

UDC of 632.937:631.3

© 2015

V.V. Adamchuk,

doctor of engineering sciences

V.H. Myronenko, doctor of engineering sciences

S.O. Maranda

A national scientific center is "Institute of mechanization and electrification of agriculture"

Pilotless aircrafts are in a plant-grower

Aim. To create pre-conditions for deployment of pilotless aircrafts in the newest technologies of agriculture in Ukraine. **Methods.** An analysis of tasks of hardware, synthesis of technical decisions, laboratory and field researches, is from determination of rational parameters of pilotless aircraft. **Results.** The structure of basic scientific and technical tasks to realization of organic agriculture and bringing of biologics is worked out in the system of defence of plants. Basic descriptions and rational parameters of pilotless aircraft are certain for monitoring of the state of sowing and bringing of biologics, and also efficiency of his use. **Conclusions.** Introduction in the agroindustrial complex of Ukraine of the specialized pilotless aircraft with certain rational parameters for the air monitoring of the state of the field and bringing of biologics from defence of plants creates terms for passing to the industrial production of organic goods.

Keywords: plant-grower, pilotless aircrafts, monitoring, bringing of biologics, efficiency.

In modern agriculture the problems of economic and ecological plan appear all sharper, and for 100 last the the coefficient of efficiency of the use of soil at the industrial conduct of agricultural production diminished from 4 to 1,5-2 times.

The decision of problem of providing of humanity quality foodstuffs in the conditions of worsening of the ecological state of natural environment requires complex alteration of agriculture on biopower basis and passing to organic agriculture [1, 10].

The production of organic foodstuffs in the world grows constantly. For today the volume of this market is estimated in over 55 milliards of euro and annually grows almost on 5%. The circle of countries that have a corresponding legislation in industry of organic agrarian production broadens - presently such countries already 84.

An aim of researches is creation of pre-conditions for deployment of pilotless aircrafts in the newest technologies of agriculture in Ukraine.

Results of researches. Realization of the system of organic agriculture foresees the decision of wide spectrum of scientific and technical tasks, in particular to monitoring of the state of the field on all stages of production of agricultural goods, providing of the locally-dosed till of characteristic areas of the field, application of high-efficiency organic fertilizers, biological methods of defence of plants [4, 9], the use of biological types of fuel is for the productive and domestic necessities of АПК (rice. 1).

Monitoring of the state of the field after realization can be divided into pin with soil and distance. RMON, in turn, can be remote - with application of facilities of space-based, and near - with application of facilities of the surface or air basing [2, 8].

Field monitoring by means of facilities of air-based, or, otherwise speaking, the near aeromonitoring comes true by means of літальних in air space facilities with the specialized equipment set on their side for registration of parameters of the state of the field.

Rice. 1. Structure of basic scientific and technical tasks to realization of organic agriculture

The Radioguided models of pilotless aircrafts (БЛА) for today are optimal facilities of air-based for registration of місцевизначених parameters of the state of the field [3].

The specialized equipment is set onboard airplane and contains a device for realization of survey of surface of the field (video camera, spectrometer), equipment of the system of місцевизначення and equipment of record of information.

During implementation of process of monitoring of the state of the agricultural field of БЛА moves above the surface of the field on a certain height and on the set trajectory, a survey device carries out the survey of the field surface, and the geographical system of positioning (ГСП) fixes the coordinates of trajectory of flight of airplane (rice. 2). After realization of monitoring information from a load map is passed on a computer, where treatment of the got information is by means of the special software. Quality of picture of the field surface depends mainly on the parameters of survey device and from техніко-експлуатаційних possibilities of aircraft, that is why there is a requirement in the choice of optimal facilities and devices for realization of monitoring of agricultural lands.

Rice. 2. Aviation monitoring of agricultural lands

Before a survey equipment that is used onboard facilities of air-based for registration of місцевизначених parameters of the state of the agricultural field, such requirements belong: to have a high discriminability that gives an opportunity to form the quality pictures of surface of the investigated field; to have a large cruising radius for the unimpeded transmission of signal to the registration module;

to have small weight, to minimize the problems of balancing of means of air-based. There is a far of аерофотообладнання, that answers certain requirements, for example video camera of Mini DV 80: videoformat - AVI; expansion - 720?480; frequency of shots - 30 c - 1; format - 3:4.

