AZƏRBAYCAN
MELİORASİYA VƏ SU TƏSƏRRÜFATI
AÇIQ SƏHMDAR CƏMİYYƏTİ

AZƏRBAYCAN
HİDROTEXNİKA VƏ MELİORASİYA
ELM-İSTEHSALAT BİRLİYİ
“AzHvəM” EİB

ELMİ ƏSƏRLƏR TOPLUSU XLII cild

BAKI – ELM – 2021

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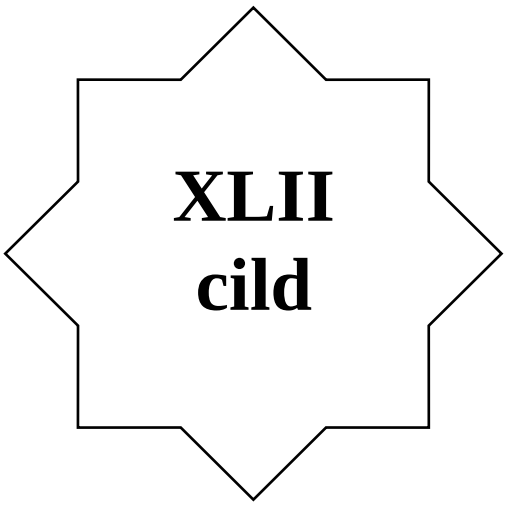

BAKI – ELM – 2021

Birliyin “Elmi əsərlər toplusu”nun XLII cildi “AzHvəM” EİB-nin Elmi Şurası tərəfindən çapa tövsiyə olunmuşdur (15 dekabr 2020-ci il, protokol № 09).

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“AzHvəM” EİB-nin “Elmi əsərlər toplusu” ilk dəfə 1949-cu ildə (1944-1946-cı illərdə “AzETHvəMİ”-də elmi işlərin yekunu kimi) nəşr edilmiş, 1974-cü ilədək Bakıda I-XI cildləri çap olunmuşdur. 1975-ci ildən başlayaraq 1989-cu ilədək Moskvada yenidən XII-XXVI cildləri capdan çıxmışdır. “AzHvəM” EİB-nin “Elmi əsərlər toplusu” Azərbaycan Respublikasının Prezidenti yanında Ali Attestasiya Komissiyasının məlum tələbatına uyğun olaraq 2007-ci ildən hər ilin yekunu olaraq çap etdirilir. “Elmi əsərlər toplusu” Azərbaycan Respublikasında dissertasiya işlərinin əsas nəticələrinin dərc olunması tövsiyə edilən dövri elmi nəşrlərin siyahısına daxildir.

İSBN-5-80-66-1223-6

Azərbaycan Hidrotexnika və Meliorasiya Elm-İstehsalat Birliyinin 2020-ci ilə dair “Elmi əsərlər toplusu”, XLII cild – Bakı: 2021-ci il, “Elm”, 412 s.

“AzHvəM” EİB-nin “Elmi əsərlər toplusu”nun XLII cildi hidrotexnika, meliorasiya və meliorativ torpaqşünaslıq, meliorasiya və su təsərrüfatı sistemlərinin tikintisinin təşkili, iqtisadiyyatı və istismarı sahəsində, hidrotexniki qurğuların yeni konstruksiyalarının yaradılması və hidromeliorativ sistemlərin etibarlılığının təyini və təmini metodları üzrə aparılmış elmi-tədqiqat işlərinin nəticələrinin analizinə, respublikada torpaq və su ehtiyatlarından istifadənin müasir vəziyyətinə, bu sahədə mövcud olan problemlərə, onların həlli yollarına, qlobal iqlim dəyişikliyinin respublikanın su ehtiyatlarına proqnozlaşdırılan təsirinə, kənd təsərrüfatı bitkilərinin müxtəlif aqroiqlim vilayətləri üzrə suvarma rejiminə, qlobal iqlim dəyişikliyi şəraitində müxtəlif suların suvarmada istifadə imkanlarına dair elmi-tədqiqatların nəticələrinə həsr edilmişdir. Ukraynada müxtəlif təbii-təsərrüfat şəraitində aparılmış kənd təsərrüfatı bitkiləri altında meliorasiya olunan torpaqların meliorativ vəziyyətində suvarmanın, müxtəlıf aqromeliorativ tədbirlərin təsiri ilə baş verən dəyişikliyə, müxtəlif kənd təsərrüfatı bitkilərinin becərilməsinə təsir edən amillərə, subasma zonalarında qurğu və binalara suyun zərərli təsirinə dair elmi-tədqiqat işlərinin nəticələri də öz əksini tapmışdır.

“Elmi əsərlər toplusu” ildə bir dəfə olaraq çap edilir.

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XLII том «Сборника научных трудов» Азербайджанского Научно-Производственного Объединения Гидротехники и Мелиорации был рекомендован изданию Научным Советом НПО «АзГиМ» (от 15 декбря 2020 года, протокол № 09).

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Впервые «Сборник научных трудов» НПО «АзГиМ» был издан в 1949 году (как итог работ АзНИИГиМ в 1944-1946 годах), I-XI тома до 1974 года публиковались в Баку. С 1975 года по 1989 год XII-XXVI тома были опубликованы в Москве. Начиная с 2007 года «Сборник научных трудов» НПО «АзГиМ» как результат ежегодных научных исследований, издаётся ежегодно в соответствии с требованием Высшей Аттестационной Комиссии при Президенте Азербайджанской Республики. «Сборник научных трудов» входит в список периодических научных изданий, рекомендуемых для публикации основных результатов диссертационных работ по Азербайджанской Республике.

