ANALYSIS OF THE EFFICIENCY OF UNMANNED TECHNOLOGIES IMPLEMENTATION IN AGRARIAN PRODUCTION

A. A. Abdumazhitov,

I. G. Gorlova
Tashkent State Agrarian University
E-mail: axmad-abdumajitov@mail.ru

Abstract: The article provides an overview of unmanned aerial vehicles (UAVs) usage in the agricultural sector. The conducted analysis showed that UAVs are used as aerial robots that can perform the function of both aerial photography and delivery of plant protection products. A quadrocopter (drone) can also be used to create 3D models of various objects or small areas of fields with territory of less than 0.8 hectares.

Key words: unmanned aerial vehicles, quadrocopter, drone, agricultural production.

The relevance and demand for the use of unmanned aerial vehicles (UAVs) in the agro-industrial complex (AIC) is due to the need of obtaining timely reliable information. The range of use of UAVs is very wide: monitoring of pastures, agricultural land, assessment of the volume of work and control of their implementation, protection of farmland. Currently, there are many types of UAVs in the market: aircraft type, helicopter type, unmanned balloons, hybrid subclasses of vehicles

The importance of using modern technologies as one of the main factors in increasing the competitiveness of the national agro-industrial complex was noted by the President of Uzbekistan Sh.Mirziyoyev during the monitoring of the project for the use of quadrocopters and agrodrons in agriculture. In particular, the head of state said: “Such modern devices are important for agriculture. If we are concerned about the future of agriculture, we must pass faster to modern working methods. It is necessary to pay special attention to mastering the production of drones, to organize a joint venture for this purpose and to train the appropriate

personnel. "It was noted that, first of all, it is necessary to organize accurate accounting of agricultural lands, improve their usage.

According to the definition approved by the Assembly of the International Civil Aviation Organization (ICAO), "an unmanned aerial vehicle (drone) is an aircraft without a pilot ... that flies without the pilot-in-command and is either completely remotely controlled from another place on the ground, from another board, from space, or programmed and completely autonomous. "

Unmanned aerial vehicles are difficult to classify very clearly as they have different characteristics. This diversity comes from an abundance of layouts, configurations, and components. Today there are no uniform requirements established by international aviation regulators.

When conducting research on the basis of a systematic approach, the methods of technical and economic, comparative and functional-morphological analysis were used. Information on patent and scientific and technical literature, as well as information posted on the global Internet was selected as information sources. The analysis of the possibility of UAVs usage in decision support systems was carried out.

Below an overview of the most common and most demanded UAVs of aircraft and helicopter types and examples of their use in agricultural production is given.

By layout and device, drones (drones) are divided into the following types:

- ✓ fixed wing - a drone with a fixed wing, classic takeoff and landing and a power plant
- ✓ rotary wing - a drone with a rotating wing - this is the same helicopter, but more compact and without a pilot;

Fig. 2. Yamaha RMAX sprayer on an agricultural field.

- ✓ multirotor is a vertical takeoff and landing drone.

Fig. 3 The use of drones in agriculture.

Currently, unmanned aerial vehicles (drones) can be used in our republic in the following areas:

- ✓ calculation of yield, pollination of crops and other agro technical operations in the field of agriculture, which in the future are less costly and more efficient;
- ✓ in the field of cartography and geodesy - measurement and registration of areas, study of soil condition and its salinity using attachments, geolocation of real estate and other geographical objects;
- ✓ in the field of tourism and media - for panoramic filming;
- ✓ delivery of goods and parcels - for the delivery of goods and parcels in a hard-to-reach environment;
- ✓ in the field of education and science - for training drone operators, developing scientific and technical creativity, creating drone models by students and young scientists and studying their application.

Analysis of world experience has shown that in Kazakhstan drones weighing up to 1.5 kg can be imported without any registration.

In the United States, according to FAA (Federal Aviation Administration) rules, drones weighing up to 250 grams are used without registration. And models weighing from 250 g to 25 kg can be registered online. The registration person must be at least 13 years old. After registration, the owner is given a special sticker that must be glued to the drone's body.

Recently, a number of decisions have been made in Uzbekistan related to the usage of unmanned aerial vehicles (UAVs).

In our country, the issues of import, registration and operation of drones are regulated by a number of regulatory legal acts. The most important of them are the Air Code, the Regulations on the Procedure for the Operation of Unmanned Aerial Vehicles in Civil and State Aviation of the Republic of Uzbekistan and the Basic Rules for Aviation Flights in the airspace of the Republic of Uzbekistan. These documents define the requirements for the import, registration and operation of UAVs for legal entities and individuals.

It is determined that all drones outside the scope of this description must undergo state registration with an authorized body and meet the following requirements:

- ✓ be of industrial manufacture;
- ✓ have a passport of the manufacturer or an equivalent document (quality certificate, certificate of conformity);
- ✓ have a maximum take-off weight of no more than 25 kg.

The UAV operator must, in particular, have the citizenship of Uzbekistan, attain the age of 18, for health reasons, be fit to perform official duties, have special training in the operation and control of the UAV, based on the recommendations of the manufacturer (supplier) of the drone, demonstrate the level of knowledge and skills, allowing you to exploit it.

