

LANDSCAPE-ECOLOGICAL SOIL-ADAPTIVE METHOD OF RECLAMATION OF TAKYR-LIKE SOLONCHAKS

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Abstract

We describe the soil-ecological, methodological and technological aspects of the implementation measures for the implementation of landscape-adaptive-commutative soil and environmental development of the method Siyazan-Sumgait saline takyr-lake alluvial array of genetic origin. The conceptual basis of the method is the division of space exploration on the rails, and accumulating the strip with a mixed structure with high absorbency of surface run of formed at maximum precipitation and implementation of measures to regulate the hydrothermal regime of soil sunder natural vegetation of the steppe.

Keywords: *adaptive landscape, soil and ecological method, development, takyr, solonchaks*

INTRODUCTION

Aiming at the development of methods of regulation of moisture and salt transport in a dispersion medium is necessary to determine the limit values of the limiting factors that encourage elementary soil processes [11]. When creating agro landscapes on alkaline and saline soils reached a new state of water-salt regime and soil properties, the stability of which is supported for reclamation and agromomic measures [1,6]. The price of this stability depends more on how the same problem agronomic transformation of the landscape with the thrust of natural processes [6]. It is reduced if reclamation processes are consistent with the natural processes of desalination and dealkalinization (relative to the territory drainage conditions), and increases when reclamation is aimed at overcoming the active processes of salinization and alkalization [6].

Issues of harmonization of reclamation processes with natural processes of desalination and dealkalinization in tune with the principles of ecological optimization of land reclamation [8], which is comparable with the principles of sustainability of the structural state of the soil to anthropogenic impacts, proposed by V.F.Utkaeva, which indicates the stability of some components, parameters, processes and functions of soil analyzes, and in relation to which the factor [9,15,17].

The stability of the structural state of the soil is realized by interaction of different specific (chemical, physical, biological, hydraulic) soil mechanisms, and to a greater extent due to the ability of the soil to reaggregation. Reaggregation of soil mass is the result of cycles of swelling-shrinkage during wetting and drying. As a result of these processes is the formation of new soil aggregates and pore space, that is a structural condition of the soil, called mixed structural state [3,9,10,14,15].

In the swelling of natural salt marsh Siyazan-Sumgait array processes swelling-shrinkage in the annual cycle offsetting between bars, returning to baseline. In natural condition, by a process of shrinkage cracks completely clogged after soil moisture in the winter. That is, due to the fact that the amount of shrinkage cracks quantitatively equal to the amount of swelling soils, the structural condition of the soil is returned to the original physical state as a whole is estimated as soil environment undisturbed-integral capillary connections.

Investigations in the annual cycle of soil and climatic parameters of soil environment of natural salt marshes Siyazan-Sumgait array having takyr morphology showed the consistency of the theoretical assumptions about handling moisture and salt transport processes occurring in the swelling of the fine soil environment under the influence of climatic factors. The study of physics, chemistry, fluid dynamics of the processes occurring in the soil environment of natural salt marshes Siyazan-Sumgait array

and evaluation mechanism of salt accumulation in natural patterns from the perspective of soil and environmental compatibility, enabled the authors to develop landscape-adaptive ion of soil-ecological method of providing reversibility of the process of salinization in natural salt marshes.

SUBJECTS AND METHODS

Investigations were carried out on gray-brown soils takyr Siyazan-Sumgait array. The conceptual basis of the method is the theory, real porosity five soil environment prone to swelling, launched by N.R.Suleymanov providing for the transformation of the natural structure of the soil mixed with a volume of more free pores larger volume swelling, compensates for the loss of free porosity of the soil when wet. This ensures the safety of the soil structure acquired the physical state of the medium, compensates for the loss of porosity-free as a result of swelling when wet soil and increases the rate of upward and downward flow of moisture, respectively, 3.97 and 2.73 times [16].

Soil structure transformed from a natural structural state to the mixed, stabilizing a new physical equilibrium. Being at the highest level in the hierarchy of the structural organization of the soil, retains links to the original physical condition, has a certain similarity and acquired differences. So within soil aggregates, lumps and blocks at the original physical condition, the parameters of which are similar in meaning to the undisturbed soil structure. The difference is observed only in the size of continuous capillaries, which are reduced to the extent of disintegration soil lumps, blocks, and in the directions of wetting and draining soil.

Acquisition of additional free pores increase capacity gravitational long breathability, contributing to a change in the temperature gradient between a single unit and soil surrounding the pore space, finally, the area directly moisture evaporation from the surface of soil aggregates, lumps, blocks [10].