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“Сборник научных трудов” Азербайджанского Научно-Производственного Объединения Гидротехники и Мелиорации за 2020 год, XLII том – Баку: 2021 год, «Elm», 412 стр.

XLII том «Сборника научных трудов» НПО «АзГиМ» посвящен анализу результатов проведенных научно-исследовательских работ в области гидротехники, мелиорации и мелиоративного почвоведения, организации строительства, экономики и эксплуатации систем мелиорации и водного хозяйства, создания новых конструкций гидротехнических сооружений и определения методов и обеспечения надежности гидромелиоративных систем, современному состоянию использования земельных и водных ресурсов в республике и существующим в этой области проблемам и путям их решения, прогнозируемому влиянию глобальных климатических изменений на водные ресурсы республики, режиму орошения сельскохозяйственных культур по различным агроклиматическим областям, результатам научных исследований по изучению возможности использования различных вод в орошении в условиях глобальных климатических изменений. Так же отражены итоги научно- исследовательских работ, проведенных в различных природно-хозяйственных условиях Украины по изучению вредного воздействия воды на сооружения и здания на подтопленных территориях, влияния орошения на происходящие изменения в результате проведения различных агромелиоративных мероприятий на землях, освоенных под сельскохозяйственные культуры и на факторы, влияющие на выращивание различных сельскохозяйственных культур.

«Сборник научных трудов» издается один раз в год.

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“The collection of scientific works” of “Azerbaijan Scientific-Production Association of Hydraulic Engineering and Amelioration” was first published in 1949 (as a result of scientific works in 1944-1946 at the “Azerbaijan Scientific-Research Institution of Hydraulic Engineering and Amelioration”), Volumes I-XI were printed in Baku until 1974. From 1975 to 1989, Volumes XII-XXVI were published again in Moscow. “The collection of scientific works” of “Azerbaijan Scientific-Production Association of Hydraulic Engineering and Amelioration” is printed as a result of each year from 2007 in accordance with the known requirement the High Attestation Commission under the President of the Republic of Azerbaijan. “The collection of scientific works” is included in the list of periodic scientific publications recommended for publication of the main results of dissertation works in the Republic of Azerbaijan.

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“The collection of scientific works” of “Azerbaijan Scientific-Production Association of Hydraulic Engineering and Amelioration” for 2020, Volume XLII – Baku: 2021, “Elm”, page 412

Volume XLII of “The collection of scientific works” of “Azerbaijan Scientific-Production Association of Hydraulic Enginering and Amelioration” was dedicated to the analysis of the results of scientific-research works in the field of hydraulic engineering,amelioration and ameliorative soil science, forming of construction,economics and exploitation of amelioration and water farm systems,according to creation of new construction of hydrotechnical installations and methods of determination and maintenance of reliability of hydromeliorative systems,the current situation of use from soil and water reserves in the republic,problems in this field,ways of solving them,predicted effect of global climate change on water resources of the Republic,irrigation regime of agricultural crops for different agro-climatic areas,results of scientific research on the possibility of using different water for irrigation in the context of global climate change.The results of scientific-research work on the change caused by irrigation,various agro-ameliorative measures,factors affecting the cultivation of different agricultural crops,harmful effect of water on facilities and buildings in flood zones in the ameliorative situation of meliorated soils under the agricultural crops in various natural-agricultural conditions in Ukraine were also represented.

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USE OF DIGITALIZATION IN AGRICULTURAL SECTOR IN MONITORING FOR WEATHER ACTIVITY AT CLIMATE CHANGE

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Məqalə redaksiya heyətinin 10.12-2020-ci il tarıxli iclasında (protokol № 04) t.e.d., S.T. Həsənovun təqdimatı əsasında müzakirə olunaraq, onun Birliyin "Elmi əsərlər toplusu"nun XLII cildinə daxil edilməsi qərara alınmışdır.

The summary. The presented article discusses the actual problems of modern times-climate change and its impact on agriculture in Ukraine. First of all, this is observed in the regional climate transformation and the recurrence of some dangerous meteorological events. During five years, as a result of the constant increase in temperature, the amount of precipitation and their fall characteristics have changed. Adaptation to climate change requires a comprehensive approach and measures at different levels.

Keywords: climate change, agricultural crops, Kherson oblast, forecasting of productivity, digitization, agroscout, robotics.

Problem statement. The incorporation of digitalization of the agricultural sector is one of the most important elements of the strategic development of the agricultural sector in Ukraine. This question is particularly relevant to global climate change. In today's world, agriculture remains a key sector of the economy, ensuring food security and the production of important commodities. In turn, it is also the primary source of greenhouse gases. As a result, there is an increase of temperature, spotty rainfall distribution and inefficient soil moisture accumulation and such weather conditions increase the intensity of dry climates. These negative factors lead to the extension of the zone of insufficient moisture and to the diversification of land in the southern regions of Ukraine [1, p.26-78].

There is a need to modernize existing models of agricultural production and improve the management of agricultural systems in response to climate change. At present Ukraine's agricultural sector is gradually adapting to climate change. Preference is given to more drought-tolerant species that are less water-demanding and can withstand dry periods for long periods of time. Attention is also being paid to identifying technologies for the cultivation of selected crops and adapting them to climatic conditions in order to reduce the negative impact of weather conditions.

