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CONCEPTUAL APPROACH TO THE MANAGEMENT OF SOLONETZIC SOILS FERTILITY IN UKRAINE

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The general tendency of the agriculture development in the world at the present stage envisages the creation of conditions for the stabilization and increase volumes of agricultural production to solve the food problem. Year by year the Ukraine's role increases as an agricultural country in the food security of Europe and the world. According to the Land Registry of Ukraine, the land fund country makes 60,3 million hectares, of which agricultural lands – 41,6 million hectares (69% of the total area of Ukraine) in arable land - 35, 5 million hectares (53, 9%). According to the Land Registry of Ukraine the area of solonetzic soils in Ukraine 2, 8 million ha. Furthermore, among the irrigated lands 600 thousand ha of secondary solonetzic of soils. Solonetzic soils cover relatively small part of arable land area in Ukraine (about 7%), but require special attention in the management of agriculture for several reasons. Firstly, their agricultural development is closely linked to the need to perform a complex set of special reclamation measures for desalination. Secondly, soil salinity can occur during the exploitation of non-saline areas in irrigated agriculture as a result of the processes of secondary salinization. Thirdly, the range of saline soils is dynamic as soil salinity can be accompanied by the simultaneous appearance of the process of secondary salinization and alkalization and new ranges of salinity on adjacent territories. Under the condition of properly and scientifically substantiated use, saline soils are a significant reserve for increasing the production of various types of agricultural products [9].

Effective use of solonetzic soils in Ukraine is possible only with accounting soil properties (power and chemistry of salinity, salt balance of soil, etc.), the level of groundwater mineralization, climatic conditions (rainfall), the direction of agricultural use (arable land, hayfields, pastures, perennial plants). Depending on the genesis and properties of different types of solonetzic soil for conditions of Ukraine, a landscape-adaptive set of measures to improve their fertility was developed. Herewith the reclamation is carried out in the following directions: chemical reclamation (soils and irrigation water), ameliorate plantation plowing, flushing, creating drainage systems, phytomelioration). Landscape-adaptive approach to the management of solonetzic soil fertility ensures sustainable environmentally safe and cost-effective use of solonetzic soils [8, 9].

The purpose is - to develop a reasonable and adapted to modern socio-economic conditions to the management of solonetzic soils fertility in Ukraine.

Materials and Methods. The research were conducted in Forest-steppe and Steppe zones of Ukraine, where is disposed 98% saline and solonetzic soils. The Objects of our research were:

- naturally solonetzic soils, irrigated soils and methods of its reclamation.

- irrigation water. For irrigation in Ukraine are used basically water of main river arteries and created on their

base water storage's and ponds.

- agricultural plants, grown on solonetzic soils in irrigating and none irrigating conditions (grains, vegetables, fodder's and technical cultures).

The main methods were field, model, analytical and statistical research, analysis and synthesis.

Also were used materials of large-scale land survey (1957-1961 yr.) and their correction; the Land cadastre; materials of agrochemical certification of the agricultural lands; data of ecological-ameliorative monitoring; data of scientific organizations UAAS, higher educational institutions and others.

Results and discussion. For today on the basis of the long-term comprehensive study of the soil processes dynamics and regimes in solonetzic soils there are identified common landscape-zonal patterns and spatially differentiated features of orientation, and the prevalence rate of soil processes. For a more accurate spatial assessment of the solonetzic soils state, a series of electronic maps of the regional and local levels is created.

At the regional level there are solved issues of spatial differentiation of land on the main factors of the formation and the degree of manifestation of salinity and alkalinity, the directions of further development of processes for determining a set of preventive and prophylactic measures. At the local level - the solution both monitoring tasks, and tasks related to the needs of the targeted land users. The main attention is paid to the definition of local variability of salinity and alkalinity manifestations, obtaining the characteristics of the soil condition and the dynamics of its performance. This approach allows creating a unified system of information and mapping support for measures to control environmental and agromeliorative state of naturally and secondary solonetzic soils and solonetzic soils, developing the principles of their rational use based on technology adaptability to soil - climatic and social conditions.

Naturally solonetzic soils of Ukraine are confined to the two tectonic cavities - the Dneprovsko-Donetskaya (Forest-Steppe zone) and the Black Sea (Steppe), where the total lack of areas drainage creates favorable conditions for the accumulation of salts [4, 5]. According to the soils classification of Ukrainian, they are presented by chernozems solonetzic and solonetzic, chernozem meadow, meadow - chernozem, meadow-chestnut, meadow, alluvial - meadow, dark - brown and brown alkaline soils, solonetzic and salt marshes [1, 6].