By N.R.Suleymanov conditions describing the process can be written as:

$$V_s / \Delta V = 1 \quad (1.1)$$

Where, V_s – soil swelling volume, ΔV – volume pore additional quantitatively equal to volume shrinkage cracks soil [9].

During this period the movement of moisture in the soil environment is in the form of a continuous capillary flow. With decreasing moisture content below field capacity (MF) occurs movement of water in the film-capillary form [2,5,10,15].

Analysis of the physical properties of soils showed that if the changes do not exceed the threshold values of the critical parameters of the structural state of the soil, its recovery is possible during the growing season. Each soil has its own threshold of critical values of the indicators of physical properties [17].

It follows that the environmental conditions, forming soil-reclamation situation of natural salt marshes Siyazan-Sumgait array and arid soils in general, contribute to the accumulation of salts in the surface layers of the soil. Natural model of natural salt marshes, with the parameters of physical condition expressed by (1.1) shows that for changing parameters of the model, it is necessary to create a soil environment with parameters satisfying theoretical conditions reclamation swelling dispersion medium, the proposed N.R.Suleymanov:

$$V_{ap} > V_s \quad (1.2)$$

Where, V_{ap} – volume of the creating addition porosities (plowing, hoeing, vibroripper), % [4,9,12,13].

Soil environment, with a porosity of greater volume of swelling soils, has a theoretical framework for the conservation of water permeability of the medium close to or greater than the natural, after a full cycle of swelling dispersion medium. It is mixed with said soil structure parameters porosity to provide downward flow of moisture, thus moving down the profile salts.

The physical essence of the above is as follows:

- The creation of a mixed structure promotes the formation of the soil environment with impaired or limited capillary connections, dramatically different from natural-source natural ecological models of natural saline;
- Mixed structure, with additional free pores, neutralizes the negative effect of the swelling of the soil, allowing the soil environment to grow under loads different from the loads generated in natural condition, ensures the safety of the free porosity, therefore, the rate of absorption observed at the beginning of contact of water with soil, throughout the layer with a mixed structure, which ensures rapid transfer of moisture in the deeper layers of the soil;
- Because of the violation of the integrity of the capillary connections, soil environment limits the upward flow, directing moisture in different directions, at a distance, to limit the size of soil aggregates, which broke up the soil layers in the transformation of the natural structure of the mixed;
- Mixed with some additional structure free pore area increases the evaporation of moisture from the surface directly aggregates which leads to faster draining soil aggregates of the entire profile with a mixed structure, setting the reducing salt migration masses in the vertical plane, prevents the accumulation of salts at the surface of the soil;
- The accumulation of salts on the surface of soil aggregates, create conditions move them down the soil profile, followed by intense precipitation (rainfall) in the underlying horizons [16]. Schematic representation of the phase distribution of moisture in the soil environment with a mixed structure during the hydration-draining cycle is shown in Fig. 1.

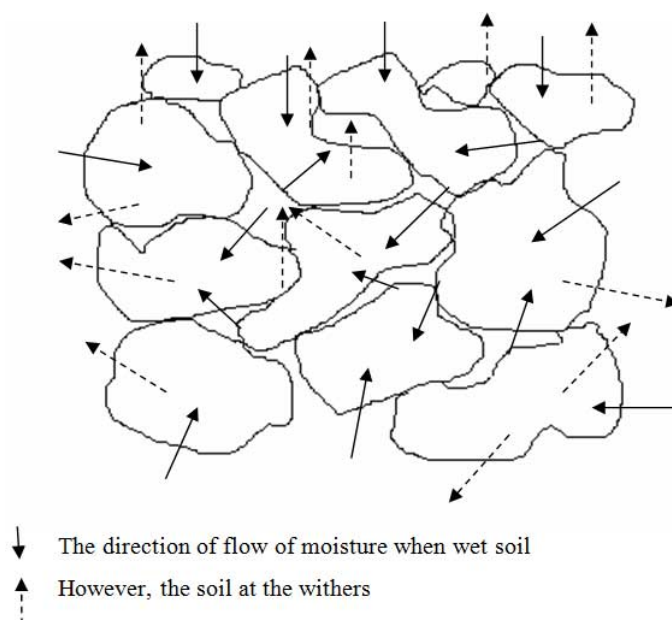


Fig.1. Scheme of movement of moisture in the soil environment with mixed structure that provides the reversibility of the process of accumulation of salts

Fig. 1 shows that by increasing the amount of free water seepage and speed of movement, under the influence of gravitational forces in the soil profile is quicker (moves downward moisture flux are shown by solid lines), which causes the first stage-stage moistening the soil horizon with a mixed structure. Under natural arid conditions, moisture soil occurs during a large (relative to MF) moisture deficit and it is measured as a mode of movement of moisture in the unsaturated medium [4,10].