Introducing elements of digitalization into agricultural production in the context of global climate change will allow commodity producers to obtain new quality information, find patterns, minimize risks, improve business processes and market governability.

Analysis of recent research and publication. According to the World Meteorological Organization (WMO) for five-year period 2015-2020 is considered to be the

hottest ever recorded instrumental meteorological observation. During this period 2019 became one of the warmest observations in history. In the warmer months of the year, long-term heat waves were observed for several weeks in June and July. There was also an increase in the number of dangerous weather events in the form of heavy rainfall, wind speeds, snowfall, fog, hail and seasonal variation. All these phenomena characterize climate change as a whole.

Among the anthropogenic drivers of climate change are: emissions from combustion and fossil fuel extraction, various types of industry, agriculture, lack of waste management and resource recovery, and accumulation of carbon dioxide in the atmosphere [2, 12-45].

The agricultural sector is characterized by: that it is both a source of greenhouse gas emissions and their sink. Agricultural production contributes to 129 different types of greenhouse gases, accounting for 23 percent of global emissions.

Also, emission reduction measures in this sector often don`t require significant and cost modernization, and the shift in production may be flexible enough to accommodate the necessary changes through relatively short production cycles (production periods). All of this combined makes allows significant emission reductions to be achieved in a short time and at a lower cost [2, 12-45].

Agriculture in Ukraine is one of the key sectors of the economy and ranks third in the structure of Gross domestic product (GDP) , leads in export structure and showing a steady upward trend [3, p.15-25].

The purpose of article. To measure the prospect of development of the use of digitalization in the agricultural and industrial complex of Ukraine on observation of meteorological conditions in the context of global climate change. To make a detailed analysis of the main problems in the agricultural sector of Ukraine, as a result of the introduction of modern tools for improving decision-making and defining promising directions of development.

Methods of research. The methodological framework of the research is the introduction into the work of agriculture of Ukraine, the continuous use of modern automated technologies and systems for monitoring the state of crops.

The results of the study. Statistical data of 2019 in Kherson region were analysed. In the study of the problem, the space schedules of the areas occupied for the planting of crops and their yields over a period of five years were drawn up. The conclusions are drawn and the influence of changes in natural and climatic conditions on crop selection in Kherson area was analysed.

Presentation of existing methods and types of crop yield forecasting were given. The importance of implementing and producing such forecasts was stressed. The future quality of any sector of the national economy under investigation or of a process or phenomenon was considered to be a scientific and technical forecast. The forecasting process itself is considered as a necessary planning stage agricultural business by increasing the scientific validity of the plan. The main purpose of planning is solution with methods which provide high accuracy of predictive development.

The scientific novelty. Adoption and application of a promising focus to the

development of the agricultural sector in Ukraine. The use of modern digital technologies and automated computer systems and programmes through which observations can be made. On the basis of which analysis and making decisions are carried out on the resolution of winter resistance aimed at improving the state of the crops and growing the yield of the cultivated crops.

Practical value. In today’s world, to save workforce and resources, in order to minimize the human factor and to be able to access speedy analysis, there is a growing demand for reducing interaction and automation of complex technological processes and operations carrying out the necessary agricultural work. With the support of digital technologies it is possible to check the state of the crops and carry out the agronomic activities from the resolution of the number of weeds in the crop to spraying, their mechanical removal, fertilization for the crop, etc. [4].

Presentation of the main material of the study. At the beginning of the twenty-first century, the part of the traditional economy is declining swiftly worldwide, while the digital economy is growing. The World Economic Forum in Davos (2019) identified a list of the most hopeful digital technologies, including mobile technologies; cloud computing; biometric technologies; blockchain; virtualization; augmented reality; and additive technologies (3D printing); artificial intelligence.

The Concept of Development of the Digital Economy and Society of Ukraine for 2018-2020 indicates the need for the digitalization of the agricultural sector, on which the competitiveness of domestic farmers depends. That is, a new platform in the development of the agrosphere will require modern specialists to be able to use on-board computers, intelligent equipment, introduce innovative methods of plant and soil treatment, application of fertilizers and chemical migrants, plant protection agents, service soil scanners, vertical hothouses and drones, helicopter sprayers, that sort of thing.

According to the McKinsey Global Institute, agriculture, which employs more workers, will become a leader in replacement manual labor. The introduction of digitalization in agrarian sector is thus one of the pillars of successful and sustainable economic management [5].

Over the past five years, the dryness repetition trend has doubled in the steppe zone of southern Ukraine. There has also been an increase in the prevalence of dry conditions in the central and northern parts of Ukraine, which belong to the zone of sufficient humidity.

Based on the indicator of increased agricultural productivity, climate change has a two-way effect and can have positive and negative effects. Positive effects include improved production conditions and reduced harvest time. The introduction in the growing process of late ripe varieties and crop types that require more heat inputs as well as more efficient fertilizer application.

The negative effects of climate change are demonstrated in the worsening of grain quality, growing-season droughts, accelerated humus decomposition in soils, deterioration of soil wetlands (especially in the southern regions of Ukraine). Wind and water soil erosion is increasing due to increased droughts and extreme precipitation. As a result of the large, frosty-free periods in winter, crops become contaminated and the number of plant pests and

pathogens increases.

Climate mitigation is most often at the expense of rising winter temperatures. Provide creating favourable conditions for over-wintering certain types of pests, pathogens and weeds which of serious risks concern to plants.

