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Analysis of Agricultural Aviation Operating Conditions in Liuzhou Characteristic Agricultural Demonstration Zone

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ABSTRACT. *With the popularization and development of consumer UAV technology in China, agricultural aviation technology has become an important development direction of modern agriculture in China. As a breakthrough of agricultural modernization in China, the demand for agricultural aviation technology in characteristic agricultural demonstration zone is becoming increasingly prominent. In view of the special situation of Liuzhou, an industrial city in Guangxi, this paper analyzes the operating conditions of agricultural aviation in the characteristic agricultural demonstration area in the region. First of all, the characteristic agricultural demonstration areas are classified according to the current situation of the development and application of agricultural aviation technology. Then, the characteristic agricultural demonstration areas suitable for plant protection operation and agricultural situation monitoring are analyzed. Finally, the paper puts forward some suggestions for the future development according to the operating conditions of agricultural aviation in Liuzhou characteristic agricultural demonstration zone. This will provide strong support for the introduction of agricultural aviation technology into Liuzhou characteristic agricultural demonstration zone.*

KEYWORDS: *Characteristic Agricultural Demonstration Zone, Agricultural Aviation, Operating Conditions*

1. Introduction

The implementation of rural revitalization strategy is an important national strategic deployment in China. In the implementation of rural revitalization strategy, the development of efficient and high-quality modern agriculture is the most important link. The construction of characteristic agricultural demonstration areas is considered to be an important starting point of the rural revitalization strategy. It is worth noting that as an industrial city, the accumulation of agricultural technology in

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Liuzhou, Guangxi is relatively weak due to historical reasons and natural conditions. For the lack of agricultural technology accumulation, this is representative in Guangxi and even the whole country. In order to build modern agriculture, Liuzhou must introduce new agricultural technology and realize corner overtaking on the basis of scientific and technological innovation. The concrete manifestation of the construction of the characteristic agricultural demonstration zone in Liuzhou is agricultural modernization, and the rural revitalization plan is carried out on the basis of realizing agricultural modernization.

In recent years, agricultural aviation technology, represented by multi-rotor UAV, has developed rapidly in China [1-3]. The multi-rotor agricultural UAV has the advantages of small size and low operating height [4, 5], which may overcome the limitations of agricultural natural conditions in Liuzhou mountain area. Therefore, introducing agricultural aviation technology into the construction of characteristic agricultural demonstration areas and providing new technological power has become an important way for the construction of agricultural modernization in Liuzhou. The analysis of the operating conditions of agricultural aviation technology in Liuzhou characteristic agricultural demonstration zone has become the premise of the introduction of related technologies.

2. The Present Situation of the Development and Application of Liuzhou Agricultural Aviation Technology

Liuzhou agricultural aviation technology has developed rapidly in the past few years with the development of national agricultural aviation technology, especially around 2014, the consumer-grade multi-rotor aircraft represented by DJI UAV occupies a large area of the international market, agricultural aviation technology has become a hot spot of modern agriculture in China[6, 7]. Liuzhou agricultural aviation technology has experienced a process from scratch since 2014. Although Liuzhou is the largest industrial city in Guangxi, there are few related technologies and industrial layout for aviation and remote sensing for a long time, so the development of agricultural aviation technology is basically at the average level of the whole Guangxi. Due to the relatively few agricultural industrial layout, compared with base, guests and other cities, Liuzhou's own demand for new agricultural technology is not strong enough, so in recent years, it is only at the average level of the whole Guangxi, and there is a certain gap with the leading cities.

2.1 The Current Situation of the Development of Agricultural Aviation Technology in Liuzhou

The agricultural aviation technology in Liuzhou was basically zero before the outbreak period in 2014, and the agricultural aviation technology in Liuzhou has also developed rapidly with the explosive development of national agricultural UAV technology around 2014. However, like many Chinese cities, the mainstream agricultural drones in Liuzhou are currently based on multi-rotor aircraft, which is completely different from the traditional definition of drones[8]. It is also essentially

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different from the international agricultural aviation technology represented by the United States. The main results are as follows:

The aeronautical technology content of multi-rotor aircraft is very low. Generally speaking, they are specialized agricultural equipment converted from consumer-grade aircraft far less than 1 ton. Compared with the international UAV which includes gyroscope, navigation, positioning and other relatively complete aviation technology, the agricultural UAV based on multi-rotor aircraft is not strictly an aviation technical equipment. Take the MG-1S launched by DJI Company as an example, flight control mainly depends on GPS positioning system. According to the current control accuracy of GPS open for civil use, it is obvious that there is a great pressure on field operations. Especially for the operation of irregular plots under windy conditions, the stability of the control system is extremely high. In order to keep the operation stable, some requirements are put forward for the power system. However, most of the existing multi-rotor plant protection UAVs in China are mainly driven by motors, which may be difficult to meet the control requirements under specific circumstances. Similar foreign brands are relatively perfect, such as Yamaha, Japan, even the 32L medicine box Fazer R is equipped with a fuel injection engine. Drones with a load of more than 1 ton obviously have more complete and complete aviation equipment .

