December 5 – «World Soil Day»

RESEARCH INSTITUTE OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

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Good afternoon dear colleagues and guests. Allow me, on my own behalf and on behalf of all employees of the Research Institute of Soil Science and Agrochemistry of Uzbekistan, to welcome you to the event dedicated to December 5 - World Soil Day and the 100th anniversary of the Research Institute of Soil Science and Agrochemistry, on the topic "Soil science in modern society: achievements, problems and prospects".

The Research Institute of Soil Science and Agrochemistry of the Republic of Uzbekistan was established in 1920 at the Turkestan State University under the name "Institute of Soil Science and Geobotany". In subsequent years, the Institute functioned under the Ministry of Agriculture, the Academy of Sciences, the State Committee for Geodezy, Cadastre of the Republic of Uzbekistan. Now the Institute functions under the Ministry of Agriculture of the Republic of Uzbekistan.

The Institute has a rich history of scientific research in the field of soil science and agrochemistry, which were of significant importance in the development of agriculture in the Republic of Uzbekistan.

In the first years of its existence, expeditionary research was carried out at the institute to study the soil cover of Central Asia. The scientific results of the first years of work were consolidated soil maps of river basins and individual large regions: the upper and lower reaches of the Amu Darya, the Zarafshan basin, the Syrdarya basin, all of Uzbekistan, Tajikistan, Turkmenistan, Kyrgyzstan and Central Asia as a whole. These maps contained the meliorative and agronomic characteristics of the main soils, necessary for the general planning of various agricultural activities.

In 1927, the staff of the institute compiled the first consolidated soil map of the Central Asian republics on a scale of 1:1 million, which was shown at the 1st International Congress of Soil Scientists in Washington.

In subsequent years, the soils of the irrigated territories of the republics of Central Asia and Kazakhstan with a total area of about 1.5 million hectares were studied in detail. These works laid the scientific basis for the use of mineral fertilizers in agriculture, taking into account soil conditions: the optimal ratios of components in fertilizer mixtures for basic soils, fertilizer doses for the then existing level of crop yields were established.

An important result of these studies was an idea of the quality and areas of the irrigated land fund, based on detailed soil maps. This made it possible subsequently to carry out agro-soil zoning and appraisal of soils in the territory of irrigated agriculture in the republics of Central Asia.

In subsequent years, the Institute carried out large-scale soil-meliorative studies to substantiate irrigation projects and develop new territories in the Karshi, Hungry, Jizzakh, Sherabad steppes, the lower reaches of the Amudarya, and the Ferghana Valley.

The study of the experience of integrated land development in the Hungry Steppe and Central Fergana made it possible to draw an important theoretical conclusion that in desert and semi-desert conditions, in the absence of sufficient natural outflow of groundwater in drainless conditions, irrigation will inevitably cause secondary soil salinization. These and other materials made it possible to develop a scientific position on the genetic essence of the evolution of saline soils, to establish the provinciality, regionality of types and the degree of their salinity.

In the subsequent period, large-scale soil-geographic studies of unexplored soil territories (the mountainous part of the republic and the desert zone) were carried out, soil-erosion studies were carried out for the first time in Uzbekistan. On the basis of these materials, sheets of the State Soil Map relating to the territory of Uzbekistan, other republics of Central Asia, and Kazakhstan were compiled.

Based on the generalization of soil research materials, the Institute staff developed the main provisions of the theory of regional soil formation, which formed the basis for the soil classification of the republic, developed by the Institute staff.

In 1971, employees of the Institute and Tashkent State University (now NUUz) developed a soil-

climatic zoning of irrigated and rainfed lands in Uzbekistan. At the same time, the agricultural territory of the republic was divided into parts that differ in natural conditions and the system of irrigated and dry farming. The maps “Zoning of irrigated lands of Uzbekistan” and “Zoning of rainfed lands of Uzbekistan” were compiled and published.

The materials of these studies were used in the planning of agricultural production in the republic, in particular, in the differentiation of agricultural systems.

In connection with the need to introduce the state land cadastre, "Guidelines for the appraisal of irrigated and rainfed soils" were developed, which were used by Uzgiprozem in the first round of a qualitative assessment of soils in agricultural areas.

The Institute took part in conducting scientific research and, on this basis, carrying out design studies related to the problem of territorial redistribution of water resources, including the transfer of part of the flow of Siberian rivers to Central Asia, Kazakhstan and the Volga river basin.

Expedition studies of the soil cover of the Amudarya delta, Central and Northern Kyzylkum and Ustyurt have been carried out. On their basis and using stock soil-cartographic materials, lands suitable for irrigation were determined, and their areas were calculated for individual regions and soil types.