The output of the field surface can come true both in a plan, when an optical axis of survey device is in perpendicular position in relation to the surface of soil and in a prospect, when an optical axis of survey device is under a certain corner to the surface of the field.

Pictures in a plan quality enough recreate the picture of густоти of vegetation on the surface of the investigated field, where the greater and less thickness of vegetation is clearly visible on his area. On information of such picture it is possible to be set by a question about reasons of unevenness of cover of vegetation for the areas of the field and to define, what factors she appeared under act of. The pictures got in a prospect embrace the large areas of the agricultural field. After such pictures it comfortably enough to determine the thickness of sowing on large territories of agricultural lands and conduct research by means of spectrology.

The effective use of місцевизначених parameters of the agricultural cultures got by means of фотовідеозйомки of the field surface foresees creation of electronic database to that it is needed to bring in obtained information about accordance of certain color of the field areas to certain physical and chemical properties of soil and plants, according to information of pictures to classify zones with different густотою of germination of plants after reason of influential factor that predetermines the unevenness of vegetable canopy. With the aim of construction of electronic database it is needed to conduct spectral calibration for comparative description on the areas of the field with the different colors of picture. In particular, to define variations of areas with different maintenance of nourishing elements, height and густоту of pedicellate mass of the grown cultures, and also to register areas the fields, staggered by illnesses and wreckers, artificial and natural factors.

A biological method of defence of plants is one of basic factors of effective development of organic agriculture. Thus power equivalent of expenses for defence of plants by preparation of entomologist in 5-7 times less comparatively with chemical pesticides.

One of the most difficult scientific and technical tasks that require a decision at the industrial use of biological facilities of defence of plants is providing of them effective bringing (rice. 3).

Presently in the conditions of Ukraine by the basic means of biological method of fight against wreckers both on the fields and in gardens, there is трихорграма that provides inhibition of шкодочинності complex of dangerous wreckers, such as: підгризаючі and листогризучі совки, вогнівки, білани, молі, garden листокутки and others like that.

The prime price of the hectare of agricultural lands treated by трихорграмою largely depends on a transmitter on that a device is assembled розселення. Use of traditional surface and aviation technique -

tractors of class-1,4, airplanes of AN-2, helicopters WE-2, the carrying capacity of that in hundred one times exceeds the deadweight of device of розселення together with the necessary supply of biological material in him, results in considerable недозавантаження of these facilities (approximately on 95-98%). The analysis of the known technologies and technical equipments of monitoring of the state of the field and industrial розселення of трихограми gave an opportunity to draw conclusion about perspective of the use of the pilotless aircrafts equipped by modern facilities of remote-control. In the collaboration of НУБіП of Ukraine, it is created НТТУ "КПІ" and ННЦ "ІМЕСГ" and prepared to the wide productive tests the radioguided pilotless aircraft of БЛА "А-1" (rice. 4) for aeromonitoring of the field and розселення of трихограми in the stage of імаро, id est трихограми that is contained in the eggs of grain-growing моли. The pilotless aircraft of "А-1" belongs to easy БЛА with GTOW 5 kg For the improvement of transporting into place of implementation of works the construction of airplane is executed by demountable - wings are dismantled. The start of airplane takes place from a hand. Landing of airplane comes true by means of supporting ski on the surface of the field [5, 6].

Rice. 3. Structure of basic scientific and technical tasks of bringing of biologics

Rice. 4. A pilotless aircraft of "А-1" is with the variable norms of bringing of biologics for defence of plants

Basic technical descriptions over and rational parameters of БЛА "А-1" are brought in a table. 1.

