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Recovery of Microflora of Salinated Soils by Growing *Glycyrrhizaglabral.*

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Abstract

The influence of *Glycyrrhizaglabra L.* on the dynamics of the microbiol community, depending on the length of the growth period (control, after the first year, after the third year, after the sixth year, after the tenth year) has been studied in the studied saline soils of the region: The patterns of changes in enzyme activity and respiration rate Soil, humification coefficient under the influence of the influence of the crop; Correlation links between microflora and enzymatic activity, as well as soil respiration, the role of scientifically grounded agrobiological methods for reclamation of saline soils for specific cotton-growing regions under conditions of biologization of agriculture have been revealed.

Introduction

The current practice of desalinization of soils subject to salinization includes capital leaching on the background of the collector-drainage network, irrigation irrigation regimes that combine with deep soil treatments, introduction of chemical meliorants, etc. Such soil desalinization technology requires huge unproductive irrigation water costs, agrochemical, agrophysical and biological properties Soils and is very expensive.

In the case of these lands, new approaches are needed, and biological methods of desalinization of soils with use of salt tolerant crops and halophytes are promising in this respect. From sources we know that biomelioratsiya saline land with halophytes is economical, environmentally friendly and relatively easily performed views reclamation. The use of halophytes provides a reduction in the level of groundwater, the removal of salts by the aboveground mass, the enrichment of the soil with organic substances and the improvement of the complex of soil properties. At present the tendency towards the use of special halophytes is growing all over the world, which, on the one hand, can withstand the high content of salts due to their biological and ecological and physiological characteristics, and on the other hand they have meliorative effect on soils, sources of high protein and energy-feed and medicinal herbs. Among such crops - biomeliorants, a number of species and ecotypes were promising, where the high meliorative effect was distinguished by Licorice naked (Glycyrrhizaglabra L.).

Licorice naked (liquorice) GlycyrrhizaglabraL.- is a perennial, root shooter of the *Fabacae* family. The name of the plant means "sweet root". This widely developed plant is also used in pulp-and-paper, textile, chemical, perfume, food industries and fodder production in livestock. This herb is effective in the biological reclamation of saline soils. It is highly drought-resistant, prefers soils rich in carbonates, it is grown on a wide variety of soils-loamy, loose sands with shallow groundwater levels, and also on saline soils. On poor soils soils licorice grows well for its ability to accumulate in bacteria nitrogen from air. On one place grows more than ten years.

It is known from the works of scientists that this culture has a highly mediating and medio-optimizing function and, owing to this, has a high meliorative effect on saline soils. Due to the effective shading of the soil surface by the above-ground mass, the pump functions of biological drainage, they provide a sharp reduction in physical evaporation, a lowering of the groundwater level, removal of salts by the aboveground mass and provides desalinization of the soil. They enrich the soil with organic matter, improve physical, agrochemical, physico-chemical properties of the soil, change pH, electrical conductivity, etc. Other elements of fertility are also optimized (Shamsutdinov, 2002, Kushiev et al., 2005, Toderich et al., 2006, Mikhailova, 1966). , Haydarov, 1971, Kerbabaev 1971, Pausner, 1971, Nigmatov et al. 1991, Ashurmetov, Karshibaev, 1996, Badalov, et al., 1996).

With soil degradation and development of salinization under arid soil conditions, the

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water, air, nutrient, especially biological properties of soils, the activity of soil microorganisms, including the nitrogen cycle-Azotobacter, cellulose decomposing, nitrifiers, are violated, and the enzymatic activity of soils, Humification, the "breathing" of soil, the balance and availability of nutrient macro and microelements are disturbed, their absorption and movement to the aerial organs is inhibited, ess of photosynthesis, delayed growth and development, deteriorating soil productivity and the degradation of their happening.

In order to maintain a sustainable level of soil fertility, to predict and create the conditions necessary for the growth and development of crops, it is necessary to thoroughly investigate the interrelationship between physical, chemical and, in particular, biological properties of soils.

Biological condition of soil is characterized with quantity of different groups of microbodies, fermentative activeness and soil breathing. Microbiological and fermentative assessment of soil allows to identify soil condition, degradation process and fertility level, also opportunity to identify methods of increasing productivity of plants and compiling organic substances, also improving soil condition. Revealing ecological conditions and management of fertility must be constructed on strictly scientific, oriented to regulation of biologic processes in them.

Acknowledgement of legislation of soil process procedures based on learning biologic properties of soil allows to find a key to reserve and increasing productivity of degredated soils.

Increasing productivity of depredated soils through introducing biologic technologies, especially through introducing technologies of bio-melioration by using Licorice naked (liquorice) GlycyrrhizaglabraL is considered to be resource-saving, soil protective technology which is oriented to recovery, increasing and productivity of harvest of salinated soil and improving ecologic condition of lands.

The irrigating lands of Syrdarya region are salinated in different level and resulted to degradation. Rational usage and protection of soil in the region, introduction of resource-saving and nature-protective technologies for increasing and productivity harvest of soil are the priority issues yet.

With regard to these lands, new approaches are needed, and in this respect, soil protection technologies for increasing the fertility of saline soils by using the Glycyrrhizaglabra L. licorice are promising. Cultivation of this culture contributes to the improvement of soil properties and is an environmentally friendly and relatively easy to implement agrotechnical device for the restoration and reproduction of saline soils. At present, the tendency of the biologization of agriculture and the production of ecologically clean products is growing all over the world, and on the other hand, they make it possible to obtain additional sources of valuable high-protein and energy-saturated feeds, medicinal raw materials etc.

The continuing interest in the nitrogen problem is now being explained by the task facing humanity, among which is the most important the elimination of protein deficiency in food. In addition, the world production of agricultural crops annually brings out huge nitrogen reserves from the soil and there is always a nitrogen deficit, that is, annually it is taken out with a nitrogen crop more than returns to soil. Therefore, the nitrogen deficit is compensated by the use of nitrogen fertilizers, which are a factor in increasing soil fertility, but at the same time, this method is expensive, requiring material and huge energy resources, contributing to environmental pollution, affecting in irrational use on quality and environmental performance products. For the solution of the nitrogen problem, the use of legume-rhizobial systems is ecologically clean, resource-saving, most expedient.

Naked meat (liquorice) GlycyrrhizaglabraL. is a legume culture, has the ability to fix the molecular nitrogen of the atmosphere and convert it into an available ammonium form. The atmosphere nitrogen fixed by microorganisms in the form of NH_4^+ is included primarily in the glutamine amino acid, alanine and glutamine, and then into the protein, so it is harmless and renders Beneficial effect on soil fertility. It is established that 90% of nitrogen, fixed by bacteria

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in the nodules, enters the aerial organs of the host plant and is used to build a plant organism and form a crop. Because of this, the attention of researchers is drawn to the biological fixation of nitrogen and the cheaper and clean source of this element for farming.

The role of symbiont bacteria is not limited only to the fixation of atmospheric nitrogen, they also synthesize physiologically active substances that stimulate the growth and development of the host (auxins, gibberellins, vitamins, antibiotics). Microorganisms participate in complex biochemical processes occurring in the soil. They are the basis for obtaining bacterial fertilizers. The main symbiotic properties of nodule bacteria are found in special plasmid structures that are able to pass from the cells of certain bacterial species to the cells of others.

The cultivation of these crops contributes to the formation of a fine-grained and granular water-resistant structure. It should be noted that the root system of the main crop and legumes penetrate to different depths and they leave after cleaning in the soil the residues differing in quantity and quality. If these crops alternate, the consumption of mineral elements and moisture will occur evenly and slowly, which will not lead to a marked decrease in crop yields. In addition, the harvested crops leave a different amount of organic matter in the soil, while sowing certain crops, it is possible to keep the yield at a high level and save the fertility of the soil without significant expenditure. Legumes enrich the soil with bound nitrogen, improve phosphorus nutrition, leave organic substances in the soil and do not share common diseases with many grain and tilled crops, thereby improving the phytosanitary state of the soil.