During this period, the institute carried out work on the study of soil processes under intensive systems of irrigated agriculture, the processes of formation of the fertility of irrigated soil and ways to increase it. Studies of soil erosion, optimization of water and thermal regimes, individual physical properties of soils, organic and mineralogical composition have been widely developed;

In the agrochemical direction, the staff of the institute studied the transformations in the soil, the use of fertilizers by plants and the loss of nitrogen and established the nitrogen balance in the "soil-fertilizer-plant" system, the nature of phosphorus fixation, phosphorus fertilizers in irrigated soil, the potassium state of irrigated soils and developed methods and ways to increase efficiency of nitrogen, phosphorus and potash mineral fertilizers.

The microelement composition of irrigated soils in Namangan, Andijan, Ferghana, Bukhara, Kashkadarya and Khorezm regions has been studied. Regional maps were compiled on the content of microelements - copper, cobalt, molybdenum, manganese and boron, which made it possible to determine the territories of insufficient provision of soils with microelements.

The acquisition of Independence by the Republic of Uzbekistan set new tasks for the development of the economy of the republic, including agriculture

Since the first days of Independence in the Republic of Uzbekistan, a deeply thought-out strategy for the development of agriculture has been consistently implemented, aimed at ensuring the food security of the country. In order to implement market and institutional reforms in the agrarian sector, changes in the structure of sown areas were carried out, cotton crops decreased by almost 2 times in favor of grain crops.

Changes in the structure of sown areas with a reduction in the area under cotton and the inclusion of grain crops required the development of new farming systems, effective crop rotation systems and crop rotation. All this required new data on the basic properties of soils, the current ecological-meliorative state of irrigated lands and their level of fertility.

To this end, the Institute conducted comprehensive soil-ecological studies in the irrigated zones of the Republic of Karakalpakstan and all regions. A salt survey of the irrigated soils of the republic was carried out and cartograms of soil salinization were compiled in the context of farms (massifs), recommendations were developed for flushing saline soils.

As a result of these studies, soil maps, maps of the mechanical composition and water permeability of soils, land assessment, soil-meliorative, environmental and bonitet maps, maps of soil supply with macro- and microelements using GIS technologies were compiled, recommendations were developed for the rational use and improvement of irrigated soils republics.

Based on the results of these works, agro-soil and land assessment maps of the Republic of Karakalpakstan and all regions (M: 1:100000, M: 1:200000) were compiled. A soil map of the Republic of Uzbekistan (M: 1:750000) and an atlas of the soil cover of the republic were compiled, reflecting information on the soil cover of the republic in the context of regions and in the whole country.

In the same period, agrochemical studies were carried out. As a result, the nitrogen and phosphorus funds of irrigated soils and their structure (fractional composition), the composition and structure of soil

organic matter (group and fractional composition of humus) were established, the current supply of irrigated and rainfed soils of the republic with humus, mobile phosphorus and exchangeable potassium was established.

In accordance with the Decree of the Cabinet of Ministers of the Republic of Uzbekistan No. 496 dated December 23, 2000 “On approval of the Regulations on land monitoring in the Republic of Uzbekistan”, work is underway to monitor agricultural land in the Republic of Karakalpakstan and in all regions.

The results of these studies were the basis for the development of unified state measures to improve soil and environmental conditions, scientifically based placement of crops, proper maintenance of the land cadastre and more efficient use of land and water resources of the republic.

In recent years, a new stage of cardinal large-scale reforms in the economy has begun in the republic, including in the field of agriculture

One of the priority areas of the “Action Strategy for the Further Development of the Republic of Uzbekistan”, adopted at the beginning of 2017, is the modernization and intensive development of agriculture. On October 23, 2019, the Presidential Decree approved the "Strategy for the Development of Agriculture of the Republic of Uzbekistan for 2020-2030", which covered nine strategic priorities, the first of which was ensuring the food security of the population.

In order to ensure the implementation of the above Decree of the President of the Republic of Uzbekistan, the Institute carried out scientific research and achieved certain results.

Research results of recent years

In recent years, the institute has carried out comprehensive studies of the soil cover of the Aral Sea region, Tashkent, Syrdarya and Bukhara regions. As a result of these studies, the patterns of soil cover formation on the dried bottom of the Aral Sea under the conditions of global climate change and the current ecological meliorative state of irrigated soils in Tashkent, Syrdarya and Bukhara regions were revealed.

In order to provide emergency soil services to farms, agro-clusters and landowners in the regions, a mobile laboratory «Soil clinic» was created.

Guidelines for carrying out soil assessment works are developed. And on their basis, an assessment of the quality of soils of irrigated lands in Andijan, Jizzakh and Bukhara regions was carried out.

Agrochemical cartograms of irrigated lands in some regions of the republic on a scale of 1:10,000 were compiled, on the basis of which recommendations were given for the differentiated use of mineral and organic fertilizers.

Research is underway to develop norms and methods for the use of new modern biofertilizers, nanosubstrates to improve soil fertility in the republic.