A negative component is also the process of changing nature of precipitation in terms of intensity, frequency and their rainfall patterns. Impossible conditions of forecasting with a high percentage of reliability are created due to the redistribution of precipitation quantity by regions of Ukraine and seasons. Rainfall decreased in winter and increased in autumn, with little change in spring and summer. The observation of precipitation, eventually for the year, remained almost unchanged.

There has been an increase in the number of extreme and heavy rainfall events that have contributed to the deterioration of crop conditions. This is the case when half or monthly rainfall occurs in a few hours [1, p.25- 78; 6].

The need to save and increasing the resilience of forest ecosystems stems from the fact that they are the cheapest and most active contributor and the battery for the selection and retention of carbon dioxide in the form of plant phytomass (The value of the « net amount» photosynthesis of an organic substance is from 7.7 to 21.8 hectares, of which 25-45 percent of the products of photosynthesis convert to wood) [1, p. 25-78].

Due to the intense increase in temperatures during the last five years from 2015 to 2020, changes occurred in the agricultural sphere. That is, the area under cultivation, the types of crops cultivated and the level of yields.

According to the data in the statistical yearbook of the Kherson region for 2019 area for winter grains decreased by 10,600 hectares, which represents 1.65 percent of the total sowing. In particular, for summer crops, the area of cultivation has decreased by 17,000 hectares, which is 9.2 percent. The total area for cereals and pulses, including winter crops and spring crops, decreased by 26,500 hectares, which is 3.5 percent for Kherson region. For potatoes, vegetable and cucumber crops, the total area decreased by 7.8 percent. [7, p.204 -228].

Table 1

Area of agricultural land in Kherson region (thousands of hectare)

Year	Agricultural land	Including arable land	Hayseed	Pasture	Deposits	Perennial
2015	1969,4	1777,9	10,6	155	–	25,9
2016	1969,4	1777,9	10,6	155	–	25,9
2017	1969,3	1778,7	10,7	153,9	–	26
2018	1962,1	1780	9,6	150	–	22,5
2019	1964,9	1784,6	9,4	148,4	–	22,5

*** According to the State Service of Ukraine for Geodesy, Cartography and Cadastre in Kherson region at year-end .**

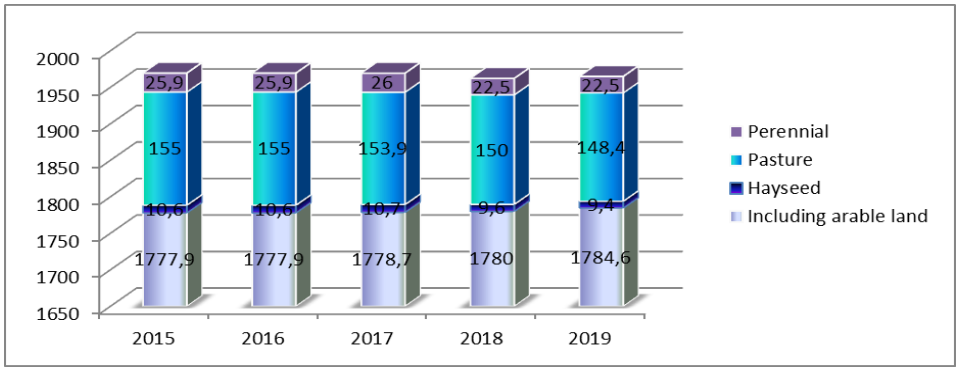


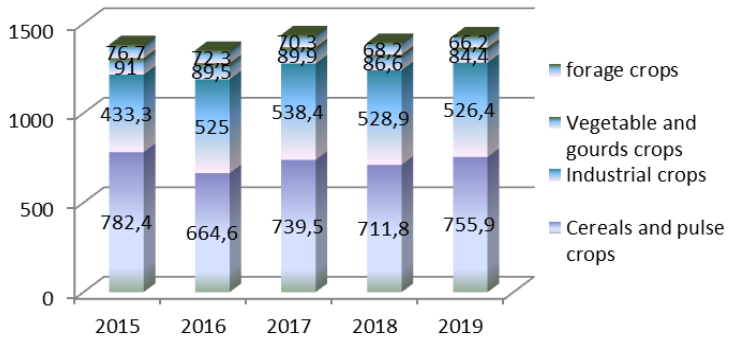
Fig.1. Employment schedule for agricultural grounds in Kherson region (thousand hectares).

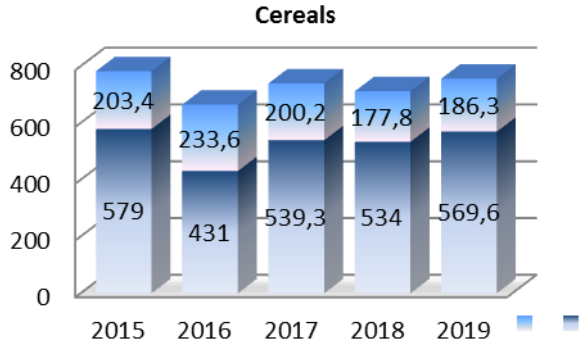
Table 2

Sown area per crop Kherson region (thousand hectares)