It is known that the biological activity of soils is the most sensitive indicator of fertility and its ecological state. However, complex studies on the study of microbiological and enzymatic activity and respiration of saline soils in their relationship to properties in biomelioration using the Naked (licorice) –GlycyrrhizaglabraL.-Licorice have not been adequately studied and are an urgent task.

Therefore, the identification of patterns of changes in the microbiological and enzymatic activity of saline soils in biomelioration with the use of Licorice naked (Glycyrrhizaglabra L.), the determination of the correlation between biological activity and basic soil properties, as the basis for the sustainable provision of fertility fertility for degraded saline-gray-meadow soils, was the main goal of this work.

Methods and objects

The subject of the research was irrigated saline grey-meadow soils of the Syrdarya region (on the example of the soils of the farm "Galaba" of Bayaut district). The tasks were solved on the basis of studies of the biological activity of saline soils and the influence of biomelioration on them using the Naked (Licorice) Cot – GlycyrrhizaglabraL. The studies were performed on the basis of licorice plantations created by the Gulistan University and the International Water Management Institute (IWMI).

In the course of the work, 5 supporting soil sections were laid, soil samples were taken by the following horizons-0-5, 5-15, 15-30, 30-50 cm, where the microbiological and enzymatic activity, the "breathing" of the soil were studied. The incisions are based on the number of years of licorice growth: no plant (P-1) control, after the first year (P-2), after the third year (P-3), after the sixth year (P-4), after the tenth year of cultivation (P-5).

The main agronomically important groups of microorganisms are:

- Total number of microorganisms assimilating organic forms of nitrogen (ammonifiers) on meat-peptone agar (MPA).
- Actinomycetes-on starch-ammonia agar (CAA).
- Microscopic fungi, on the environment of Czapek
- Nitrogen fixators-on Ashby's liquid environment.
- Nitrificators - on the liquid environment of Vinogradsky.
- Denitrificators-on Giltay's environment.
- Aerobic cellulose-decomposing microorganisms - on the liquid environment of Omelyansky.

• Oily bacteria on Rushman's liquid environment.

• "Breath" of soil-according to the method of Shtatnov in the modification of Kolesko.

The activity of soil enzymes: the activity of catalase, invertase, peroxidase, polyphenol oxidase, according to the methods of soil enzymology, described by F.Khaziev (1990). The provision of soils with enzymes was determined according to the classification of Zvyagintsev (1978).

RESULTS OF THE RESEARCH

Conditions and factors of soil formation. Characteristics of the main elements of soil fertility.

Syrdarya region is located on a vast piedmont plain, from the south adjacent to the foothills of the Turkestan range. The flat terrain is disturbed by a mildly pronounced deflection going from the southeast towards the sands of the Kyzylkum. The deflection is divided into a number of channel-shaped depressions and depressions, among which the largest are Agachatinskaya, Jetysai-Sardoba and Shuruzyak. The central part of the plain is lined with lacustrine-alluvial-proluvial sediments. The eastern part is composed of loess and alluvial deposits. The plains have a slow natural drainage of groundwater, which, under irrigation, leads to their ascent and strengthening of vertical water exchange. This causes the transition of automorphic soils to semihydromorphic soils, and then to hydromorphic soils and the appearance of secondary soil salinization. The depth of occurrence of groundwater in different parts of the plain is different. On the terrace above the floodplain of the Syr Darya they lie at a depth of 1-2.5 m, in the central parts of the plain - up to 3-4 m, and in depressions their level is slightly higher.

The region is located in the Turan soil-climatic province, in the belt of light gray soils. Here, on the loess plain, light gray soils have been formed for a long time. Over time, due to changes in hydrogeological conditions, most of them were transformed into grey-meadow and meadow soils, often subject to secondary salinization. At present, there are very few light gray soils. The predominant part of the irrigated land fund of the region falls on grey-meadow and meadow soils with small patches of marsh-meadow soils. Some of these soils are gypsum-bearing.

In the region of research of Bayaut district in the association of farms "Galaba" - the major part is occupied by irrigated lands where irrigated grey-meadow, meadow soils predominate, and light gray soils occupy a small area.

According to the degree of soil salinity, they are weakly and moderately saline with highly saline stains. The type of soil salinity is chloride-sulfate. According to the humus content of the soil - low and medium-income.

Microbiological activity of saline irrigated grey-meadow soils in biomelioration using Naked (licorice) – GlycyrrhizaglabraL.

Microorganisms are the main element of the soil-forming process and a necessary link in the cycle of substances in nature. In accordance with climatic conditions, vegetation, physical and chemical properties of the soil, a community of microorganisms is formed, characteristic of this type, the soil subtype.

The essence of soil formation is the accumulation and strengthening of fertility in the primordial relatively infertile breed, which changes under the influence of the colonizing organisms. Since microorganisms are the mandatory and the most active participants in this process, the problem of fertility is legitimately considered as a microbiological problem in a significant sea (Aristovskaya, 1988).

The research of the biological processes taking place in the soil, and the microflora, the main link associated with them, in the knowledge of the laws of soil formation and fertility. In connection with this, the determination of the composition and quantity of the main groups of microorganisms in saline grey-meadow soil and its dynamics in biomelioration using licorice is of theoretical and practical importance.

The groups of microorganisms studied by us are involved in the cycle of nitrogen and

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carbon in the soil, the number of which can characterize the direction of biological processes occurring in the soil.

The cycle of transformations of nitrogen-containing compounds in soil is inextricably linked with the activity of ammonifying microorganisms. Ammonification is the first step in the chain of the nitrogen cycle in nature. Ammoniations are prone to proteins, nucleic acids, urea, chitin and humic substances. The group of ammonifying bacteria is predominant in almost all studied soils and constitute the bulk of soil microorganisms. Therefore, their quantity characterize the activity of the ammonification process in the soil. It should be noted that the content of ammonifying bacteria along the profile in the investigated soils is higher than the content of actinomycetes and fungi. This means that they play a big role in comparison with fungi and actinomycetes in mobilizing nutrients for plants and in the underlying horizons. The high intensity of the ammonification process contributes in turn to the development of nitrifying microorganisms carrying out the last stages of the transformation of organic matter. A significant increase in ammonifying microorganisms in variants of P-4 and P-5 soils (after the 6th and 10th year of licorice cultivation) indicates a much larger quantity of fresh organic matter in these soils (Fig. 1).

The importance of actinomycetes in the life of the soil is enormous and their functions are diverse. They take part in the decomposition of organic substances in the soil, both nitrogen-free and nitrogen-containing. Actinomycetes are involved in the transformation of organic matter that has already undergone destruction, since their more powerful enzyme apparatus allows the splitting of compounds such as lignin, chitin, cellulose and humic compounds, sparingly soluble phosphates, etc. Actinomycetes are considered to be one of the most drought-resistant microorganisms able to develop Account for minor amounts of organic substances.