Studying the dynamics of storage, the scale of transformation capillary connections during creating a mixed structure, affecting to the change in the flux of moisture of migration and salt components and hierarchical relationships between ecosystems of the landscape is a key in the soil-ecological approach to solve the problem.

In view of the above, acquires relevance the development of improved soil-ecological techniques that provide a better match moisture and salt transport processes with natural processes, with maximum adaptation to the potential of the soil environment of the elementary soil area, in particular, the landscape as a whole [10]. Experiments have shown that an increase in evaporation area and change the heating conditions of the soil by improving aeration, updrafts moisture motion changing, directing them to the soil part of the unit is different from the inner to the temperature gradient, i.e., the outer surface of soil aggregates. As a result, the proportion of evaporation of moisture through the outer surface of soil aggregates, as compared to a natural soil environment of addition increases, the process of moving and soluble salts on the surface of the aggregates is intensified. The direction of flow during evaporation of moisture is indicated in Fig. 1 by dashed lines.

THE RESULTS OF RESEARCH

As shown by experiments to determine the limits increase the rate of moisture and salt transport in soil environment with different levels of structural organization, is due to the restructuring of the downdraft of moisture, which is a consequence of the increase in the specific volume of free water moving under the influence of gravitational forces on the newly created additional free pores (ΔV). This is confirmed by the difference between the rates of water-lifting and filtration, which ranges 43,84-174,86 mm / hour.

Transformation of the structural state of the upper-layer mixed takyr-like intensified speed natural upward and downward flows of moisture, and the redistribution of surface runoff during storm emerging norms of precipitation, concentrating in natural micro depressions (in closed depressions), in the absence thereof, in the artificially created bands area water harvesting which exceeds the area of accumulation (humidification) 3 times, creates conditions for the movement of salt components. The developed scheme of territory with salt marshes takyr morphology is shown in Figure 2.