Due to the limitation of load, the performance of agricultural UAV based on multi-rotor aircraft is single and the working trajectory is unstable. At present, the most important agricultural application of multi-rotor aircraft is pesticide spraying. Even so, in pesticide spraying, because of its light weight, its course, pesticide spraying range and other operating conditions are easily disturbed by environmental factors such as wind direction, working terrain and so on. For example, there are few reports on the use of agricultural drones in the plant protection operations of characteristic fruits. If litchi, grape and other characteristic fruits use multi-rotor UAV for plant protection, it is obvious that the accuracy of the working trajectory is higher. Relatively speaking, the international UAV has large size and high load, so it can realize the corresponding operation by carrying all kinds of equipment, so as to meet the operation demand.

The technical threshold of multi-rotor aircraft can not be formed because of its relatively low technical content. Compared with the international aviation technology and industry represented by the United States, multi-rotor aircraft have low requirements and lack of standards. For example, there are special agricultural aviation pesticides for the application of pesticides in the world, and its spraying operation standards and procedures are completely set for agricultural aviation technology[9-11]. The pesticides currently used by multi-rotor aircraft for agricultural plant protection are traditional ground spraying pesticides. For example, internationally, brands with similar size to the common multi-rotor aircraft medicine boxes in Liuzhou generally target hundreds or thousands of them, and the price of their products is rarely less than 1 million yuan. And the common multi-rotor plant protection UAV in Liuzhou, even if the price of simple supporting devices is less than 100000 yuan, even if equipped with ground stations, differential modules and other modules, its price is generally no more than 200000 yuan. Generally speaking,

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at present, Liuzhou Guangxi agricultural aviation technology uses multi-rotor aircraft to spray pesticides. Because it can reduce the demand for labor in agricultural operations to a large extent, it has a certain application in some areas with larger farmland area and crops with higher work intensity. For quite a long time in the future, if there is no major technological update, this will be the main development direction of Guangxi Agricultural Aviation in Liuzhou .

For example, internationally, brands with similar size to the common multi-rotor aircraft medicine boxes in Liuzhou generally target hundreds or thousands of them, and few of their products sell for less than 1 million yuan. And the common multi-rotor plant protection UAV in Liuzhou, even if the price of simple supporting devices is less than 100000 yuan, even if equipped with ground stations, differential modules and other modules, its price is generally no more than 200000 yuan. Generally speaking, at present, Liuzhou Guangxi agricultural aviation technology uses multi-rotor aircraft to spray pesticides. Because it can reduce the demand for labor in agricultural operations to a large extent, it has a certain application in some areas with larger farmland area and crops with higher work intensity. For quite a long time in the future, if there is no major technological update, this will be the main development direction of Guangxi Agricultural Aviation in Liuzhou .

The application status of agricultural aviation technology in Liuzhou

In recent years, the development of agricultural aviation technology in Liuzhou is mainly reflected in the introduction of plant protection UAV operation. After the introduction of northern Tiantu UAV by Liuzhou Agricultural Machinery Promotion Station in 2016, some enterprises and institutions represented by Guangxi Kehong Pest Control Co., Ltd. began to gradually introduce plant protection drones and carry out related plant protection operations. However, due to the limitations of a series of factors, such as small agricultural land, small unified planting area, complex farmland environment and so on, there are the following problems in the development of agricultural aviation technology in Liuzhou .The main results are as follows:

The planting habit in Liuzhou basically does not meet the operating conditions of the mainstream multi-rotor UAV in the market. Liuzhou City is lack of large area, flat agricultural land, there is generally no unified planting in agricultural planting, there are many flower arrangements, each doing things in his own way is the mainstream. It is obvious that multi-rotor UAV can not be used for plant protection in different growth periods and different crops. Although there is a certain amount of land transfer in Liunan District to form a relatively obvious scale of planting, but relative to the operational efficiency of UAV, these fields are only just to meet the needs of UAV plant protection operations, and the number of such fields is too small .