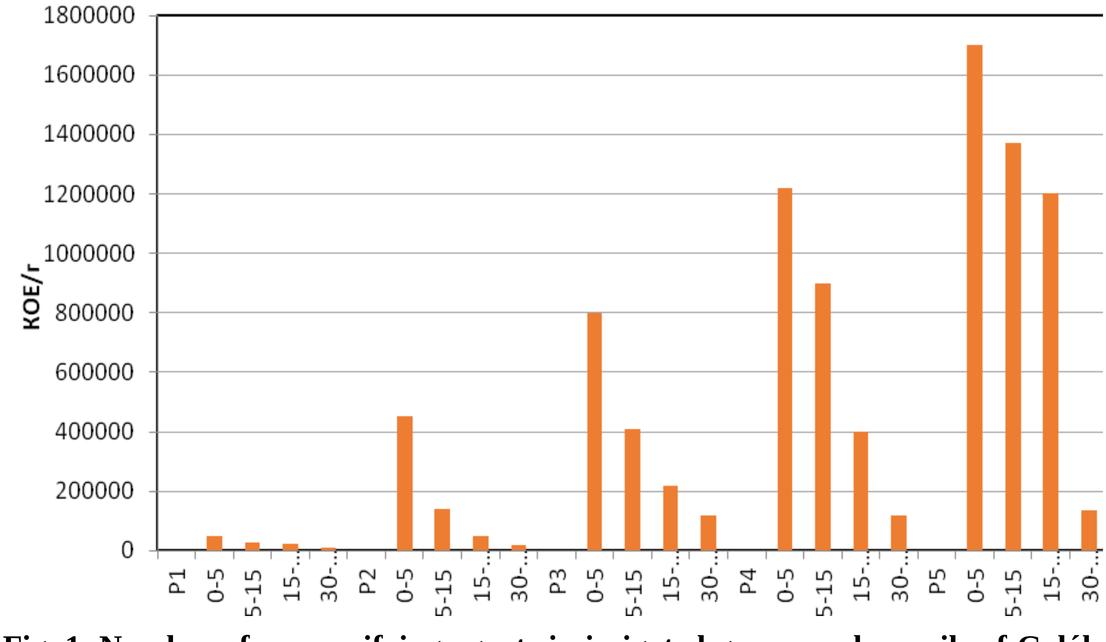

Fig. 1. Number of ammonifying agents in irrigated grey-meadow soils of Galába farm with biomelioration using GlycyrrhizaglabraL.

In the studied soils, the amount of actinomycetes in the upper horizons reaches after the first year of growing licorice 6x104-12x104 and the largest values reach 6x104-36x104 thousand KOE /r by the 6th year (Figure 2).

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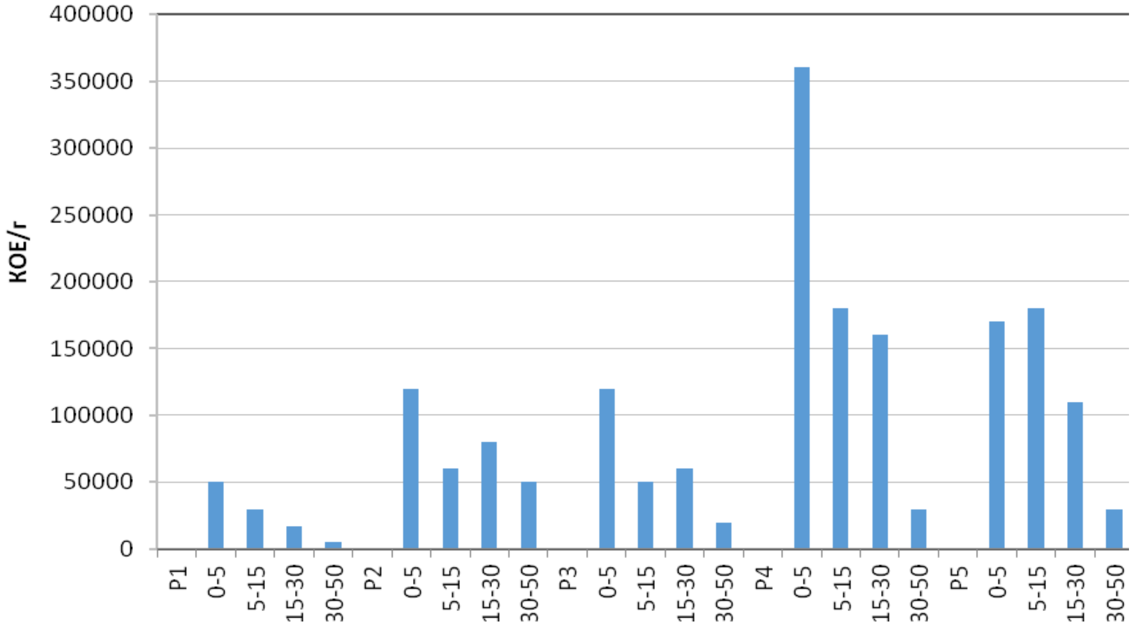

Fig. 2. The number of actinomecites in irrigated grey-meadow soils of Galaba farm's field in biomelioration using GlycyrrhizaglabraL.

A group of actinomycetes of various color colors (white, gray, pink) occupies a significant place in soil samples. Microscopic fungi play an important role in the decomposition of protein compounds, destroy many carbonaceous substances, and some of the fungi mineralize the compounds and even humus. The fungi flora is not very high and make up 3x103-7x103 thousand KOE / g (Figure 3).

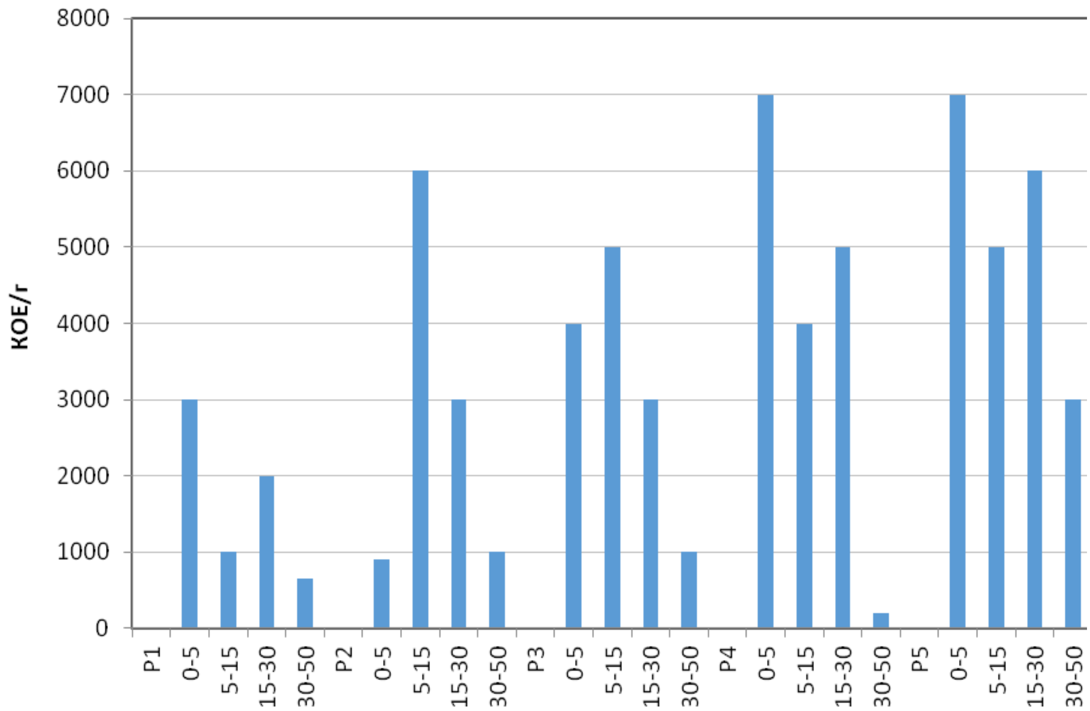

Fig. 3.The number of fungi in irrigated grey-meadow soils of Galába farm with biomelioration using GlycyrrhizaglabraL.