Year	Agricultural crops	Cereals and pulse crops	Winter crops	Spring crops	Industrial crops	Vegetable and gourds crops	Feed crops
2015	1383,4	782,4	579	203,4	433,3	91	76,7
2016	1351,4	664,6	431	233,6	525	89,5	72,3
2017	1438,1	739,5	539,3	200,2	538,4	89,9	70,3
2018	1396,2	711,8	534	177,8	258,9	86,6	68,2
2019	1433,7	755,9	569,6	186,3	526,4	84,4	66,2

*** According to the State Service of Ukraine for Geodesy, Cartography and Cadastre in Kherson region at year-end .**





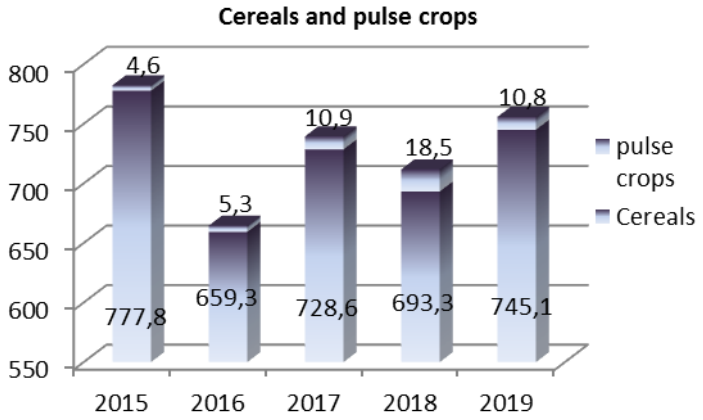


Fig. 2. Reductions schedule the distribution of sown area by crop type in Kherson region (thousand hectares).

Other than a territorial redistribution of the structure of the crops, the dynamics and growth of their productivity are uneven. Average grain and pulse yields in southern Ukraine declined by 10 percent.

Under conditions of climate change, the level and elements of wetting in a given region is a major factor, this constrains agricultural productivity and limits the natural potential of farming.

For the prevention of negative processes as a result of climate change and minimization of its losses, Ukraine’s agricultural development strategies for the next 10 years, up to 2030, must be respected.

Table 3

Yields of agricultural crops

Year	Cereals and pulse crops	Winter crops	Spring crops	Pulse crops	Vegetable crops	Potato	Forage root	Fodder corn
2015	33,6	34,7	30,4	27,4	301	121	126	159
2016	34,1	34,5	33,4	34,1	313	118	130	133,3
2017	34,5	34,4	34,5	24,3	304	110	227	205,8
2018	31,9	31,8	32,4	11,4	316	119	225,3	225,2
2019	36,2	34,9	40,2	20,2	322	116	224,3	231

*** According to the State Service of Ukraine for Geodesy, Cartography and Cadastre in Kherson region at year-end .**

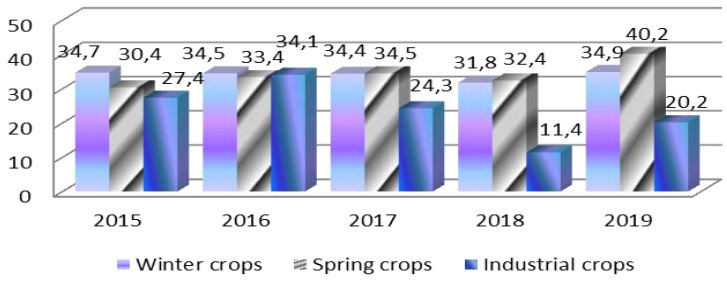


Fig.3 Trends in cereal and pulse yields over a period of 5 years in Kherson region.

Cereal yields for winter crops are 7 per cent higher, amounting to 2.6 tz per hectare over a five-year period. Summer crop yields increased by 24 percent, while for winter crops there was no significant increase. Pulse yields decreased by 35 per cent, while for vegetable crops yields increased by 6.5 percent for Kherson region.

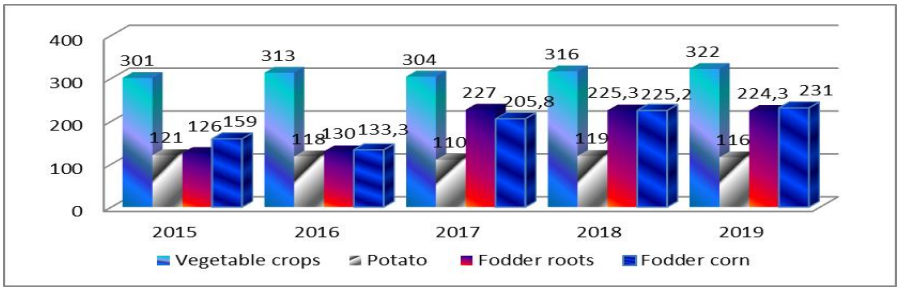


Fig.4 Crop trend of potatoes, corn, forage root and other vegetable crops for 5 years in Kherson region.

On the basis of data from the statistical yearbook of the Kherson region, one can draw a final conclusion. Considering the trend of a slight decrease in the area planted to crops in Kherson region, only technical crops (17.7 percent) show an increase in the area planted for cultivation. There has been a decline in the number of employed crops in cereals and pulses (-3.5 percent), vegetables and cucumber crops (-7.8 percent) and fodder crops (-15.9 percent).

In the south of Ukraine, the agrarian business is aimed at cultivating plants resistant to high temperatures and dry periods, using economical up to wet-supply and accelerated growing time of crops.

Crop yield forecasting is based on special estimation procedures and is of significant scientific and practical value. Improving and adapting crop production technologies to modern conditions requires the development of more accurate and earlier methods for assessing and predicting crop yields.