The farmland conditions in Liuzhou are not suitable for UAV operation. This is mainly reflected in three aspects: lack of field roads, many obstacles in field air operation, and insufficient leveling of the field. The field roads of farmland in Liuzhou are generally ridges and ridges, and they can only walk away. Generally used agricultural machinery and tools are mainly micro-tillers, while plant

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protection drones are generally more than 2-3 meters after wing deployment, so it is necessary to transport drones to the work site by field roads, but most of the farmland in Liuzhou does not meet the requirements. The farmland construction in Liuzhou City is mainly based on the ground, and ditch irrigation and the integration of water and fertilizer are the mainstream for a long time. Telephone poles are generally set up in the air, and tall trees on the edge of the field are also common. Such an operating environment for plant protection UAV is prone to blow-up accidents, according to the recognized operating environment of multi-rotor aircraft, it is impossible to fly. In plant protection operation, UAV mainly sprays pesticides, and different ground height and slope will directly affect the effect of pesticide spraying. On the other hand, the slope of many slopes of farmland in Liuzhou can reach about 4 degrees even in some so-called suitable cultivated land. In addition to the obvious terraces, the ladder height difference between fields is also a common phenomenon in Liuzhou farmland.

Some previous forced operations had adverse consequences, which affected farmers' acceptance of plant protection operations to a certain extent. Although the operating conditions and planting habits of Liuzhou do not meet the operational requirements of agricultural drones. However, some enterprises forcibly promote plant protection drones, which have obvious adverse consequences in some parts. In particular, in 2018, spring silkworms did not spin silk in two districts of four counties in Liuzhou City, which was identified as mulberry leaves contaminated by experts organized by the agricultural department. In the same period, Guangxi Kehong Pest Control Co., Ltd., which used manned helicopters for plant protection operations in some areas, was listed as an important suspect. Although the company said that "since April, the company did carry out flying spray operations in Daliang Town, Rongan County, Luzhai Town, Luzhai County, and Dongquan Town, Liucheng County, but did not carry out similar operations in other counties." Today, in areas where there is no flying spray operation, spring silkworms do not spin silk, and it is not scientific to divide the responsibility on the company. "it is also proposed that" every operation of the aircraft owned by the company is managed by the air force and civil aviation. There are records, tracks and records. In addition, with regard to the scope of spraying, the aircraft will carry out GPS positioning, according to the wind speed and altitude, the accuracy is maintained at about 1 meter, there is basically no problem of pesticide drift. " However, from the perspective of agricultural cultivation, this explanation is obviously unacceptable, and the destruction of farmland biological environment must be avoided unconditionally. In fact, according to the current domestic academic research on the application conditions of plant protection UAV, there is also a great controversy that "the accuracy is kept at about 1 meter according to the height of wind speed". Due to the lack of enough experiments to prove this conclusion, the domestic agricultural engineering academic circles generally do not accept it. At the same time, except for a few unrepeatable experiments, many scientific studies have come to the opposite conclusion. At present, this conclusion should be in the laboratory stage, without small-scale test, pilot-scale test, and it is still far away from the industrial application. Therefore, the academic research results are directly applied to the plant protection operation market, which greatly affects Liuzhou farmers' confidence in agricultural

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aviation technology. At present, there is more and more controversy about UAV plant protection operation in some areas of Liuzhou City, and some farmers have gradually promoted this technical problem into a social problem. Once the drug drift of plant protection operation of agricultural UAV becomes a social problem, farmers no longer believe in the technical explanation, and it will be difficult to further develop the agricultural aviation technology in Liuzhou. To sum up, after the explosive growth of agricultural aviation technology in Liuzhou in recent years, due to the limitations of its own conditions, it has encountered a great bottleneck in its development. The existing agricultural aviation technology is difficult to provide technical support for the explosive growth of agricultural industry in Liuzhou.

3. The Classification of Liuzhou Characteristic Agricultural Demonstration Zone Based on Agricultural Aviation Operation Content

The limitation of classified operating conditions of Liuzhou characteristic agricultural demonstration zone based on agricultural aviation operation content is the bottleneck of Liuzhou agricultural aviation technology development at present, and as the representative of Liuzhou modern agriculture, characteristic agricultural demonstration area is undoubtedly the bellwether of Liuzhou agricultural development. therefore, analyzing the agricultural aviation operating conditions of characteristic agricultural demonstration area is the only way to promote the development of Liuzhou agricultural aviation technology and the development of Liuzhou agriculture. Whether the agricultural modernization of Liuzhou characteristic agricultural demonstration zone can be realized through agricultural aviation technology, the key at present is whether the operating conditions of the relevant demonstration area meet the requirements of the introduction of agricultural aviation technology.