Researches have shown an increase in oligonitrophiles in the soil when growing licorice, where available forms of nitrogen and carbon become the subject of competition of the whole microflora, which should be considered a positive factor in soil formation, since in the biological cycle of nitrogen-containing and carbon compounds, oligonitrophils, assimilating bound C and N and fixing them In the form of microbial plasma, fulfill the ecologically important role of the

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keeper of fertility (Fig. 4). In grey-meadow soils, oligonitrophils form considerable quantities and gradually decrease from the profile of soils from 110x105 to 96x104 in P4, from 360x104 to 108x104 in P-5000 KOE / g.

The most widespread in the rhizosphere soil of the investigated plants are spontaneous bacteria with oligonitrophilic properties that grow on Ashby's environment. Morphological colonies growing on these environment were small, colorless, translucent.

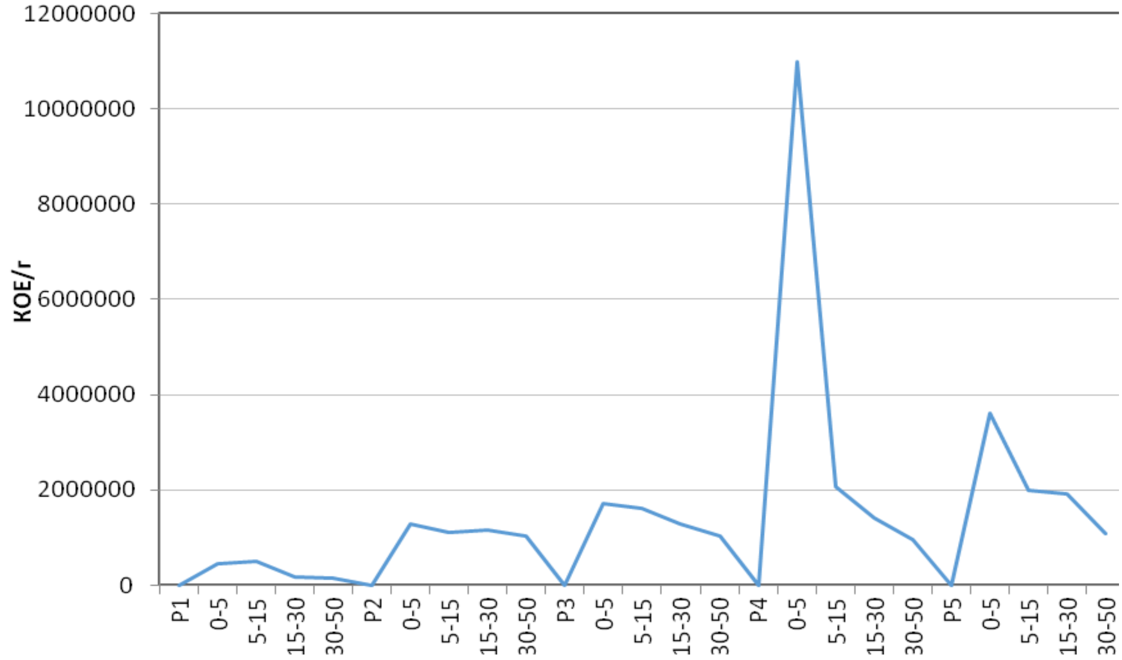

Fig. 4. The number of oligonitrophiles in irrigated grey-meadow soils of Galába farm with biomelioration using GlycyrrhizaglabraL.

Oleaginous bacteria in the initial soil due to salinity and unfavorable properties make up the smallest values from 25x102 to 70x103, and when the licorice grows, the values of these bacteria increase up to 20x 105 -70x105 (P-4, P-5) thousand KOE / g (fig. 5).

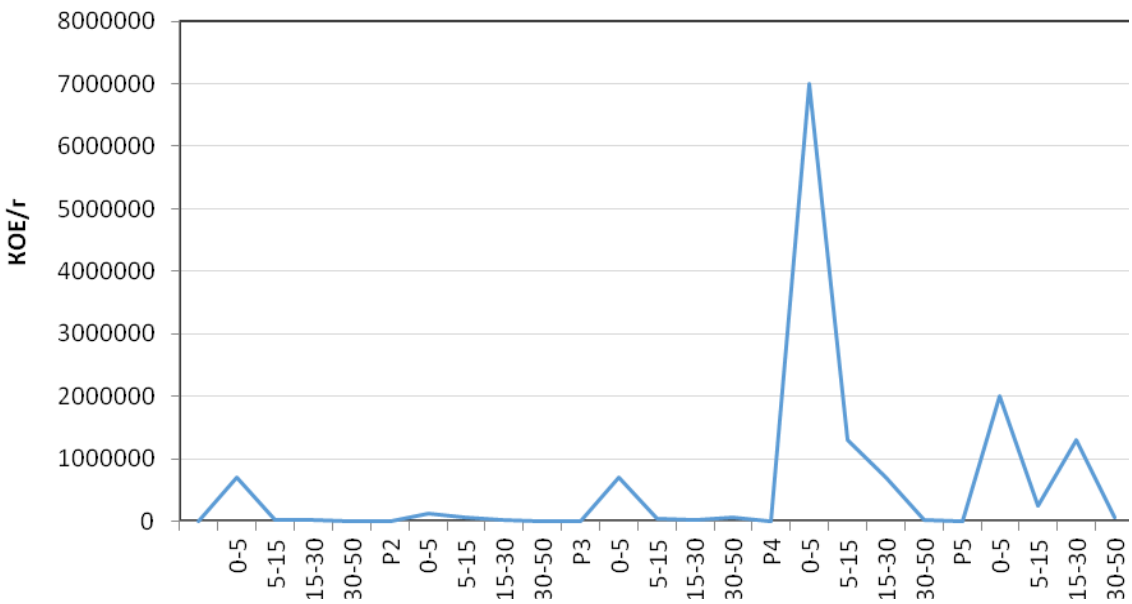

Fig. 5. The number of oil-acid bacteria in irrigated grey-meadow soils of Galába farm with biomelioration using GlycyrrhizaglabraL.

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Similar data were obtained from the change in the soil of the number of denitrifying agents (Fig.6) and nitrifiers (Fig. 7).

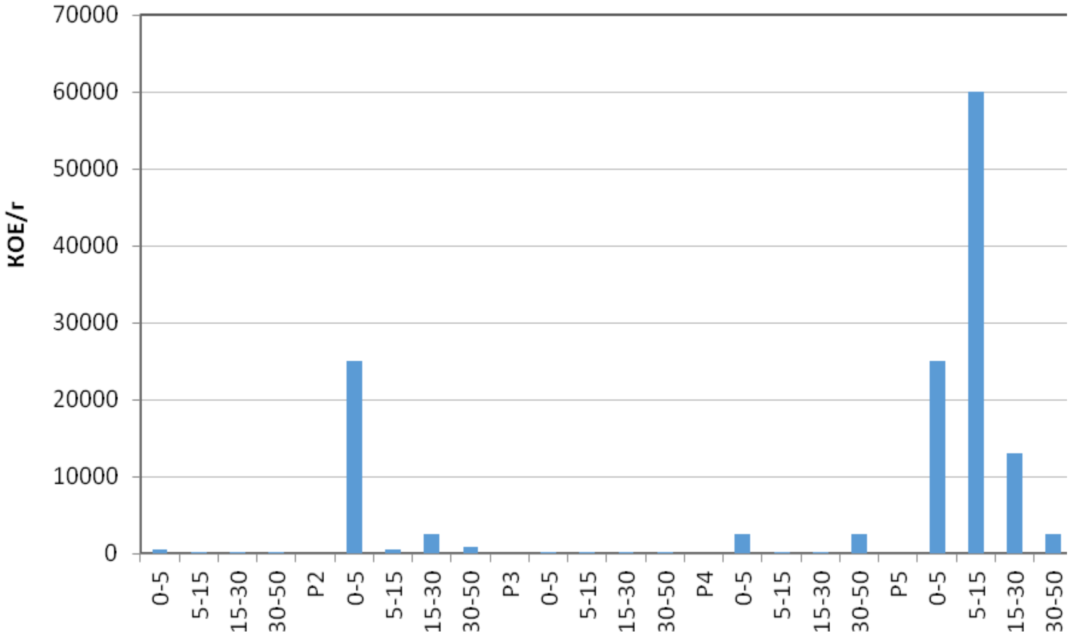

Fig. 6. The number of denitrifiers in irrigated grey-meadow soils of Galába farm's field in biomelioration using GlycyrrhizaglabraL.