In particular, the impact of «Zeolite», «Torfogel», «Biomax» and «Bio-Bitpest» preparations produced by «Torfogel Torfusha» of the Russian Federation and «AgribioekoTex» of the Republic of Azerbaijan on soil fertility and crop yields is being studied.

On the basis of the memorandum of understanding between the Institute and «Zion Holding Ltd» of the Russian Federation, field trials are being conducted on the pilot plots of «Bukharo agrocluster llc», Peshku district, Bukhara region, on the use of the «Zion» ionic substrate on vegetable and melon crops on sandy soils subject to deflation.

A joint project agreement has been signed with the Food and Agriculture Organization of the United Nations (FAO) and research is underway to assess and map degraded soils using geographic information systems in the Bukhara district of the Bukhara region to develop a system of indicators to assess soil degradation.

In order to preserve and improve soil fertility, prevent and eliminate the consequences of soil degradation, introduce new modern resource-saving agricultural technologies in the production of differentiated fertilizer rates, the Institute holds regular field meetings and seminars for land users in the regions.

Provision of services to agricultural clusters and farms through the mobile laboratory «Soil clinic»

The Institute created a mobile laboratory «Soil clinic» to provide prompt soil services to farms, agro-clusters and other land users. Mobile laboratories can use compact equipment placed in special vehicles to determine the meliorative state of soils, nutrient content and other agrochemical indicators directly in the field at different stages of crop vegetation.

On the basis of the chemical analyzes of the soil carried out to date, practical recommendations were given for the effective application of mineral and organic fertilizers at different stages of crop vegetation, as well as for determining the timing and rates of irrigation.

The use of mobile laboratories ensures the economical use of mineral fertilizers and irrigation water while increasing crop yields and, ultimately, high profitability of agricultural production.

Assessment of the ecological state and compilation of ecological cartograms of irrigated soils

To date, soil quality index (SQI) indicators are used in the USA, Japan, Canada, China and several European countries. In the conditions of our republic, preliminary work was carried out to assess the quality of the soil using indicators of the soil quality index (SQI).

Current work on the application of IT technologies in soil science

Institute scientists work within the framework of state technical programs for the use of geographic information systems in soil science.

In particular, «Application of geographic information systems technologies in maintaining, restoring and determining the fertility of irrigated soils in modern forms of land use»;

«Soil fertility monitoring using modern information technologies, and development of the application soil-geoinformation-analytical system (SGAS)»;

«Development of a scientifically based system for the optimal placement of crops using GIS technologies».

Within the framework of these projects, significant results were obtained in the development of information systems, the digitization of traditional data on soil science.

The software «Program for placement of agricultural crops according to soil properties» has been developed, which performs the function of optimal placement of crops.

For the purpose of differentiated use of organic and mineral fertilizers, a «Program for calculating the optimal norms of nutrients in the «soil-plant-fertilizer" system» has been developed.

To reduce the degree of salinity and carry out high-quality reclamation measures, a «Program for calculating the amount of total, toxic and non-toxic salts in soils and waters, as well as determining their qualitative composition» has been developed.

As a result of recent work on the application of information and communication technologies in soil science at the Institute, 7 databases and software products received copyright certificates from the Intellectual Property Agency. As a continuation of the work carried out at the Institute for the digitization of science, this year the department «Soil-geographic information systems and pedometrics» was opened.

Prospects for the development of research-production activities of the Institute

development of technology for applying international standards for chemical analysis of soils and innovative methods in them (51ISO / TC 190 Soil quality) in the republic;

carrying out work on the assessment of soil quality using indicators of the soil quality index (SQI);

development of technology for soil degradation analysis using remote sensing (RS) and unmanned aerial vehicles (UAVs);

creation of high-precision digital soil assessment maps based on modern GIS technologies for sustainable management and efficient use of land resources;

development of a new geophase-intelligent fertilizer application system based on specific factors in irrigated agriculture;

development of agricultural technologies that increase the viability and productivity of plants grown in the arid region of the Aral Sea;

introduction of agricultural technology of organic farming, based on the creation of environmentally friendly soil conditions;

introduction of the mobile application «Saline Soil», a mobile database on irrigated saline agricultural lands.

development of a system for integrated monitoring and management of soil resources using artificial intelligence technologies and big data.

As a result of the implementation of the above scientific areas, an information database will be created that characterizes the evolution of soils, changes in their properties, the direction and intensity of soil processes, soil degradation processes under the influence of anthropogenic and natural factors in the context of the development of desertification processes and global climate change. The scientific basis for the prevention of degradation processes and other negative phenomena will be assessed and created in order to improve the ecological state, increase soil fertility, obtain high and environmentally friendly crop yields and increase the potential of agricultural production.

At the end of my speech, I would like to note that the activities of the Research Institute of Soil Science and Agrochemistry serve the effective use of land resources, in particular the soils of the Republic, their protection, conservation and improvement of soil fertility, and also on the basis of this, leaving the future generation fertile, healthy and ecologically clean soil.