With the wide application and promotion of multi-rotor aircraft in plant protection operations since 2014, the concept of agricultural UAV equivalent to plant protection UAV has gradually become the mainstream understanding. In fact, from a technical point of view, plant protection UAV is only one application field of agricultural UAV. At present, due to the related technologies and applications are not mature enough, many applications can not go out of the laboratory. From the perspective of future development, plant protection UAV is only a small part of the field of agricultural aviation, and there is still a lot of room for improvement in agricultural situation monitoring, intelligent agricultural machinery and other fields, so in addition to the traditional consumer UAV enterprises for the manufacture of agricultural aircraft, at present, many agricultural machinery, remote sensing, monitoring, sensors and other enterprises have also begun to pay attention to the manufacture of agricultural aircraft. Due to the low threshold of multi-rotor UAV manufacturing and relatively simple financial and technical requirements, it is easier for related companies to enter the industry, which greatly increases the possibility of related applications coming out of the laboratory.

From the existing academic research, in addition to plant protection operations, based on low-altitude close-range remote sensing technology, agricultural situation

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monitoring aimed at agricultural big data and intelligent agriculture is a development direction of UAV application. To this end, the Guangxi government proposed in 2019 to speed up the deep integration of agricultural mechanization, information and intelligence. Promote the application of mobile Internet, Internet of things, big data, intelligent control, satellite positioning and other information technology in agricultural machinery equipment and agricultural machinery operations. Draw up a technical roadmap for high-end agricultural machinery equipment and guide the development of intelligent and efficient agricultural machinery equipment. We will support superior enterprises to connect with key users and form a mutual promotion mechanism between R & D, production and promotion and application. We will build a demonstration base for digital agriculture and promote the integrated development of intelligent agricultural machinery, intelligent agriculture and the construction of cloud farms. We will speed up the construction of an information management system for agricultural machinery in Guangxi, support the construction of a service platform for cooperative development of agricultural machinery in Guangxi, and promote the joint participation and cooperative development of new agricultural operators and financial institutions. " All this is based on the acquisition of agricultural information. according to the mode of relying on satellite and aerial remote sensing in the northern plain, the operating conditions of agriculture in Liuzhou can not be met. Take satellite images as an example, satellite images with cloud occlusion below 3% are regarded as valid images, while a scene image is generally 10 km × 10 km, and there are not many valid images in Liuzhou mountain area in a year. Under such conditions, it is difficult to obtain the agricultural information of related crops and carry out agricultural operations accordingly, so using multi-rotor UAV to collect relevant videos and images is an effective way to solve this problem.

In addition, from the application of consumer-grade multi-rotor aircraft, shooting images and video is its main application and technical positioning. Take DJI Company as an example, its products have been greatly applied and recognized around the world, mainly focusing on the application of its products for image and video shooting. Because of its portability, simplicity and high performance-to-price ratio, its competitors are digital cameras, smart phones and other data acquisition products. Therefore, in agricultural aviation, the application of consumer-grade multi-rotor aircraft for agricultural image acquisition is to give full play to its technical expertise and in line with its technical positioning. Therefore, it is reasonable to believe that this field is more suitable for consumer-grade multi-rotor aircraft than plant protection operations. According to the existing products in Xinjiang, the flight control requirements of agricultural monitoring can be basically met by using the eliminated elves 3 and 4, with a lag time of nearly 30 minutes and the control of the ground station. The image and video acquisition system and image transmission system can obtain at least centimeter-level images when the distance is appropriate, which fully meets the needs of agricultural monitoring. Therefore, there is no need for transformation, and the existing consumer-grade multi-rotor aircraft can basically meet the technical needs of agricultural monitoring. To sum up, according to the conditions of Liuzhou characteristic agricultural demonstration zone, characteristic agricultural demonstration can be divided into three categories:

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suitable for plant protection operation, not suitable for plant protection operation suitable for agricultural condition monitoring, neither suitable for plant protection operation nor suitable for agricultural condition monitoring.According to this classification, the agricultural demonstration areas of Liuzhou are classified as follows:

Table. 1 Part of Liuzhou characteristic agricultural demonstration area classification

Number	Type	Liuzhou characteristic agricultural demonstration zone
1	It is suitable for plant protection operation.	(1) Golden Sun Modern Urban Ecological Agriculture demonstration Zone in Liunan District; (2) Daohua Piaoxiang Modern Food Industry Agricultural demonstration Zone in Liucheng County; (3) Modern Sugar Industry demonstration Zone in Chong Mai Town, Liucheng County; (4) Liujiang District is full of happy scallions industry agricultural demonstration area. It is not suitable for plant protection operation and suitable for agricultural monitoring.
2	It is not suitable for plant protection operation and suitable for agricultural monitoring.	(1) urban leisure agriculture demonstration zone in Zhaomei, Luzhai County; (2) Gulan Xinyun kumquat industry agricultural demonstration zone in Rong'an County; (3) Sanjiang Camellia oleifera industry agricultural demonstration area in Sanjiang County; (4) Sanjiang Dongzhai Sanjiang Tea Industry Agricultural demonstration Zone in Sanjiang County; (5) citrus industrial agricultural demonstration area in the city of overseas Chinese in Liucheng County. (6) the agricultural demonstration area of kumquat industry in the small village of Rongan County; (7) the demonstration area of citrus industry in Liuhe Orange Sea, Luzhai County; (8) the agricultural demonstration area of vegetable industry in Damiaoshan, Rongshui County.
3	It is neither suitable for plant protection nor agricultural monitoring.	(1) Luzhai County Youyou Luming Grape Industry Agricultural demonstration Zone; (2) Lanting Linxu Flower Seedling Industry Agricultural demonstration Zone in Liubei District; (3) Modern Agricultural demonstration Zone in Miao Township, Rongshui County; (4) Moonlight Agricultural demonstration Zone in Hetang, Liujiang District; (5) Silk sericulture demonstration Zone in Chanyun, Liucheng County (6) Honghua laying hen ecological breeding core demonstration area in Liunan District;