The main purpose of applying crop yield forecasts is to correct the planned pattern of sown areas. In short-term and medium-term forecasts, an acceptable difference between actual and projected yields within the margin of error of 10-15 percent. This yield projection doesn`t influence management decisions, but rather determines the direction of yields, increases or decreases. Taking advantage of such forecasts will be the ability to choose the optimal strategy and technology for carrying out the work, decide on the location of crops on the territory of a farm, and reasonable use of cropping patterns and rational way.

Long-term yield forecasts, which are prepared for 4-6 months before planting or before harvesting, are only indicative. But such indicators are valuable and of great practical importance. Long-term projections allow for the early resolution of organizational and policy issues. In practice, such predictions are used in conditions of reliability, that is, estimates of the probability of carrying out a projection.

Short- and medium-term forecasting of cereal yields calls for the development and use of weather models and random factors that influence fluctuations in gross grain harvests

and yields over time.

A method of analogy, modeling and expert estimation is used to develop forecasts of medium-to-long-term yields. According to the basis of the extrapolation method, exact forecasts are made taking into account the fluctuations of yields in the forecast period.

The influences of agroclimatic factors on crop conditions and yields have long been monitored. Experienced scientists in the field of forecasting can make predictions on the basis of the data obtained from natural phenomena. In the modern world, human labor is replaced by high-tech devices, measuring with minimal errors and automatically creating predictions based on the data received.

The quality and speed of forecasting have significant advantages when using automatic agrometeostasis.

In the leading countries of Europe and Asia are taking a promising direction in agribusiness using robotic agricultural machinery. Of most interest to farmers is the use of drones to help monitor crop and spray conditions, as well as unmanned tractors and other platforms.

More than 20 companies are working on the development of prototypes of unmanned agricultural machinery: unmanned tractors - New Holland, Yanmar, Kubota, iTarra, Avrora Robotics; soil operations platforms - DOT, Agrosmart Naio, Continental Automotive; harvesting robots - Root AI, Fieldwork Robotics, Agrobot, spray aircraft - AeroDrone; spraying robots - Swarm Farm Robotics, WM Agri Technics, autonomization terminals - Infocom LTD, Cognitive Technologies, etc.

The leading agricultural machinery companies listed are actively cooperating with IT organizations - electronic equipment and software organizations that seek to improve out of date machinery and system. In order to improve the quality of work of new technologies, to modernize them by installing automatic and unmanned systems.

For each specific agricultural activity, depending on the type of plants grown and the technology of work in crop care and harvesting, a special specification of algorithms and electronic program development is developed.

The favorable development of autonomous robotics and other automatic mechanisms creates the sphere of agrarian business. Agricultural activities have always been considered labour-intensive and extensive process for heavy work. It should also be noted that such work is devalued and poorly paid. The introduction of autonomous mechanization in agriculture is therefore a practical solution.

But the question arises: all agricultural farmers and farms in Ukraine are morally and physically ready to reorganize production. The only 3-5 percent without much damage can fully switch to robotic maintenance at one time, while leading countries of the world have already assessed the quality, efficiency and cost-effectiveness of the use of modern tools in the agricultural sphere. In European countries, the most common use of unmanned equipment is on farms [4].

Precision farming, or what is known as husbandry (specifically field crops), through the introduction of innovative technologies, is based on soil maps and data in the form of a satellite or drone photographs, as well as receiving additional data, can be obtained through

the Internet Things (Internet of Things). Following the example of the implementation of the concept of *IoT* such system as «Smart Farm». Based on the analysis of the environmental data, depending on the received sensor data, changes the temperature and humidity of the air, the degree of lighting, irrigation and other necessary measures to produce a good crop.

The main purpose of creating the concept of precision farming is to avoid the heterogeneity of development within a single crop. In order to detect and prevent negative impacts in a timely manner, use agrarian sector digitalization, including the acquisition of GPS satellite data, using special sensors, aerial photographs and special agri-food programsGIS-based planning and mapping. Crop mapping has been widely used and implemented since the 1990s, using combinations of GPS and sensor technologies with working agricultural techniques.

For the production of the crop yield map, sensor equipment was installed on the working combines, namely grain sensor, grain humidity sensor, GPS navigator with precise location determination, the speed sensor and the amount of memory for the continuous recording of the received data.

On the basis of the analysis of the obtained data, a comprehensive assessment of the density of the crops is made, and the necessary number of fertilizers and plant protection agents is calculated, the identification of these indicators is necessary to achieve accurate crop forecasting and financial planning. The adoption of integrated assessment also needs to take into account the local characteristics of educated soils and natural climatic conditions. This in turn allows better identification of the causes of disease and other adverse effects that are specific to the locality.

The introduction of state-of-the-art technologies makes it possible to increase the volume of production using a rational number of resources and taking into account the limits of the allocated territories. The autonomous system should take into account the introduction of mechanized technologies that reduce not only the economic performance and development period of plants, but also the greening of production.

Through the automation of control systems and process control, changes in plant growth and development are reacting quickly. With the help of a satellite-based system for the observation and management of combined harvesters, the speed of harvesting is increased by mechanical means, thanks to the system’s tracking of traces of the assembly combine, in order to increase crop yields and reduce fuel cost lubricants and time.