Currently, there is no systematic training, education (training) or advanced training with subsequent certification of UAV operators.

To develop the scope of UAV applications in the sectors of the republic's economy, it is necessary:

1) to include the departments associated with the aviation and space industry, industry educational institutions for training, retraining and improving their qualifications in the list of authorities for the import and operation of drones;
2) organize a service for the maintenance and repair of UAVs operated in the republic;
3) creation of a certified training center for training UAV operators;
4) working out of educational and methodological documentation, training materials and carrying out of practical trainings in courses;

5) expansion of international cooperation with leading scientific and educational centers and the development of a local scientific school.

The use of drones in everyday life, the automation of production and operational processes with their help, as well as their replacement of classical tools is an urgent issue in the near future. It is necessary to pay close attention to solving of the above issues with the involvement of competent specialists and the study of international experience.

The use of drones in agriculture is becoming more large scale.

There are more UAV units and functions that the flying farmer assistants can handle. (fig. 5.)

Fig. 5. UAV work on a farm site.

Drones monitor, take pictures from a height, create 3D maps, plant seeds, apply mineral fertilizers and chemicals, control crops, help in irrigation, and control animals in agriculture. (Figure 6-8)

In Pittsburgh, USA, Skycision company is actively using drones and infrared technologies for both disease diagnosis and pest monitoring. The drone operator takes hundreds and thousands of infrared images and then creates a detailed map with photographs.

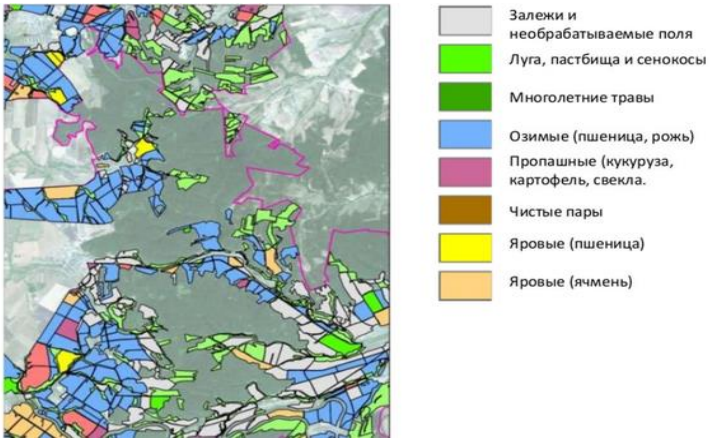

Fig. 6. Creation of a planning and cartographic base, vector maps and field passports

Результаты: цифровые карты содержания азота в почве и тканях растений. На основе полученных данных рассчитываются необходимые количества и места внесения азотных удобрений

Fig. 7. Monitoring. The need for nitrogen fertilization.

Moreover, infrared sensors are even capable of detecting the amount of chlorophyll in plants. Disease marker: crops are affected - chlorophyll is reduced. You can also use the doctor of plant medicine program from Skycision company, thanks to which you can analyze the problem and get an "appointment" for the processing of crops.

UAVs help to collect the information you need much more easily than obtaining data from aircraft or echo sounders. High-quality images from drones have become an excellent tool for farmers.

The analysis revealed that the UAV can be used in land reclamation, agroecology, in the field of land monitoring and protection, as well as in animal husbandry and in the construction of hydro technical structures.

Modern UAVs can monitor all agronomic indicators. Starting with the digitization of the relief: determining watercourses, waterlogging places, preparing the soil for the season, forming agronomic maps, and ending with the control of height, plant density, nitrogen content, etc.

In animal husbandry, it is possible to control the livestock population. In agroecology, differentiated application of mineral fertilizers in order to ensure uniform plant density, creating a map of diseases, weediness of crops, soil fertility. The operation of systems using drones involves both monitoring the situation in the fields and processing the information received.

In this case, information may be required not only by the farmer, but also by agricultural insurance companies, banks and credit institutions, investment companies and development corporations.

Practice shows that satellite images can give distorted data. For example, one field is monitored for five days. On the first day in the picture, the field is green, on the second day it is half red, that is, the disease, on the third day everything is red, on the fourth day green appears again and in the fifth day field is green. Based on the results of the survey, it can be concluded that everything was fine, then the disease started, destroyed the crops, then everything sprouts again. In reality, atmospheric conditions influence the intensity of light transmission and its reflection. Satellite data is not calibrated based on weather conditions. When shooting is done on a drone (quadrocopter), there are two people in the crew: a pilot and a ground specialist, whose duties include carrying out atmospheric calibration, which allows us to compare the images regardless of the conditions in which they were taken.

The drone can be used to apply crop protection products with low-volume fine equipment. Today, further scientific and technical developments, such as accurate mapping and drone batteries, are needed to implement this function.

Thus, the results of the analysis showed that UAVs are often used as aerial robots that can perform the function of both aerial photography and the delivery of plant protection products and other functions. The quadcopter is also convenient to use for creating 3D models of various objects (buildings, technological structures, reclamation facilities and hydro technical structures), or small parts of fields with an area of less than 0.8 hectares.

In general, unmanned technology will contribute to the introduction of market mechanisms in agriculture, the establishment of scientifically based production, which will lead to more effective food security, an increase in food per capita and a manifold increase in exports.

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