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		(7) Danzhou Ancient City Leisure Agriculture demonstration Zone in Sanjiang County; (8) Huangmian Silkworm Industry Agricultural demonstration Zone in Luzhai County.

(1)

(2)

(3)

(4)

(5)

(6)

Figure. 1 Liuzhou characteristic agricultural demonstration zone which is not suitable for neither plant protection nor agricultural condition monitoring

As shown in Table 1 and Figure 1, (1)-(6) the characteristic agricultural demonstration areas in Table 1 are neither suitable for plant protection nor for agricultural monitoring, as shown in figure 1. (1)-(3) the three characteristic

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agricultural demonstration areas mainly rely on the greenhouse to develop the planting industry, and the grapes, orchids and vegetables are mainly planted in the greenhouse. Even in the modern agricultural demonstration area of Miao Township, Rongshui County, in order to ensure the timely supply of canteens in urban primary and secondary schools and other units, its vegetable cultivation also adopts the way of planting in the greenhouse, and its flower cultivation is completely planted in the greenhouse. Therefore, there is no opportunity to display the ability of agricultural aviation technology in this kind of characteristic agricultural demonstration area which is mainly planted in greenhouse. And (4)-(6) the main industries of the three characteristic agricultural demonstration areas are tourism, silk and poultry, which have little relationship with planting industry and do not belong to the scope of agricultural aviation technology. Therefore, it is necessary to focus on the analysis of the working conditions of Liuzhou characteristic agricultural demonstration area under plant protection operation and agricultural situation monitoring operation.

4. Analysis of the Operating Conditions of Agricultural Aviation Plant Protection for the Characteristic Agricultural Demonstration Zone

The characteristic agricultural demonstration area which is suitable for agricultural aviation vegetation is generally a large area of characteristic agricultural demonstration area, which is mainly the cultivation of rice and sugar cane in Liuzhou City. In this kind of demonstration area, the planting area is large, there are a series of crops in the same period, and the needs of plant protection operations are the same. Take the four characteristic agricultural demonstration areas listed in Table 1 as an example, the pictures are shown in Pic. 2.

(1)

(2)

(3)

(4)

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(1) Golden Sun Modern Urban Ecological Agriculture demonstration Zone

(2) Rice Flower Piaoxiang Modern Grain Industry Agriculture demonstration Zone

(3) Sugarcane Kaige Modern Sugar Industry demonstration Zone in Chong Mai Town

(4) Green Onion Industry Agricultural demonstration Zone

Figure. 2 The characteristic agricultural demonstration areas are suitable for plant protection operation

Table. 2 Part of the characteristic agricultural demonstration area are suitable for plant protection operation

Number	The characteristic agricultural demonstration zone	Area	Domain
1	Liunan district golden sun modern urban eco-agricultural demonstration zone	core area 3,100 mu	leek; beans, sweet bamboo shoots, rice and other snail powder industry
2	Liucheng county rice flower floating fragrance modern grain industry agricultural demonstration area	20,520 mu	selenium-rich rice
3	Liucheng county Chongmai town sugarcane Kaige modern sugar industry demonstration area	core area 3,056 mu	sugar cane
4	Liujiang district full of happy spring onion industry agricultural demonstration area	47,250 mu	chive

The planting area and industrial characteristics of the four characteristic agricultural demonstration areas are shown in Table 2. It can be seen from figure 2 that a large area of continuous land is the characteristic of this kind of characteristic agricultural demonstration area. And from the perspective of its industry, the cultivation of crops is relatively simple, which is convenient for unified management and unified operation. In such an environment, agricultural aviation technology has great advantages compared with traditional manual operation and traditional ground plant protection machinery. At present, the factors restricting the promotion of agricultural aviation technology in this kind of characteristic agricultural demonstration areas mainly include the following three points.