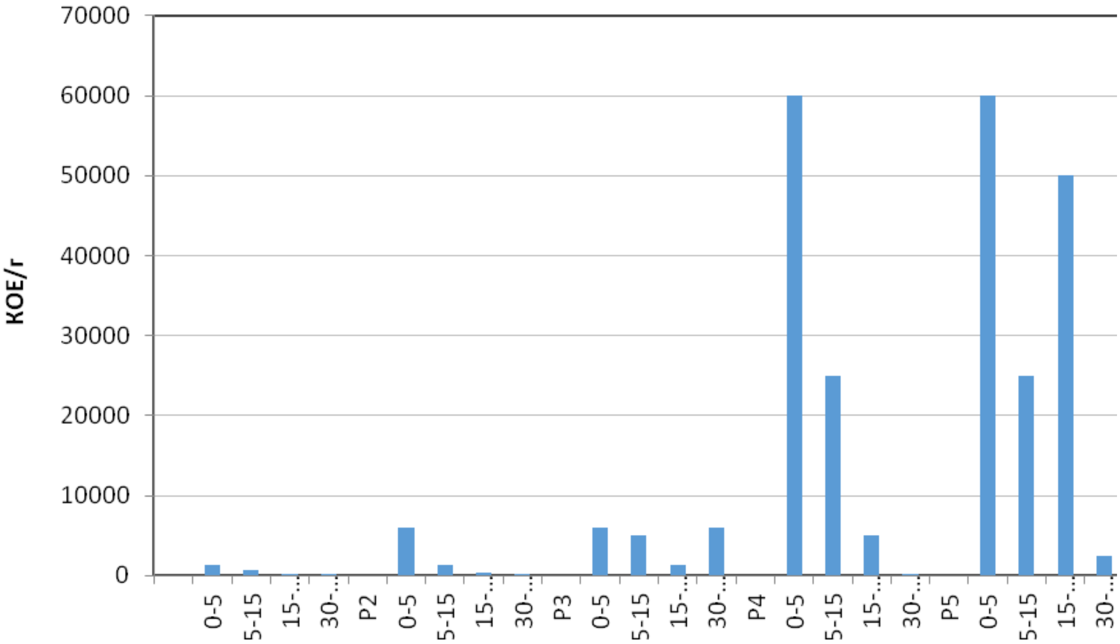

Fig. 7. The number of nitrifiers in irrigated grey-meadow soils of Galaba farm with biomelioration using GlycyrrhizaglabraL.

The results of the determination of the change in the number of microorganisms in the soils of the Galaba farm are shown in Fig. 8.

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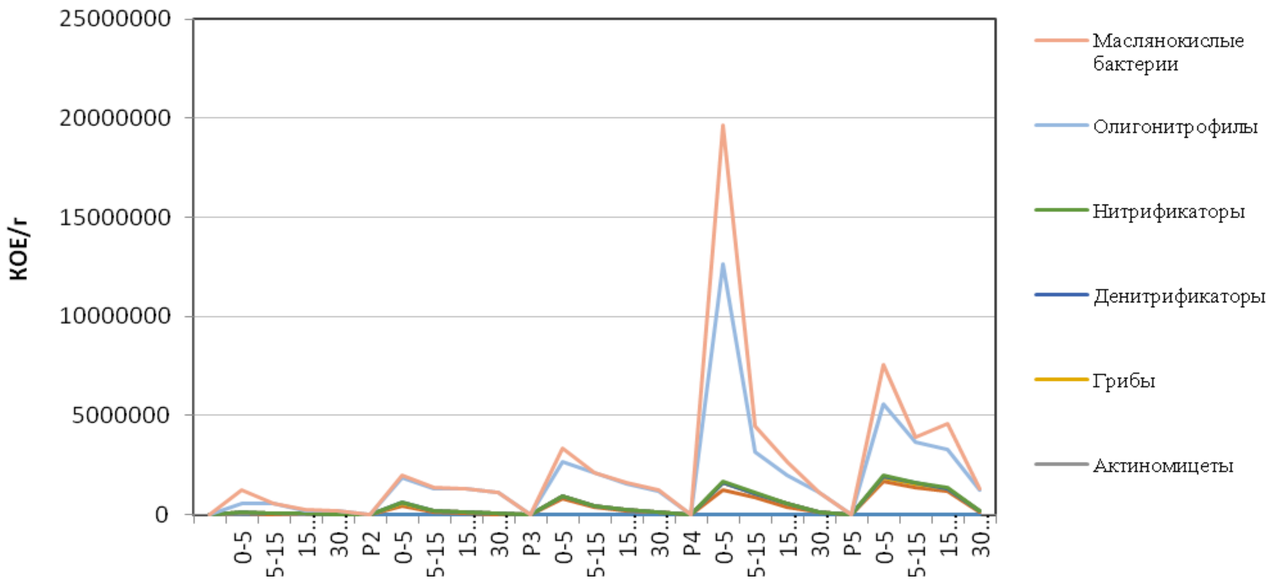

Fig. 8. Quantitative content of microorganisms in irrigated grey-meadow soils of Galaba farm in biomelioration using GlycyrrhizaglabraL. (Thousand KOE / g)

Thus, researches have shown that, among the groups of microorganisms studied, ammonifiers are the most predominant group of the microbial population, followed by actinomycetes and oligonitrophils, followed by oleaginous bacteria, fungi, nitrogen-fixing, nitrifying and denitrifying bacteria, increasing by an order to the variant using the naked (licorice)) Glycyrrhizaglabra L., after the 6th and 10th years of cultivation.

Quantitative changes in the studied groups of microorganisms along the soil profile are observed, which is also related to genetic features. In general, the initial soils are characterized by low values of the number of microorganisms throughout the profile, and the number of microorganisms in these soils drastically decreases with depth, which can be explained by a sharp decrease in humus content, a lack of nutrients, and deterioration of physical properties in the lower horizons of saline soils. Biomelioration using licorice increases the biological activity of soils. The large number of microorganisms growing on MPA indicate the development of the ammonification process, which is ensured by the presence of a larger organic matter. Significant intensity of the ammonification process, in turn, leads to intensive development of nitrifiers, which contributes to the improvement of nitrogen nutrition of plants. This pattern is characteristic of soils where the liquorice was cultivated. Sufficient supply of mineral forms of nitrogen contributes to the further development in them of cellulose-destroying microorganisms and intensive destruction of cellulose, which, in turn, leads to the development of nitrogen-fixing microorganisms.

The influence of the soil-ecological conditions of the investigated territory is also reflected in the development and distribution of actinomycetes and fungi in saline conditions. The results showed that with a low amount of microscopic fungi on saline carbonate grey-meadow soils, the values of actinomycetes increase. This is explained by the fact that as a result of a small amount of precipitation, the process of leaching of salts is hampered, includingcarbonates, which creates a weakly alkaline environment, which requires actinomycetes.

Researches have shown that the number of major agronomically important groups of microorganisms increased after growing licorice, by 6thyear the number of ammonifiers increased from 122 x 104 to 170 x 104 by the 10th year of growing actinomycetes - 36 x 104 and 17 x 104, fungi - 7x103 and 5x103, oligonitrophils - 110x105 and 360x104, oil bacteria - 70x105 and 20x105, respectively. The obtained data on the number of microorganisms show that the

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cultivation of the naked shell (licorice) –GlycyrrhizaglabraL.-improves soil fertility.