To improve the efficiency of agribusiness, they create certain food supply algorithms and respond quickly to market volatility. As a result, it is necessary to reorganize agriculture by digitalization or digitizing all the results of the observation, to conduct basic business processes, storing consistent data over the entire period of cultural development and then using this information. Introduce current processes based on real-time data and use them for decision-making and immediate response [8].

In the agricultural sphere, there is an active process of attracting modern IT technologies and they have a great influence on the development of precision farming systems using navigation satellite systems and remote sensing systems. Involvement of

autonomous and unmanned robotics, maintenance of remote inventory and inventory control systems and application of the agro-scouting programme.

Agro-scouting (Crop scouting English), has a literal translation - crop and exploration, a procedure that involves the use of mobile applications to collect information from the field, in order to control the quality of the work performed (soil treatment, irrigation, harvesting, etc.) Determination of crop condition (vegetation, activity, health, disease and pests) and development of field specifications.

The agro-scouting programme itself is very young and is used by farmers for only three years and is constantly updated and improved.

Agro-scout or mobile agronomist collects data in a field using a tablet with the mobile application «Agro-scouting», which allows to quickly find fields with the help of incorporated satellite navigation and automatically records the dates and times of their visits, which gives the possibility to control the quality of the examination.

The agro-scouting programme is used to monitor phyto-sanitary planting patterns, to load and store photographic information, to note the presence of diseases or pests in the fields, the degree of contamination of the crops by weeds, defining the stage of development of cultures according to the international, generally accepted BBCH scale. Corresponding to the data listed above, it is possible to accurately determine the state of the plants in the field and to design technological measures to preserve and increase crop yields. The program performs automatic synchronization using the net resource and provides instant access to information to other employees. It is also possible to monitor and control the quality of the work performed on the field by agricultural machinery and to formulate recommendations for its further processing [9].

The identification of areas of concern is sought through satellite imagery from drone launches or other means. This method allows detailed work to be done on the definition of photographic health and evaluation. You can create a new field survey task from a computer or tablet.

The photographs taken during the field survey record the coordinates of the location of the field itself, the time and the date of the photograph. The program automatically processes new photos and binds them to the relevant researched field and creates the Survey Act. The survey process on farms using unmanned aerial means is further simplified.

Agro-scout will be able to create Survey Acts and add new photos even in off-line mode, and after synchronizing the inspection data, the mobile device will automatically upload photos and GPS-when connected to the Internet network coordinates where they will be immediately available to other employees and stored in field history.

The advantages of using digital technologies are that it is possible at any time to look at the information collected and sorted for each site, to check the number of field survey reports produced, to look at the dates and times of reporting. Without leaving the office you can get all the necessary information about the work on the fields and the state and development of plants.

Through the agro-scouting programme, access to timely and reliable information is provided, the programme forecasts possible risks, monitors the development of plants, and

quickly fixes problems. Corrections made on time will save money and optimize costs per hectare, and the reclamation of identifying infertile land will help to conserve resources and create new types of crop rotation [10].

In Ukraine, an inventory of agricultural land is being carried out through land-use digitalization. It is an integral part of the property registry of an agricultural enterprise, which monitors and verifies the existence and condition of the land to ensure the reliability of accounting and financial reporting.

Soil density and humidity are determined to form soil quality, and this is a factor in obtaining stable yields. Observation of the hydrological characteristics of the land, namely the level of groundwater, determination of the temperature of the water in nearby bodies of water, implementation of calculation values for the quantity of water. During the digitalization of the agricultural sector, meteorological events are observed and their direct effects and manifestations on agriculture are evaluated. Generally, agrometeorological observations cover temperature and humidity, wind speed and direction, precipitation, atmospheric pressure, surface temperature and solar radiation intensity.

Integrated information systems for agricultural production management are used to process and evaluate all farm data received. These include global positioning technologies - GPS, GIS (geographic information systems – technologies), various programmes for crop monitoring, remote sensing and technology of control.

Better development takes place in an area in which the State has an interest in and fully promotes and supports its activities. The Ministry of Economic Development, Trade and Agriculture of Ukraine presented the project «Open Land». In which it was proposed to ensure transparency and traceability of land relations, and to provide information to landowners, the value of the sale and lease transactions, the concentration of land in one hand, etc.

The main tool of the project is the geo-portal, where the results of the processing of remote sensing data from Ukraine are collected and a public cadastral map is connected. On the obtained geo-portal map you can see the boundaries of the plots, or they are cultivated or not, which crops grow there, which moisture of the soil, which vegetation index at the time of the survey and other. The geo-portal data is used to address unregistered land that is used but not taxed. The public authorities shall also receive the data, check their correctness and follow up on the information provided [11].

The impact of agribusiness digitalization at the enterprise level in the application of modern digital technologies through remote sensing of the Earth and the processing of the data obtained is monitored by the processes and processes for crop development, crop yields are predicted and the state of crops assessed. Continuous monitoring is also carried out to determine the feasibility of fertilizers and plant protection products, check and monitor crop rotation and the quality of planned agricultural activities.

At the level of the State, the application of digitalization makes it possible to monitor extreme natural phenomena, the development of the economy itself, the state of the soil and the environment, the development of crops and the spread of weeds in crops, produce crop forecasts for major crops. Also, mainly, to carry out spatial mapping on the basis of the

digital data obtained [12, 15, 16].

Current problems need modern solutions. The use of digital technologies in the agricultural business is positive, so the improvement of observation systems and the reorganization of methods make it necessary to provide the farms with appropriate skilled personnel, which will be able to maintain the continuity of up-to-date technology.