The direction of development is not firm enough. Due to the impact of low agricultural returns, it is often difficult to achieve sufficient economic benefits for the cultivation of a single crop. For example, the annual income of one mu of rice field is likely to be not as good as the income of accompanying consumption such as diet produced by visitors when the rice is ripe. As a result, the characteristic agricultural demonstration areas suitable for plant protection operations are often developed in the direction of agricultural tourism. In fact, once joining agricultural tourism, it is inevitable that within a period of time, the income driven by agricultural tourism is close to or even exceeds the income of planting. This makes the further development of the relevant ad hoc agricultural demonstration areas

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shaken to a certain extent. It can be seen that almost all the characteristic agricultural demonstration areas suitable for plant protection operations regard agricultural tourism as their own development direction, and the real restriction on the landing of agricultural tourism is the objective conditions rather than the will of each characteristic agricultural demonstration zone. On the other hand, it should be noted that agricultural tourism needs certain tourism facilities, especially tourists to enter the fields. This is not a big problem in traditional planting, but the newly added overhead lines such as wires, networks and landscapes such as pavilions and water tankers have no small impact on agricultural aviation. Therefore, the increase of agricultural tourism facilities is an unavoidable problem in this kind of agricultural demonstration area suitable for plant protection operation at the present stage.

There is no quantitative evaluation of operation effect. The most intuitive effect of the introduction of agricultural aviation technology is the saving of manpower. According to the traditional way of plant protection that requires farmers to work in the field, the intensity and time of farmers' work are very large. In particular, compared with the efforts of workers in industrial production, the benefits of such labor intensity are relatively low. Therefore, the emergence of agricultural aviation makes plant protection operations possible, which really reduces the work intensity and time of plant protection operations. But apart from that, what is the effect of pesticide spraying? Is there any drift in pesticide spraying? There is no quantitative evaluation. Therefore, at present, the most direct understanding of agricultural aviation is to reduce the labor intensity, but there is controversy about the effect of the operation. Especially in some specific agricultural pollution incidents, the existence of pesticide drift in Liuzhou has become an unavoidable problem for agricultural aviation. Due to the long-term lack of operational effect evaluation, the advantages of agricultural aviation have not been fully reflected. This is a great restriction to further promote the application of agricultural aviation in Liuzhou special agricultural demonstration zone.

The timing of operation is not accurate. Due to the lack of sufficient agricultural information, the application of agricultural aviation technology for plant protection operations is generally arranged according to the time of plant protection operations in the traditional planting industry. In fact, agricultural aviation technology has a greater advantage in the choice of operation time for plant protection operations. The growth of crops in the field is obtained through agricultural aviation technology, and plant protection operations are carried out selectively. Choosing different doses of pesticides for spraying in different areas will inevitably improve the operation effect and save the expenditure of pesticide costs and reduce the soil residues of pesticides. Therefore, the lack of attention to the operation time directly affects the agricultural aviation technology to give full play to the advantages of plant protection operation. Therefore, great attention should be paid to these characteristic agricultural demonstration areas which are suitable for plant protection operations. This is the basis and bridgehead for the promotion of agricultural aviation technology in Liuzhou agriculture in the future. The government should give certain policy support and economic support, for example, in the allocation of agriculture-related support funds, such as the identification of

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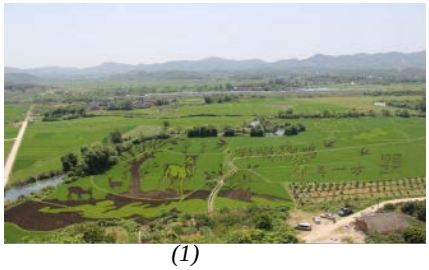
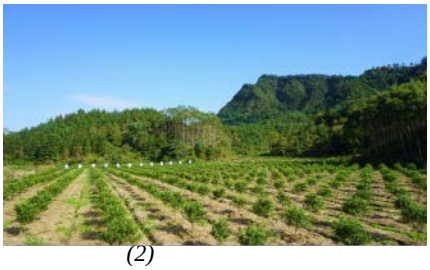
relevant qualifications, we should actively adopt agricultural aviation technology in the characteristic agricultural demonstration areas suitable for plant protection operations.

5. Analysis of the Operating Conditions of the Characteristic Agricultural Demonstration Zone for Agricultural Aviation Agricultural Situation Monitoring

A kind of characteristic agricultural demonstration zone in Liuzhou are not suitable for plant protection operation but suitable for agricultural situation monitoring. Take the (1)-(4) characteristic agricultural demonstration areas listed in Table 1 which are not suitable for plant protection but suitable for agricultural monitoring as an example, the picture is shown in figure 3, and part of the situation is shown in Table 3.