3. The enzymatic activity of grey-meadow soil and the influence on them of biomelioration using licorice

In the increase of soil fertility an important role belongs to the biochemical processes that continuously flow in the soils. Biologically active substances indicate the flow in the soil of a variety of processes, the study of the variety and nature of which will allow us to better understand the activity of microorganisms and enzymes in the soil and their role in increasing fertility.

Soil "as a biochemical system" or as a system of immobilized enzymes forms and functions as a single whole with coordinated and directed biochemical processes. Being powerful catalysts, enzymes ensure the successful implementation of the "soil-microorganisms" system and its main function, the destruction of the primary organic matter and the synthesis of the secondary, the enrichment of the soil with nutrients and humus.

Enzymatic activity is a sensitive indicator of the biological state of soils, and is widely used in solving diagnostic and indication issues of soil science, it characterizes the intensity of biochemical processes and can serve as an additional diagnostic indicator of the level of soil fertility. The enzymatic activity of soils depends on the effect and interaction of soil formation factors and is due to the fact that each soil, in connection with its genesis, composition, external conditions and the influence of agrotechnical and meliorative measures, is characterized by the intensity of biological processes, in connection with which the study of the evolution of enzymatic activity of soils will contribute to knowledge essence of processes of soil formation, degradation or sustainable reproduction of soil fertility.

Catalase is one of the most stable common enzymes in nature and to a certain extent can characterize the state of the soil. This enzyme is an indicator of the degree of development of oxidative processes and plays an auxiliary role in oxidative exchange reactions, decomposing the hydrogen peroxide poisonous for a living cell, formed by oxidation of carbohydrates, proteins and fats with flavoprotein enzymes.

Scientists have shown that catalase activity in soil depends on the content of microorganisms. The results of our studies showed that the greatest catalase activity in the initial meadow-grey (R.1) soil was observed in the upper horizons (10.7-13.2 ml 0.1 N KMnO4 / 2.5 h), ie in the most biologically active layers And sharply decreases to the lower layers of the soil (5.4-5.8 $KMnO_4$/2.5h). In the soil with licorice after third year of cultivation (Fig. 9), the indicator increases (to 13.4-17.3 $KMnO_4$/2.5h), reaching its highest values after 6th year (22.1-28.9 $KMnO_4$/2,5h), slightly decreases after 10 years of cultivation (19.8-21.5 $KMnO_4$/2.5h). The indicators of catalase activity correlate with the value of microbiological activity and soil respiration. According to the variants of the experiment, according to the activity of soil catalase, P-4> P-5> P-3> P-2> P-1.

Researches have shown that irrigated grey-meadow soils are characterized by low invertase activity (Fig. 10). In the upper horizons of the studied soils, before the beginning of licorice cultivation, 0, 5208-1.375 ml of glucose per gram of soil in 24 hours. After the beginning of the experiment, after the first year of cultivation, the invertase values changed insignificantly. After the sixth year, invertase activity increased and amounted to 2.4479-3.4896 ml, and in soil 10 years of cultivation of licorice -1.3542-2.6563 ml of glucose per gram of soil for 24 hours.

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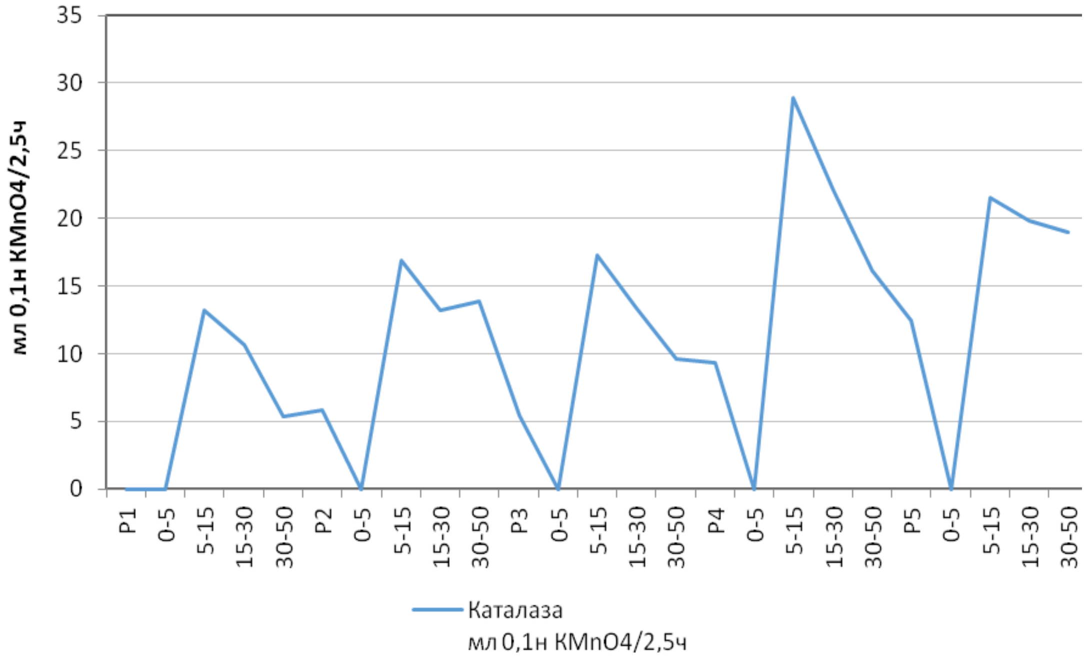

Fig. 9. Catalytic activity of irrigated grey-meadow soils of Syrdarya region (Galaba farm of Baiyat district) with biomelioration using GlycyrrhizaglabraL.

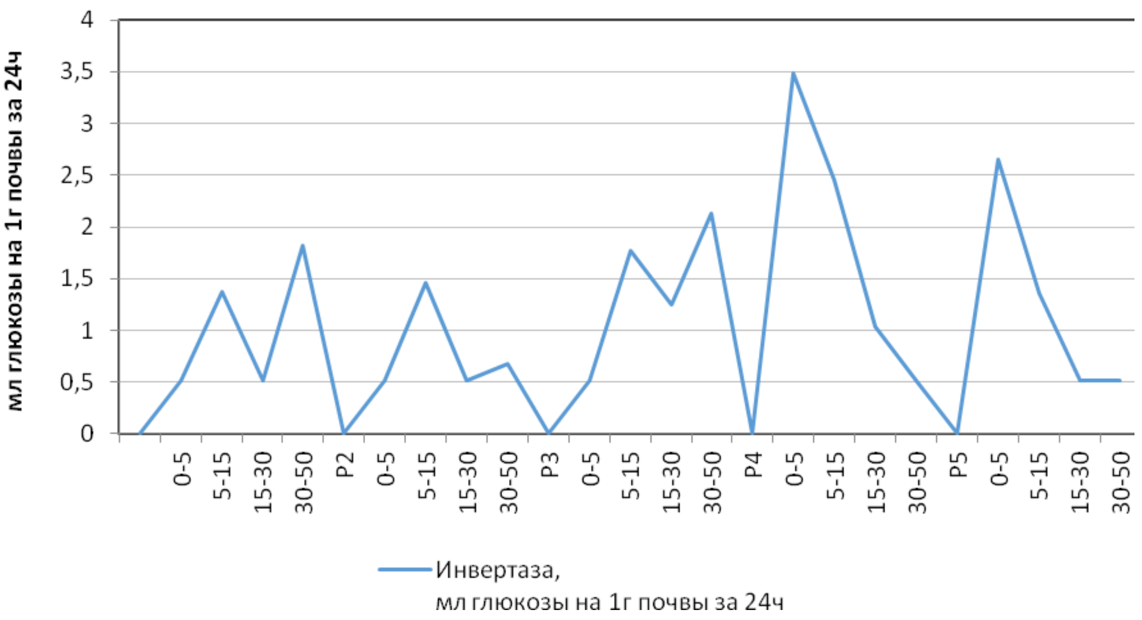

Fig. 10. The activity of peroxides of irrigated sulphurrated land-meadow soils of Syr Darya region (farming association Galaba of Bayaut district) in bio-melioration by using GlycyrrhizaglabraL.