Scientific knowledge and competence in their work are provided to future agronomists through modern tools in the learning process. Which is why new meteorological station iMETOS® was installed at the Kherson State Agrarian and Economic University in March 2019. It is an automatic weather station that receives 24-hour data on temperature and relative humidity, wind speed and direction, atmospheric pressure, precipitation, ultraviolet and solar radiation, leaf humidity, temperature and soil humidity [13]. The main meteorological date on which observations are carried out can be viewed with the help of the net resource on the portal FieldClimate. All date collected for which observations are made are recorded in convenient graphs and tables.

The main use of the iMETOS® Automatic Weather Station program is meteorological monitoring. Improve weather forecasting at the local level, taking into account actual weather conditions. The possibility of modelling the development of crop diseases. Continuous monitoring of soil moisture and planning irrigated system is carried out as necessary. It also monitors the hydrological status of the area and gives warnings in the event of a flood. Monitoring is in progress for crop and environmental overseeing.

The programme FieldClimate is making analysis and prediction based on receiving weather data, about plant development during cultivation. Optimum planting dates are proposed, a better fertilizer application period for a certain crop is determined, the need for additional irrigation, protection of plants against pests and the appearance of diseases may be indicated, as well as harvesting.

Each agrotechnical measure is determined and planned by FieldClimate, depending on fixed time observations [14]. During the last 4-5 years, there has been a trend towards earlier dates for the planting of summer crops. One before the time shift occurs for the efficient use of winter reserves of productive moisture in the soil. As moisture is considered the main limiting factor for crop production. And the deficit in the southern region of Ukraine is growing every year.

Conclusions and proposals. The latest technologies are increasingly part of the agricultural sector. The use of modern programmes facilitates farming and farming. Helps with accurate data analysis and crop yield forecasting. Carry out a reasonable and reasonable selection of plants in accordance with agro-climatic conditions of the growing region. Modern agronomists make free use of electronic devices and tablets, which are equipped with convenient tools for solving technical problems and provide access to the cloud database.

Through the active introduction of digitalization in the agricultural sphere, a simplified system for monitoring crops is being established, and the accuracy of crop forecasting is being improved, real data are obtained, land use can be tracked and the influence of natural and local conditions on plant development can be assessed.

One of the most popular digital tools is agro-scouting, which is a field-based information-gathering procedure according to set parameters and serves to monitor crop conditions. The agro-scouting programme helps to monitor and check the production process and technology, the state and development of crops in each area. Information was collect, stored and preserved for further use.

Modern advances in information technology weren`t static, and farmers were well established and an essential part of agrobiz.

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İQLIM DƏYİŞİKLİYİ ZAMANI HAVA AKTİVLİYİNİN MONİTORİNQİ ÜÇÜN KƏND TƏSƏRRÜFATINDA RƏQƏMSAL DİAQRAMIN İSTİFADƏSİ

Xülasə. Təqdim edilən məqalədə müasir dövrün aktual problemlərinə – iqlim dəyişmələri və onun Ukraynada kənd təsərrüfatının aparılmasına təsiri məsələlərinə baxılmışmdır. İlk növbədə bu regional iqlim transformasiyasında və ayrı-ayrı təhlükəli meteoroloji hadisələrin təkrarlanmasında müşahidə edilir. Beş il ərzidə daim temperatur rejiminin artması nəticəsində yağıntıların miqdarı və onların düşmə xarakteristikası dəyişilmişdir. İqlim dəyişikliklərinə adaptasiya olunma (uyğunlaşma) kompleks yanaşma və müxtəlif səviyyələrdə tədbirlərin aparılmasını tələb edir.

Açar sözlər: iqlim dəyişmələri, kənd təsərrüfatı bitkiləri, Xerson vilayəti, məhsuldarlığın proqnozlaşdırılması, dijitalizasiya, aqroskautinq, robotexnikası.

ИСПОЛЬЗОВАНИЕ ЦИФРОВОЙ ДИАГРАММЫ В СЕЛЬСКОМ ХОЗЯЙСТВЕ ДЛЯ МОНИТОРИНГА ПОГОДНОЙ АКТИВНОСТИ ПРИ ИЗМЕНЕНИИ КЛИМАТА

Резюме. В приведенной статье была рассмотрена актуальная проблема современности - изменение климата и его влияние на ведение сельского хозяйства в Украине. В первую очередь это наблюдается при трансформации регионального климата и увеличение случаев отдельных опасных метеорологических явлений. Вследствие постоянного повышение температурного режима на протяжении пяти лет, перераспределение количества осадков и характер их выпадения. Адаптация к изменению климата требует комплексного подхода и выполнения мероприятий на различных уровнях.

Ключевые слова: изменение климата, сельскохозяйственные культуры, Херсонская область, прогнозирование урожайности, диджитализация, агроскаутинг, робототехника.

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II. SUVARMA, SUVARMA TEXNİKASI VƏ TEXNOLOGİYASI

III. HİDROTEXNİKİ-MELİORATİV QURĞULAR,TİKİNTİLƏR VƏ ONLARIN ƏSASLARI

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ELMİ ƏSƏRLƏR TOPLUSUNDA DƏRC OLUNMASI TÖVSİYƏ EDİLƏN ELMİ MƏQALƏLƏR QARŞISINDA QOYULAN T Ə L Ə B L Ə R

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Redaksiya heyəti

Т Р Е Б О В А Н И Я
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