(1)



(2)

(3)

(4)

(1) Luzhai County Zhaimei Urban Leisure Agriculture demonstration Zone;

(2) Gulan Xinyun kumquat Industry Agricultural demonstration Zone in Rong'an County;

(3) Sanjiang Camellia oleifera Industry Agricultural demonstration Zone in Sanjiang County;

(4) Sanjiang Dongzhai Sanjiang Tea Industry Agricultural demonstration Zone.

Figure. 3 The characteristic agricultural demonstration areas are suitable for agricultural monitoring but suitable for plant protection operation

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Table. 3 Part of characteristic agricultural demonstration areas are suitable for agricultural monitoring but not not suitable for plant protection operation

Number	The characteristic agricultural demonstration area	Area	Domain
1	Luzhai County Zhaimei urban leisure agricultural demonstration area	19,500 mu	(1)400mu Zhongdu ancient town folk culture experience area; (2)860mu Xianghe Xiangyun agricultural sightseeing and leisure area; (3)1260 mu rice industry experimental demonstration area in Daohua Xiangli (4)Xiangqiao Ecological Leisure Health Zone
2	Gulan Xinyun kumquat Industry Agricultural demonstration Zone in Rong'an County	Core area 3480 mu	Kumquat
3	Sanjiang Camellia oleifera Industry Agricultural demonstration Zone in Sanjiang County	core area 2472 mu	Camellia oleifera
4	Sanjiang Dongzhai Sanjiang Tea Industry Agricultural demonstration Zone	core area 3650 mu	Tea

This kind of characteristic agricultural demonstration area mainly includes two types: one is the demonstration area like Zhaimei in Luzhai County, which is degraded from the demonstration area suitable for agricultural plant protection; the other is that the crops and planting conditions are not suitable for the introduction of agricultural aviation technology for plant protection operations. For the first type of demonstration areas such as the United States in Luzhai County, mainly due to the needs of agricultural tourism, the output of planting is no longer the first priority of agricultural demonstration areas. On 19500 mu of land, Zhaimei has arranged cultural experience areas and leisure health areas, while there is no need for plant protection operations in rice planting areas as shown in figure 3. However, such characteristic agricultural demonstration areas are more concerned about the growth of crops. The appearance of crops is the main part of their tourism landscape, and the growth and appearance changes of crops can be effectively predicted by agricultural monitoring. At this time, the demand for agricultural testing is much higher than that of plant protection. For example, for rice, when rice can be golden and what can realize the landscape of "rice blossom in the bumper year" is more important for this kind of characteristic agricultural demonstration area. To predict the growth appearance of crops in such an area, agricultural aviation technology is obviously the most suitable technology in the existing technology. For the second kind of areas due to the limitations of crop types and planting conditions, the aviation operation of plant protection is more difficult. For example, "Gulan Xinyun kumquat Industrial Agricultural demonstration Zone in Rong'an County" and

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"Sanjiang Dongzhai Sanjiang Tea Industrial Agricultural demonstration Zone in Sanjiang County" investigated by the research group, there is an obvious slope and height difference between the fields in the core planting area, and the crops are also based on plants. If the agricultural aviation technology is used for plant protection operation, there will be high stability requirements for the flight trajectory and operating point of the multi-rotor aircraft. Come to think of it, with the current technical requirements of DJI UAV, MG1-S hovers over a single citrus tree to spray pesticides, which is too demanding for both flying hands and equipment. However, for this kind of cash crops, the monitoring of their growth process and the monitoring and prediction of insect control, weeding and water shortage are indispensable. Obviously, the introduction of agricultural aviation technology for agricultural monitoring is a prerequisite for the rapid and timely completion of related work. More importantly, the estimation of yield is the premise of the final income of this kind of cash crops, and the lack of yield estimation is the pain point of the inability to carry out effective market intervention. In the north, in the case of the introduction of satellite and aerial remote sensing to estimate the yield of a large area of crops, it is gradually possible to introduce multi-rotor aircraft to monitor the agricultural situation in the characteristic agricultural demonstration area of Liuzhou, and to estimate the yield accordingly.

In addition, it is worth emphasizing that the introduction of subversive technology to improve existing agronomy is an unavoidable problem when the cash crops planted in this kind of characteristic agricultural demonstration areas want to develop to the high end, whether it is citrus or tea. Take tea production as an example, good tea is only 10-20 jin per mu, but it can generate sales income of tens of thousands of yuan. The low-end tea can have more than 200 jin per mu of land, but the income may be less than 10,000 yuan. In terms of cost input, the water and fertilizer input of low-end tea is higher. If Liuzhou agriculture needs to produce high-quality tea and further improve the income of a single mu of tea garden, the introduction of agricultural monitoring technology is an effective way to maintain the stability of tea quality. Therefore, for the future development of high-end agriculture, agricultural aviation technology is likely to make a breakthrough in this kind of characteristic agricultural demonstration areas which are not suitable for plant protection but suitable for agricultural monitoring and extension.