Manifestation of secondary salinity is often the environmentally negative consequence of irrigation. Considering the fact that in Ukraine every two years from the five are arid, irrigated lands are the insurance fund of the country, as 75% of the territory of Ukraine for natural hydration are in unfavorable or partially favorable for agricultural production conditions, which

greatly affects the efficiency. Most often, secondary salinity in Ukraine occurs in conditions of inadequate drained low-lying areas by the absence of the collector-drainage network and / or by using for irrigation of saline water (more than 1 g / l) [11].

Herewith it is set a positive salt balance in excess of accumulation of salts over their removal [3]. The causes of secondary salinity in Ukraine can also be [4, 7]:

- adverse chemical composition of the irrigation water in which the content of alkaline salts of sodium, potassium, in an equivalent ratio exceeds the content of salts of calcium, magnesium, iron and other two- and trivalent cations;
- rise to the surface of the ground water with the same adverse chemical composition and so secondary salinity can be stored for a long time. Then, during salt flushing by precipitation or irrigation water in soils secondary alkalization process can be developed;
- special flushing of saline soils, as well as the development of the rice systems based on naturally saline soils (the early years).

According to the soils classification of Ukrainian, secondary solonetzic soils are represented by chernozem ordinary, southern and dark chestnut soils [1, 6].

Until 1991 fertility improvement of solonetzic soils in Ukraine was carried out mainly with the use of chemical amelioration on the area 2 million ha. After 1991, the reclamation of solonetzic soils has been given insufficient attention mainly due to high energy consumption and the lack of adequate state financial support. During this period, the agriculture of Ukraine in general has gone on the way of extensive development, which inevitably leads to the loss of soil fertility, reduced yields and volatility of gross yield of agricultural products. This has contributed to changing attitudes, principles, methods and technological solutions to problems of land reclamation [8].

The feasibility of reclamation, its kind, technology are defined by agro-climatic resources, modern ecological and land improvement state of solonetzic soils, tasks of agricultural production and its resourcing. The main requirement for rational use of solonetzic soils in Ukraine in modern conditions should be considered a necessity of landscape-geochemical assessment of their formation and distribution and adaptive application of different types of reclamation. It provides protection and increase effective fertility of solonetzic soils, optimization of living conditions of the crops. According to this approach, the amount of soils for reclamation can be significantly reduced (fig.1).

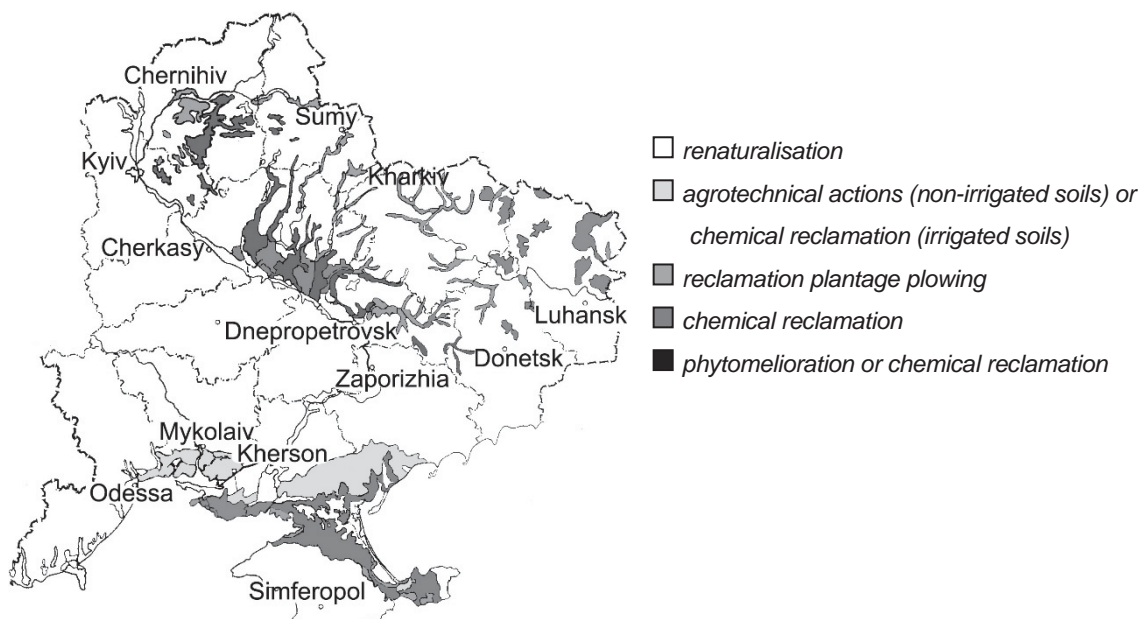


Fig.1 Landscape-adaptive approaches to the management of solonetzic soils fertility in Ukraine

The State Agency of Ukraine for Land Resources has developed and approved a procedure for land conservation, based on which the solonetzic soils containing toxic salts more than 0,4% are subject to transfer from agricultural lands to other land uses. The system of measures on re-naturalization of landscapes provides also removal of strongly solonetzic lands from arable land [10].

