aircraft service in Shanxi Province totaled 13.5 square kilometers, an increase of 600 hectares compared with 2014, an increase of 78.8%.

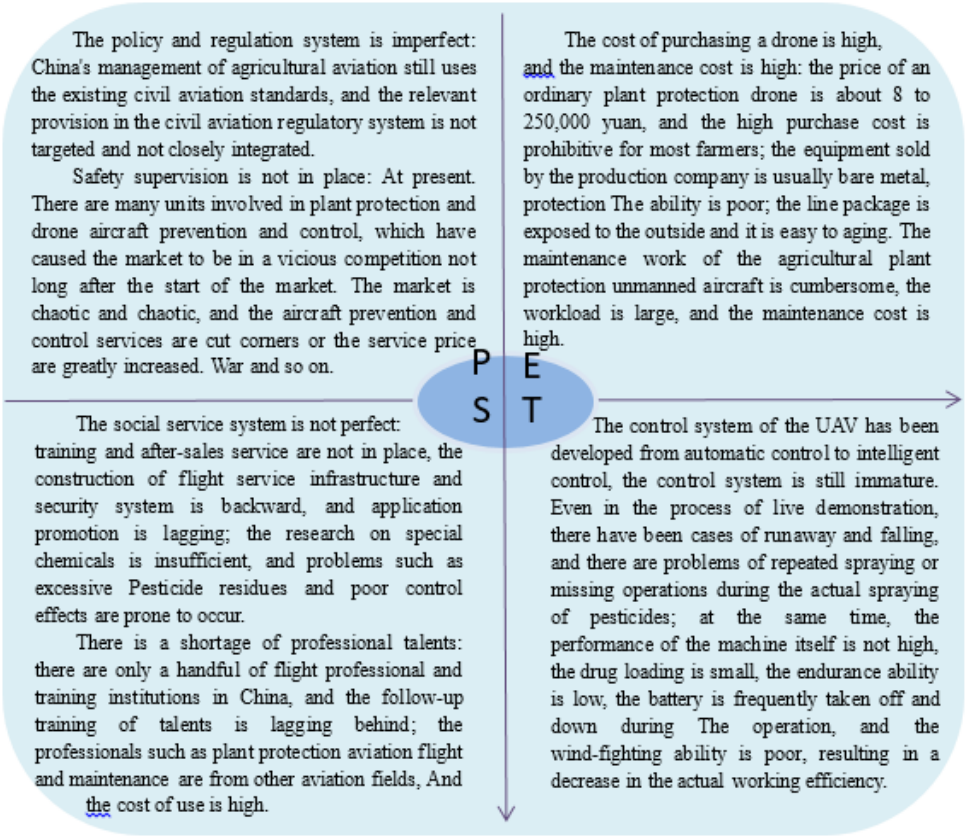
The concentration of crops in the operation service is high: the agricultural plant protection unmanned aircraft operational service in Shanxi Province is mainly concentrated on two crops of wheat and corn. Among them, the wheat operation service area is about 900 hectares, accounting for 68.4% of the province's total operational service area; the corn operation service area is about 350 hectares, accounting for 26.4% of the province's total operational service area. In addition to wheat and corn, crops such as potatoes and apples are employed to plant protection operations.

Distribution of operation service areas: Yuncheng, Linyi and Datong of Shanxi Province are the three major areas for the control of unmanned aerial vehicles using agricultural plant protection, mainly focusing on wheat and corn concentration in Wanrong County, yongjing County, Loushan County and Linyi County of Yuncheng City.

4. Factors restricting the promotion of plant protection drone in Shanxi Province

The following mainly analyzes the factors that limit the promotion of drones from the perspectives of political environment, economic environment, social environment and technical environment.

Table 2 Factors restricting the promotion of plant protection drones in Shanxi Province



5. Plant protection drone application promotion recommendations

In view of the above factors that restrict the development of UAVs in the doctrinal, economic, social and technological environments, the following recommendations are made from the perspectives of legal policies, implementation of plant protection social services and technological breakthroughs.

5.1 Legal policy aspects

Improve industry standards and regulatory mechanisms: In the operation of agricultural plant protection unmanned aircraft, there is a lack of uniform standards for operating parameters such as different crops, different growth cycle machine operating speed, spray volume, flight height, etc. The quality of operations is difficult to supervise. It is recommended to organize relevant experts and Relevant enterprises have formulated and supplemented the operational standards for agricultural plant protection unmanned aircraft; agricultural plant protection unmanned aircraft production enterprises are numerous, product quality and performance are uneven, it is recommended to organize relevant experts and related enterprises to develop production standards for agricultural plant protection unmanned aircraft, targeted Sexually carry out the quality supervision of agricultural plant protection unmanned aircraft products, and ensure that service organizations and agricultural machinery households purchase products with reasonable quality.