Technical descriptions and parameters of БЛА "А-1"

Description of начення of отужність electric motor, kWБт1,0Масе of the having a special purpose loading, кгдоп 1,5 видкість of aircraft, км/год80Доцільна working height of flight, м5Об'єм of working bunker, см3 500Місткість of biological material, г200Продуктивність розселення of трихограми, and/by hours60

Technologies of continuous or local розселення of трихограми can be used thus. Continuous розселення of трихограми is executed in the mode of autopilot with establishment of the set width of the processed area, height of flight, zone of turn and set norm. In case of necessity of local розселення of трихограми the system of operative management of bringing of technological material variable norms is used with the use of equipment for the estimation of intensity of vegetable cover on the certain area of the field. Густота of pedicellate mass of the grown cultures, and also areas the fields staggered by illnesses and wreckers are registered by corresponding primary transformers (to the ultraviolet, infra-red and other) at previous flight. With the aim of construction of electronic database spectral calibration is conducted for the receipt of comparative description on the areas of the field with the different colors of picture.

Advantage of such technology of bringing consists in technologicalness and timely and even розселенні of biologic at any state of the field surface, in particular taking into account configuration of the field, густоти of vegetation, cells of the increased quantity of wrecker.

Considerable advantages showed the conducted accounts of damage of plants of corn a butterfly on areas with bringing of трихограми. On the experienced areas of damage of stems and cobs presented from 20 to 13%, and on a control area - over 70% plants (46% stems and 26% heads)[7].

Conclusions

Ukraine has favourable natural and climatic terms and scientific and technical providing for an effective production ecologically of clean products of plant-grower in the system of organic agriculture.

Introduction in the agroindustrial complex of Ukraine of the specialized pilotless aircraft for the air monitoring of the state of the field and bringing of biologics from defence of plants creates terms for passing to the industrial production of organic goods.

Rational parameters of the worked out pilotless aircraft : flight mass is to 5 kg, power of electric motor - 1 kW, the having a special purpose loading is to 1,5 kg, volume of bunker - 500 см3. For implementation of technological process : speed is not more than 80 km/h, an expedient working height of flight is a 5 m, productivity - over 60 hectare/by hours

Bibliography

1. Адамчук In. Prospects of development of the mechanized plant-grower/of В.В. Адамчук, В.Г. Мироненко, О. Анд. Grigorievich, П. О. Косик//Mechanization and electrification of agriculture. - Вип. 98. - Т. 1. - 2013. - С. 60-67.
2. Квонтик Х.Р. Справочник пилота сельскохозяйственной авиации: trudged. с eng. - М.: Transport, 1991. are 225 p.s
3. Кобець М. Potential of безпілотників//of The Ukrainian Farmer. - 2011. - № 3.
4. Мельничук М. Bases of technology of biological defence of plants in modern agriculture/of М. Д. Мельничук, І.П. Григорюк, В.О. Дубровін and other Bioresources and природокористування. - К.: НУБіП, 2010. - Т. 2. - № 1-2. - С. 5-11.
5. Мироненко В.Г. Prospects of the use of pilotless aircrafts in agriculture of Ukraine/В.Г. Мироненко, С. О. Маранда//Lublin : MOTROLMotorization and power industry in agriculture. - Т. 13В. - 2011. - С. 25-35.
6. Мироненко In. Pilotless aircraft of "А-1" for biological defence of plants with the simultaneous monitoring of the state of the field/In. Мироненко, С. Маранда, Карнаушенко//Technique and technologies of АПК. - 2012. - № 8 (35). С. 11-14.
7. Мироненко In. Biological defence of plants is in organic agriculture/of В.Г. Мироненко, Л. П. Yushchenko//Sciences. вісн. нац. ун-ту bioresources and природокористування of Ukraine. - 2009. - № 134. - Ч. 3. - С. 33-39.
8. Шумилин В.М. Авиация в сельском и лесном хозяйстве/of В.М.Шумилин, В.М. Агарков, В.В. Белозеров и др. - М.: Ear, 1995. are 208 p.s
9. Ehlers R.U. Mass of production of entomopathogenic nematodes for plant production//of Appl. Microbiol. Biotechnonol of 56: 623-633, 2001.
10. Mironenko V. Operative of working process control of agricultural machines/of V. Mironenko//Proceedings of the 5th Research of and of Development Conference of of Central - and of Eastern European Institutes of of Agricultural Engineering Part 1. - Kiev, 2007. - P. 82-87.87.
Acted 16.06.2015.