Chemical reclamation in Ukraine is recommended to carry out on solonetzic and alkaline soils, which lend themselves well to this reclamation measure (chernozems solonetzic and solonetzic, chernozem meadow, dark -brown and brown alkaline soils with

share of solonetzic spot 10-30 % and 30-50 %, soils that irrigated by bonded suitable water). Continuous chemical reclamation is recommended to replace by the sample (contour) application of meliorant on solonetzic stains or by local application of gypsum in rows during sowing, providing economic- and material resources savings. According to this approach, areas of lands needing chemical reclamation could be significantly reduced compared to those that were reclaimed in previous years. This method of chemical reclamation provides increasing yields of grown crops at 15-20%. According to research, chemical reclamation should be repeated every 5-7 years. For the reclamation of sec-

only solonchaks it is recommended to apply the gypsum directly into the soil or with irrigation water.

In the dry conditions of Steppe, where the chemical reclamation in unirrigated conditions is ineffective, it is recommended the use of reclamation plantage plowing [2, 12]. It is expedient to apply for dark chestnut and chestnut solonchaks in combination with steppe solonchaks (25%) with 40-50 cm deposition of carbonates and / or gypsum and alkali-saline brown soils in meadow-chestnut. With the research of the properties of agrotransformed solonchaks of Dry Steppe of Ukraine in irrigated and non-irrigated conditions, conducted by NSC ISSAR [2], was determined that the

result of the aftereffect of reclamation plantage plowing is the formation of highly environmentally sustainable agro transformed soils which are unique in nature on their morphological, agrophysical and physico-chemical properties and are able to provide high productivity of agricultural crops, that are able to provide high fertility in agro-climatic conditions of the Steppe zone of Ukraine. A single conducting reclamation plantage plowing provides a positive after-effect on soil properties and productivity of agricultural crops for 50-60 years and the discontinuation of its positive aftereffect is unmarked. Gain yields are 20-25% in unirrigated conditions and up to 40% under irrigation (fig 2).

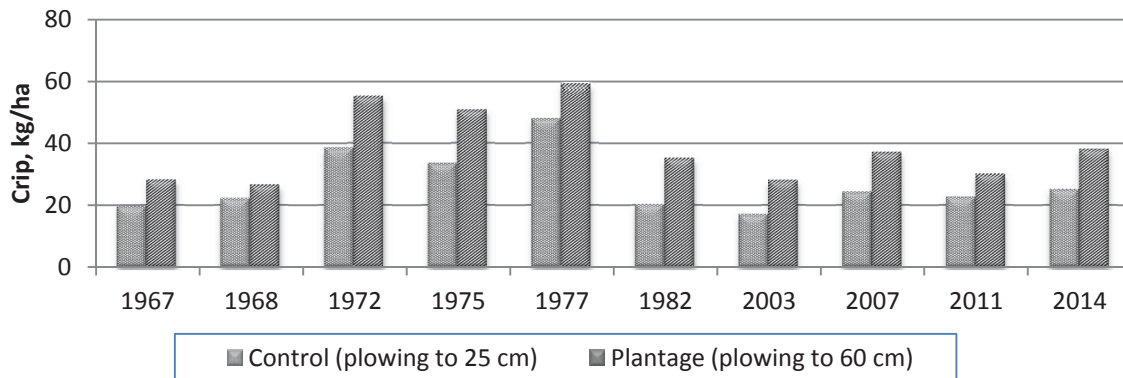


Fig 2. Effect of reclamation plantage plowing on gain yields

Large areas (92.2 thousand hectares) are occupied by solonchaks, where the reclamation is inefficient and bringing them to arable lands is economically unfeasible. It is mainly solonchak alluvial chernozem and its complexes, with medium to high degree of salinity and the level of ground water occurrence of 1.0-1.5 m and alkali-saline chernozem soils and solonchaks. Cost-effective and environmentally safe using such soils is appropriate through selection of adapted economically valuable kinds of crops to create productive perennial multicomponent agrocenoses.

Solonchak soils with not deep mineralized groundwater with adequate natural drainage of areas are recommended for usage under rice systems. For reclamation of slightly solonchaks it is recommended to use technical measures: application of organic and mineral fertilizers, the introduction of perennial grasses in crop rotation, phytomelioration.