Enzymes peroxidase and polyphenol oxidase are among the soil phenoloxidases that participate in the reactions of transformation of organic and inorganic substances in soils. They play a key role in the processes of humification, have a protective effect on the soil, decompose various xenobiotics, participate in the decomposition and synthesis of organic compounds of the aromatic series. Polyphenol oxidase and peroxidase can serve as indicators of the intensity of humification processes in the soil.

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Studies have shown that the highest peroxides and polyphenol oxidize activity is determined in the investigated soils after 6 years with growing licorice and reaches 5.4-6.8 mg of purpurgaline per 100 g of soil in the upper layers in 24 hours and sharply decreases to the lower layers to 1, 9-2,6 and in the variant after 10 years of cultivation the peroxides values are slightly less than -5,4-5,9 in the upper and to the lower layers make 1,9-27, respectively (Fig. 26). In the variant after the first year of cultivation of licorice, the peroxides values were the lowest, almost equal, as in the initial soil of 1.9-3.3 and 1.9-2.4 mg of purpurgaline per 100 g of soil in 24 hours. The data show that the polyphenol oxidize The activity in the initial soil is 2.1-2.5, in soils after the first year of licorice cultivation - 2.1-3.5, after the third year - 4.1-5.1 after the sixth year-5.7-7, 9, after 10 years 5.1-6.3 mg of purpurgallin per 100 g of soil for 24 hours (Fig.11).

Fig. 10. The activity of peroxides of irrigated sulphurrated land-meadow soils of Syr Darya region (farming association Galaba of Bayaut district) in bio-melioration by using GlycyrrhizaglabraL.

By the ratio of polyphenol oxidize and peroxides, one can conditionally judge the humification coefficient. The determination of the conditional coefficient of humification showed that an increase in the activity of polyphenol oxidize, responsible for the synthesis of humus in the soil, led to an increase in the humification coefficient, and an increase in peroxides activity promoting the decomposition of humus in the soil led to a reduction in the experiment. The data show that the value of the humification coefficient in all the investigated soils varies between 0.7 and 1.3.

Thus, in saline sulphurrated land-meadow soils, the activity of enzymes (catalyses, invertysis, peroxides, polyphenol oxidize) increases in accordance with the increase in the total microbiological activity and respiration of the soil. The greatest activity of enzymes is manifested in the upper layer of the soil, and in the lower ones there is a sharp decrease, especially in varieties without licorice and after the first year of cultivation.

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Fig. 11. Activity of polyphenol oxidize of irrigated sulphurrated land-meadow soils in bio-melioration by using Glycyrrhizaglabra L.

Under the influence of growing licorice - 6 and 10 years, soil properties improve - the soil is enriched with organic matter, the surface of the soil is obscured, the humidity is maintained, humification takes place, the soil gradually desalinizes and the level of mineralized groundwater decreases, micro-aggregation, water and physical properties, microbiological And enzymatic activity, the respiration of the soil improves - there is a steady restoration and reproduction of soil fertility.

4. Intensity of respiration of irrigated sulphurrated land-meadow soil in bio-melioration by using licorice.

The intensity of carbon dioxide production from the soil - "breathing" -is an indicator of biological activity. Breathing is a vital process of the soil, in which oxygen comes from the atmosphere and as a result of the complex oxidative decomposition of organic substances carbon dioxide is released, which is an important source of carbon supply to plants. The production of CO 2 cm of the soil surface in the atmosphere is the result of conjugate processes, where the biological factors play a decisive role. The study of soil respiration makes it possible to characterize the activity of biological processes of soils, being one of its indicators. The characteristics of the biological features of soils, and in particular of the "breath" of the soil, can give the most rapid information about the nature of the change in the soil regime.

The production of carbon dioxide by soil, along with indicators of the amount of micro flora, enzymatic activity, reflects the actual biological activity of the soil, i.e. potential soil fertility. Scientists believe that the production of carbon dioxide by soil is a good indicator of the activity of microorganisms in the soil and can be used as an indicator of fertility. Currently, the approach is adopted that, in assessing the overall biological activity and soil fertility, it is necessary to determine along with the micro flora and enzymes, and the intensity of respiration. In connection with this formulation of the issue, we studied the respiration rate of saline irrigated sulphurrated land-meadow soil and its changes in bio melioration by using licorice naked (after 1 year, after 3 years, 6 years, 10 years of cultivation) (Fig. 12).

Scientists have discovered that agrochemical, physical, physical and chemical properties affect the soil's respiration. Studies have shown that under saline sulphurrated-meadow soils soil respiration is influenced by indicators of ammonifiers, fungi, actinomycetes, activity of catalyses, invertasys, peroxides, polyphenol oxidize. Studies have shown that soil respiration is most pronounced in the upper (0-15 cm) soil layer -14.3-19.8 mg CO_2 in 100 g soil.

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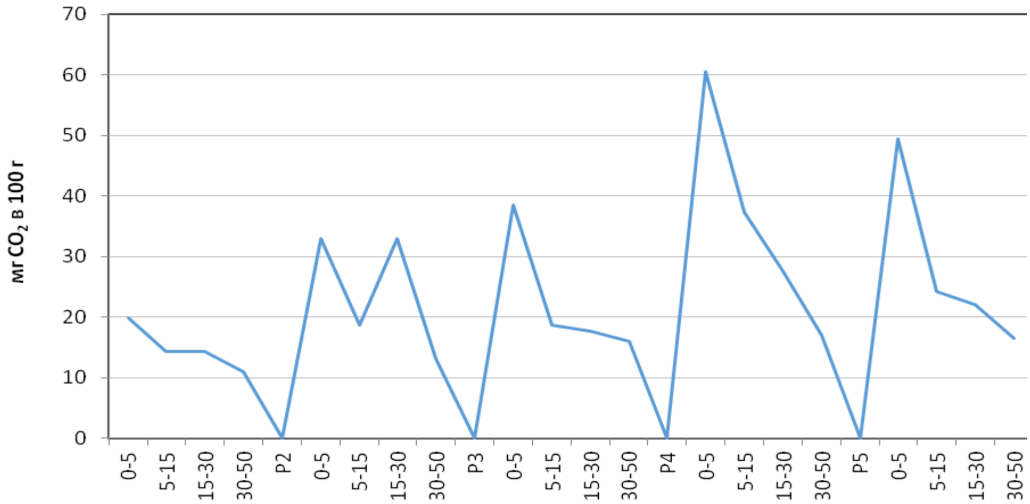

Fig. 12. Intensity of "respiration" of irrigated sulphurrated-meadow soils during bio-melioration by using Glycyrrhizaglabra L.

When growing licorice, the respiration values of the studied soils change in the following law dimensionality: after the first year of cultivation in the layer (0-15cm) -18.7-33; After the third year of cultivation, 18.7-38.5; After the sixth year, 37.4-60.5; After the tenth year of cultivation of licorice - 24.2-49.5 mg of CO_2 in 100 g of soil. The results of the studies show that the highest indices were found in the soil after the sixth year of licorice cultivation, and after the tenth year the respiration of the soil is characterized by somewhat smaller values, which correlates with the number of microorganisms and the activity of the enzymes. By the intensity of soil respiration by years (variants), the study can be located in the next decreasing series: the soil after 6 years of growing licorice-after 10 years of cultivation-after 3 years of cultivation-after 1 year of growing licorice (Figure 13). Because intensity of soil respiration is an objective indicator of soil fertility and the effectiveness of various agricultural techniques, it can be concluded that the values of soil respiration are a bio-indicator of increasing the soil fertility level in bio-melioration by using licorice, especially after the 6th year of cultivation.