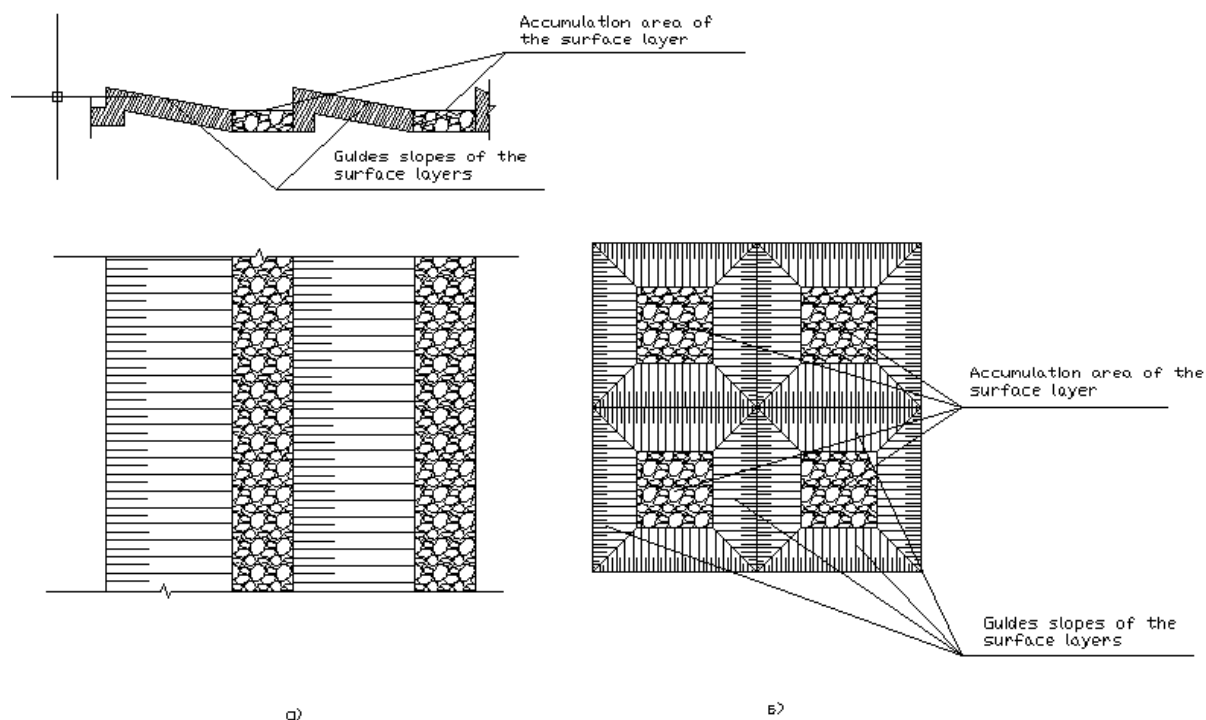


Fig.2. Scheme of the territory for the implementation of an adaptive landscape and soil-ecological Method of development of natural salt marshes Siyazan-Sumgait array

Fig. 2 shows that the regulation of surface runoff in natural micro depressions carried out with satisfaction the needs of the treated soil moisture at a certain rate equal to the moisture deficit is determined experimentally, sufficient for transporting salt masses beyond the mixed structure. Through the implementation of planning and expansion of the area of collection, depending on the destination area in the long term, it is possible redistribution of surface runoff due to the direction and moisture accumulation at sites with a stripe or a square shape.

For the implementation of the redistribution of surface runoff, the following measures:

- Creates a depth of not less than 5 cm and the adjacent parallel sections with an area of more than 2 times;
- Layout of parallel plots slope equal to $i > 0.005$ c coverage area exceeding the accumulation zone Photo 2 times.
- Split strips across the slope of the landscape, and closed depressions in the center of the basin (polygon).
- The separation of the bands on the Beds in order to evenly distribute atmosphere standards precipitation over the area of moisture accumulation.

Calculations to determine the geometric dimensions of belts and zones of formation of surface runoff are performed based on the results of studies of the authors, based on the technical features and size of the working bodies of the technique. Thus, in certain laboratory standards required for displacement of soil salts with mixed structure indicates that the volume of water required in the case of using the resin in order to consolidate the mixed structure is 508 cm³, and without polymer "VO" 601 cm³. The equivalent rate, calculated according to absolute maximum (taking into account evaporation losses, $P_{atm(max)} = 14,3$ mm) of rain Siyazan-Sumgait array, the experimental volume is respectively $2,5 \div 4,0 P_{atm(max)}$ atmospheric high precipitation.

An important link in the implementation of activities is to determine the time of writing (processing) accumulation zones runoff. It must be preceded by a start time of intense rainfall, i.e. the time from heavy precipitation should not be included in the period of cultural-technical engineering work on the organization of the site. Performance art is dependent on satisfactory organization and improvement of the technology of work. On average, productive tractors working in clingy with mounted rippers, can be planned performance within 3÷5,3 hectares per month.

Under the conditions of Siyazan-Sumgait array-period loss intensity rainfall is October-November, April and May months. Time absolute maximum loss recorded in the month of April, 14,6 mm, while the September and March is the period of cultural technical events, the composition of which, with certain assumptions, include measures to implement the planning area necessary for the introduction of landscape-adapted soil ecological method of development of natural solonchaks Siyazan-Sumgait array.

Volume of cultural-technical measures should be implemented in two phases.

The first phase includes work on cutting guide surface runoff and slopes micro depressions providing storage area runoff narrow-band linear soil desalination.

At the second stage of work on the improvement of the site and prepare for the development of soil runoff accumulation zone defined horizons of the upper layer which desalinate before the end of the season of intense rainfall. Proof of this is the emergence of plant bio indicators-herbaceous vegetation wormwood-ephemeral groups and salt-tolerant shrub-steppe plants tamarisk and others with a strong root system, which penetrates into the deeper layers of the soil.

In the future, the need for arrangements to regulate the hydrothermal regime of soil, in order to increase the stability of water retention in the mixed soil horizon. Herbaceous vegetation in combination with shrub, produces less heat the Earth's surface and evaporation of moisture. Allowed an annual capacity of intensity shrubs that promotes shading everything larger area guides slopes.

CONCLUSION

Landscape-adaptive soil-ecological method development takyr-like solonchaks cultural technical provides for measures for the accumulation, redistribution and direction of surface runoff, forming a roll-maximum storm precipitation.

Intensification of filtration capacity takyr-like solonchaks provided by the organization of bands with a mixed structure by deep soil loosening, creating soil environment with a mixed structure which preserves the free porosity on swelling soils, and by disrupting the capillary connections, preventing the restoration of salinity.

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