To separate group it should be attributed solonchaks, which in the present shortage of resource expenditure do not require radical reclamation. Increasing their fertility is advisable to make with farming practices and application of increased amounts of organic and mineral fertilizers, involvement in crop rotation perennial grasses and solonchak-stable crops. It is chernozems and dark chestnut soils with a low degree of salinization without solonchaks spots or their complexes with solonchaks spots 10%.

Conclusion. On the basis of generalization and systematization of long-term research there were highlighted the issues of the genesis of solonchaks in Ukraine, the main directions of research, the main approaches to their rational use and fertility management. Landscape-adaptive approach to the management of solonchak soil fertility is proposed. The pro-

posed system of reclamation activities, differentiated by features of different types and kinds of solonchaks soils, environmental and economic aspects of reclamation can reduce the area of chemical reclamation of solonchak soils to 1,0-1,1 million hectares compared to 2,0 million hectares in previous years and receive economic benefit by increasing crop productivity and improving product quality. Thus obtained results will serve as for securing the sustainable development of agriculture in Ukraine.

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ОПТИМІЗАЦІЯ ЕЛЕМЕНТІВ ТЕХНОЛОГІЇ ВИРОШУВАННЯ НОВИХ СОРТІВ СОЇ В УМОВАХ ПІВДНЯ УКРАЇНИ

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Постановка проблеми. При вирощуванні сої в зоні Південного Степу України важливе значення має подолання дефіциту природної вологозабезпеченості ґрунту. Основним меліоративним заходом для вирішення цієї проблеми є зрошення.

При оптимізації витрат поливної води, енергоносіїв та технологічних засобів, важливими є питання точного диференційованого управління режимом зрошення сої впродовж її вегетації шляхом ретельного контролю за водоспоживанням рослин для компенсації існуючого дефіциту вологи у кореневмісному шарі ґрунту.

Одним з найважливіших факторів, що сприяє підвищенню врожайності сої є наявність нових високопродуктивних сортів. Вірний вибір сорту - одна з вирішальних умов отримання максимального врожаю цієї культури. Недосконала технологія вирощування сої, при якій не враховані особливості умов вирощування, такі, як: клімат, умови вологозабезпеченості, густина стояння рослин, стримує одержання високих і рівнів урожаїв її зерна. Питання впливу режиму зрошення та густоти стояння нових сортів на врожай сої в умовах Південного Степу України вивчене ще недостатньо і потребує уточнення, а режим зрошення, який базується на встановлених взаємозв'язках, потребує вдосконалення. Розробка й впровадження у виробництво удосконалених елементів технології вирощування нових середньостиглих сортів сої Даная та Аратта, які є найбільш універсальними для кліматичних умов півдня України, потребують визначення оптимального режиму зрошення, густоти стояння рослин, що у поєднанні повинні забезпечувати стабільний та високий рівень врожаю сої з відповідними показниками якості зерна при одночасній економії ресурсів є актуальною проблемою сучасної меліорації і зрошуваного землеробства.

Стан вивчення проблеми. Дослідження морфо-біологічних особливостей сільськогосподарської культури сої висвітлені в роботах вітчизняних та іноземних вчених: Бабича А.О., Колісника С.О., Пекеньо Х.П., Федорищева В.Н., Скорикова

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В результаті аналітичного огляду літератури обґрунтована необхідність проведення теоретичних та експериментальних досліджень з питань впливу режиму зрошення та густоти стояння рослин на продуктивність середньостиглих сортів сої в Південному Степу України.

Наведені матеріали свідчать про те, що існує нагальна потреба у розробці елементів технології вирощування сої, спрямованих на оптимізацію витрат агроресурсів, зокрема, за рахунок удосконалення режимів зрошення та визначення оптимальної густоти стояння рослин, адаптованих до посушливих умов Південного Степу України.

Завдання і методика досліджень: Під час проведення досліджень застосовувалися загальнонаукові (спостереження, аналіз, синтез, порівняння, вимірювання тощо) і спеціальні (польовий, лабораторно-польовий, лабораторний, атестовані загальноприйняті наукові методи та ДСТУ) методи досліджень, методи системного, математично-статистичного, кореляційного, розрахунково-порівняльного аналізу та математичного моделювання.

Польові та лабораторні дослідження проведені в зоні Інгалецької зрошувальної системи впродовж 2010-2013 рр. на ділянках відділу зрошуваного землеробства Інституту зрошуваного землеробства НААН.

Вологість ґрунту визначали термостатно-ваговим методом, а поливні норми, сумарне водоспоживання та середньодобове випаровування, коефіцієнти водоспоживання, окупності поливної