6. Suggestions on the Development Planning of Agricultural Aviation Technology in Liuzhou Characteristic Agricultural Demonstration Zone

In fact, there have been some technical difficulties in the development of agricultural aviation industry in Liuzhou. On the one hand, the realistic conditions of agricultural plots and mountain areas in Liuzhou restrict the development of Liuzhou agricultural aviation industry; on the other hand, it lacks sufficient technical strength to carry out targeted scientific research. Therefore, in the formulation of the development plan of aviation technology in Liuzhou characteristic agricultural demonstration zone, the core content is to introduce technical force for targeted research, demonstration and promotion. The existing mode of computer and big data

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technology testing competition can be considered to attract domestic mainstream agricultural UAV companies and technical forces to participate in the development and cooperation of Liuzhou agricultural aviation technology, so as to speed up the cultivation of Liuzhou agricultural aviation industry. This mainly includes two forms: holding academic conferences and technical test competitions.

5.1 Holding Academic Conferences to Build Agricultural Aviation Academic Exchange Platform

By holding annual academic conferences, we can gather the problems of Liuzhou agricultural aviation with the help of domestic scientific research forces. At present, there is a lack of academic conferences for agricultural aviation in China, so universities and industries in Liuzhou are encouraged to hold special academic conferences. First of all, attract relevant researchers and enterprises from Guangxi to exchange and cooperate in the Liuzhou characteristic agricultural demonstration zone, so as to form a certain database, and then attract scholars from all over the country to come to the Liuzhou special agricultural demonstration zone through these fixed agricultural data sources. this will enable domestic scholars to go to Liuzhou characteristic agricultural demonstration zone to investigate the agricultural working environment in Liuzhou and discuss the technical problems of agricultural aviation in Liuzhou at academic conferences. Thus forming the gathering of domestic scientific research forces in Liuzhou agricultural aviation technology. This plan has a lesson from the past. Sanjiang County in Liuzhou has achieved good results by holding the national tea annual meeting, and many scientific research institutions have set up observation and experimental sites in the tea gardens of Sanjiang. Therefore, it is feasible to attract the agricultural aviation technical force of Guangxi by holding some academic conferences, and it is also possible to attract the agricultural aviation technical force of the whole country through the accumulation of a period of time.

5.2 Through the Mode of Academic Competition, Using Aviation Operation Subsidies to Attract Small and Medium-Sized Agricultural Aviation Enterprises to Service for Liuzhou Characteristic Agricultural Demonstration Zone

Academic competitions can be holded during the academic conference or in the form of relying on platforms such as Alibaba Tianchi. There will be a test competition. According to the needs of agricultural development in Liuzhou, it is best to choose citrus and tea as objects, openly provide environmental data and agricultural aviation monitoring data of tea orchards and orchards, put forward requirements for agricultural monitoring, and conduct test competitions according to the requirements. Through the test competition, the technical problems of agricultural aviation in Liuzhou characteristic agricultural demonstration zone can be pushed to the relevant domestic scientific research forces. In particular, the provision of test data free of charge significantly reduces the cost of related experiments in the field, which is of great attraction to colleges and universities. In

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essence, this is to provide test data through test competitions to attract domestic scientific research forces to carry out research and development on the technology of Liuzhou Agricultural Aviation. In 2019, Guangxi big data Bureau commissioned Alibaba Tianchi platform to conduct relevant big data competitions, providing weather conditions and average rice yields of all counties and cities in Guangxi for several years, and conducting big data prediction competitions for average rice yields. The competition had a great impact and successfully attracted a number of studies on the relationship between the strength and the rice yield in Guangxi.

In addition, the field test competition organized during the academic conference must organize the enterprise product competition for the actual field operation in Liuzhou characteristic agricultural demonstration zone. Directly compare the products and solutions of each enterprise through on-site operation. As the objects and sites of the field test are in Liuzhou characteristic agricultural demonstration zone, in order to achieve better results, it will attract domestic relevant enterprises to invest in Liuzhou characteristic agricultural demonstration zone in disguise. In addition, in order to attract the participation of domestic mainstream agricultural aviation enterprises, some enterprises need to be supported according to the results of the test competition. These supports are aimed at all enterprises that have excellent test results in the test competition, not just agricultural aviation enterprises in Guangxi or Liuzhou. This is mainly because the test itself has a very strong localization characteristics of Liuzhou agriculture, the products and achievements of related enterprises can directly serve Liuzhou agriculture, so all participating enterprises essentially participated in the construction of Liuzhou agricultural aviation industry.

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