Establish a drone driver training system: adopt centralized training, on-site operation, demonstration base observation, etc., and train operators to increase the operational skills and scientific management level of aviation plant protection equipment.

Increase policy support and carry out pilot subsidies: At present, the cost of purchasing, repairing and using agricultural plant protection unmanned aircraft is relatively high, and it is difficult for farmers to purchase on their own. It is recommended to carry out research on the subsidy policy and subsidy ratio of agricultural plant protection unmanned aircraft, and include the unmanned aircraft into the agricultural machinery purchase subsidy catalogue, reduce the burden of farmers purchasing machines, and mobilize the enthusiasm of farmers to purchase machines.

5.2 Promote the socialization of flight plant protection and improve the promotion model

Government-led, combined with enterprise promotion: Due to the special nature of agricultural plant protection drones, it is very difficult to promote enterprises alone, but its broad application prospects are worth investing. Therefore, the government should properly guide and are compatible with the research and development of agricultural plant protection drones.

Improve the pastoral company to promote the drone model: Plant protection drones have high purchase costs and are difficult to operate, suitable for purchase by family farms, agricultural machinery cooperatives and professional plant protection companies. Therefore, government departments should introduce support policies. In the promotion process, professional plant protection service organizations, professional cooperatives and other high-level cooperative organizations should be encouraged to purchase machinery, carry out shared services for flight plant protection operations, and gradually establish operational services and technical training.

5.3 Strengthening technical research

Invest more in research and development of plant protection drones: strengthen exchanges and cooperation between scientific research institutions and plant protection drone manufacturers, and improve the technological content of machinery and equipment so that they can better adapt to current agricultural plant protection requirements. Improve stability of plant protection drone flight operations while improving the endurance and load capacity of the equipment.

R & D flight special pharmacy: agricultural plant protection unmanned aircraft using ultra-low volume spray technology, pesticide formulations with oil agent as the best, it is recommended to organize experts and technicians to carry out technical improvement of pharmacy, improve the performance and safety protection performance of agricultural plant protection unmanned aircraft , carry out field trial research and demonstration and application.

6. Conclusion

With the rapid development of urbanization and the continuous implementation of the land transfer policy in Shanxi Province, the agricultural plant protection unmanned aircraft can be greatly improved due to its light weight, flexible operation, high intelligence, realization of man-machine separation and other unique flight characteristics. It will alleviate the shortage of labor in the agricultural production and application, greatly improve the level of pesticide application and the level of precision operation, save operating costs, reduce the consumption of pesticides, and improve the efficiency of plant protection operations. Therefore, the promotion of the application of agricultural plant protection unmanned aircraft in the field of agricultural planning will create conditions for improving the mechanization level of plant protection links and provide a guarantee for the full mechanization of agricultural production in Shanxi.

References

[1] Zhang Yanfa, Zhou Wei, Yuan Minmin, Gao Hui, Wu Chengwei, Zheng Jiesong. Research Progress in the Application of Plant Protection UAV crops[J]. Anhui Agricultural Science Bulletin, 2018, 24(22): 58-60.

[2] Li Fang. Application effect of plant protection drone in rice “two prevention and one spray” [J]. Grassroots agricultural technology promotion, 2018, 6 (08): 22-24. [3] Sun Shaoxia, Wang Shuang. Discussion on the market of plant protection drones [J]. Shandong Agricultural Mechanization, 2018 (04): 48-49.

[4] Xiao Jin, Gao Xing, Wang Wei. Application Status and Suggestions of Hubei Agricultural Plant Protection UAV[J]. Rural Economy and Technology, 2018, 29(13): 84-86.

[5] Zheng Shi, Chen Yumiao, Wang Zhigang. The Land Scale, Cooperative Participation and Plant Protection UAV Technology Cognition and Adoption——Taking Jilin Province as an Example[J]. Agricultural technology economy,2018(06) :92-105.

[6] Gu Yu. From the perspective of industrial design, the development of China's plant protection drones [J]. Hubei Plant Protection, 2018 (03): 60-62.

[7] Niu Muyu. Dajiang leads agricultural plant protection drone industry [J]. Agricultural Economics, 2018 (06): 71-73.

[8] Li Weijiang. Research Status and Trends of Agricultural Plant Protection UAVs [J]. Agriculture and Technology, 2018, 38 (10): 97.