Thus, the study of carbon dioxide production in sulphurrated-meadow soils indicates a regular dependence of the release of carbon dioxide from the number of microorganisms, the content of organic matter, enzymatic activity, the effectiveness of agricultural practices and the level of soil fertility.

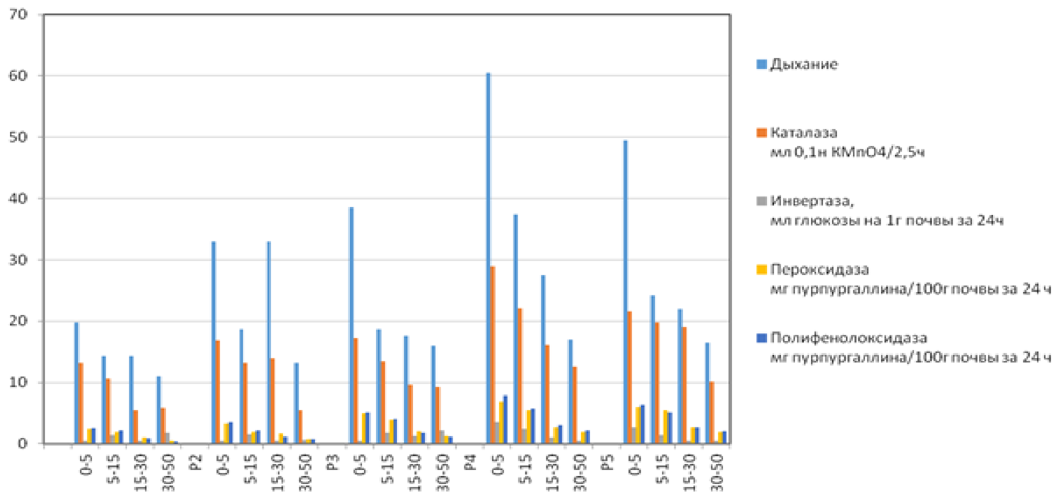

Fig. 13. Fermentative activity and respiration of irrigated sulphurrated-meadow soils in bio-melioration by using GlycyrrhizaglabraL.)

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Biological diagnostics of the level fertility of saline sulphurrated-meadow soils in bio-melioration with the use of Glycyrrhizaglabra L. licorice.

In order to assess and diagnose the soil fertility level, microbiological and biochemical diagnostic methods were used. For bio-diagnostics of the soil and the processes occurring in it, we determine the actual biological activity (BA). For a more objective and reliable assessment of the BA of sulphurrated-meadow soils, a set of the most informative indices of BA soil was determined, reflecting different parameters of the biological state, such as the activity of catalyses, polyphenol oxidize, peroxides, the intensity of soil respiration, the number of major groups of microorganisms-ammonifiers, actinomycetes, fungi.

At the same time, the largest value of each indicator was taken as 100 and the other indicators were calculated with respect to it. The relative indicators were summarized and the result was expressed as a percentage of the largest of the received sums. This method made it possible to evaluate the total BA of each variant and carry out a complex-comparative analysis under conditions of arid soil formation and characterize the degree of influence of the basic soil properties, salinization processes on the biological activity of soils. The results of the research showed that the soil with a licorice growth of 6 years, further 10 and 3 years, has the highest BA value (Table 1, Table 2). The provided regularity is determined primarily by the change in the content of humus in the soil and the length of the licorice growing period.

Thus, it can be stated that a comprehensive study of BA saline soils makes it possible to disclose their ecological and genetic characteristics, that is, the total BA of soils depends not only on the specific properties of the soil, but is interrelated and interdependent with the surrounding systems and processes. It is also possible to ascertain the effect of bio-melioration stages on the level of soil fertility and its reproduction.

Table 1. The most informative indicators of B A of sulphurrated-meadow soils of Syr Darya region (farming association Galaba of Bayaut district)

Section	Catalysis, ml O_2	Invertasys of ml glucose per 1 g soil for 24h	Peroxides of Mg purpurgaline / 100 g soil for 24 h	Polyphenol-sidase of Mg purpurgalline / 100 g soil for 24 h	Ammonifying agents	Fungus	Actinomycetes	Oil-acid bacteria	Breathing Mg of CO2 in 100 g
						thousand/haof soil			
Control									
1	23,9	1,8958	4,3	4,6	76×10^3	3×10^3	8×10^4	83×10^3	24,1
After 1 year of Cultivation									
2	30,1	1,9793	5,2	5,6	59×10^4	$6,9 \times 10^3$	18×10^4	19×10^4	51,7
After 3 year of Cultivation									
3	30,7	2,2916	8,9	9,2	121×10^4	9×10^3	17×10^4	75×10^4	57,2
After 6 year of Cultivation									
4	51,0	5,9375	12,2	13,6	212×10^4	11×10^3	54×10^4	83×10^5	97,9

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After 10 year of Cultivation									
5	41,3	4,0105	11,3	11,4	307 $x10^4$	12 $x10^3$	36 $x10^4$	22,5 $x10^5$	73,7

Table 2. The total relative biological activity (BA) of sulphurrated-meadow soils of Syrdarya region (farming association Galaba of Bayaut district)

Section	Catalysis, ml O_2	Invertasys of ml glucose per 1 g soil for 24h	Peroxides of Mg purpurgaline / 100 g soil for 24 h	Polyphenol-sidase of Mg purpurgalline / 100 g soil for 24 h	Ammonifying agents	Fungus	Actinomycetes	Oil-acid bacteria	Breathing Mg of CO2 in 100 g	BA, %
						thousand/ha of soil				
Control										
1	46,8	31,8	35,2	33,8	2,47	25	14,8	1	24,8	23,9
After 1 year of Cultivation										
2	59	33,3	42,6	41,1	19,2	57,5	33,3	2,3	52,8	37,9
After 3 year of Cultivation										
3	60,1	38,5	72,9	67,6	39,4	75	31,5	9,1	58,4	50,2
After 6 year of Cultivation										
4	100	100	100	100	69,0	91	100	100	100	95,5
After 10 year of Cultivation										
5	80,9	67,5	92,6	83,8	100	100	66,6	27,1	75,2	77,1

Conclusions

1. Gray-earth meadow soils are formed in arid climatic conditions, with a slow natural outflow of mineralized groundwater, sparse vegetation, which are reflected in the direction of soil formation processes and the properties of soils (morphogenetic, physical, chemical, biological).

2. Among the groups of microorganisms studied, ammonifying agents are the most predominant group of the microbial population, followed by actinomycetes, oligonitrophils, oleaginous bacteria, fungi. The number of microorganisms reaches the maximum values for bio-melioration by using the Licorice naked (licorice) - GlycyrrhizaglabraL. - after 6th and 10th years of cultivation, then after the 3rd year and the 1st year of growing licorice.

3. Enzymatic activity (catalyses, invertasys, peroxides, polyphenol oxidize) and respiration of the studied soils in accordance with microbiological activity increases by the 6th year of cultivation of licorice.

4. Glycyrrhizaglabra L. licorice has a high medium-forming and medium-optimizing function and thanks to this it enriches the soil with organic matter, improves physical and chemical properties, increases the biological activity of the soil and creates the basis for sustainable reproduction of the fertility of degraded grey earth-meadow soils.

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