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HALOACCUMULATIVE PROPERTIES OF PLANTS

[1]Guljakhon Kamalovna Mirsharipova, [2]Davron Mamatqulovich Mustafaqulov, [3]Laziza Amirovna Botirova, [4]Bakhriddin Ilashovich Kushbakov, [5]Botir Sadriddinovich Kasimov

[1]Associate Professor of Soil Science, Gulistan State University, candidate of agricultural sciences, тел. +998915055072, e-mail: m.guljahon @mail.ru;
[2]Tashkent State Agrarian University, Independent Researcher, Department of Soybeans and Oilseeds, тел. +998935102684, e-mail: davr2484@mail.ru
[3]Gulistan State University, Associate Professor of General Biology, Candidate of Biological Sciences, тел. +998994723174, e-mail: botirova.laziza@mail.ru;
*4*Researcher of the Department of Chemistry, Gulistan State University, tel. +998979058606
[5]Tashkent State Agrarian University, Assistant Professor of Agrochemistry and Soil Science, tel. +998977151700, e-mail: bks.kasimov@mail.ru

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Abstract
Nowadays, the search for saline soils and opportunities for their efficient use is one of the most pressing issues in agriculture. One of the positive solutions to these problems is the selection of plant species and varieties with high and high yield in saline soil conditions, the study of their salt resistance and improvement of cultivation technology.This article provides information on salt tolerance and salt accumulation characteristics of members of the Fabaceae and Asreraceae families, which were studied in order to select salt-tolerant, productive and promising forage species and varieties from the local flora and introducers in saline soil conditions. As a result of our research, the increase in galloaccumulative capacity of the studied plants is as follows: Guizotia abissinica <Crotallaria alata <Melilotus officinalis (medicinal melilot) <Onobrychis transcaucasica <Melilotus albus (white melilot) <Galega officinalis < Vicia angistifolia< Medicago sativa (control)>salinity index Vicia angistifolia>Melilotus albus> Galega officinalis>Onobrychis transcaucasica> Melilotus officinalis> Guizotia abissinica (Asreraceae family)> Crotallaria alata was defined as descending for the first time. Among all the species studied on the basis of halloaccumulative indicators of plants, it was noted that Vicia angistifolia is the most resistant species to saline soils.The results of the obtained chemical analysis show that the use of Melilotus albus, Medicago sativa and Vicia angistifolia in phytomelioration works is expedient, depending on the halo accumulative capacity of plants and the amount of chloride ions in them. In addition, the selected forage plants have the ability to retain their salt-resistance properties in other soil conditions, which indicates that their salt-resistance is a stable-genetic trait.
Keywords: phytomelioration, growth-development, haloaccumulation, salt tolerance, forage crops, legumes, Medicago sativa (local), Onobrychis transcaucasica, Crotallaria alata, Vicia angistifolia, Galega officinalis, Melilotus albus. and Melilotus officinalis (L.) Pall., Guizotia abissinica, mineral salt elements, HCO^{-3}, Cl^{-}, SO_4^{-2}, Na^{+}, K^{+}, Ca^{+2}, Mg^{+2} ions.

I. INTRODUCTION

Livestock plays an important role in meeting the food needs of the population of the country. To do this, it is necessary to strengthen the fodder base by selecting and introducing high-quality fodder crops in saline soils.In recent years, due to the limited rotation of crop rotation in agriculture, the reduction of forage crops in irrigated lands, their yields have sharply decreased. Therefore, it is important to use irrigated lands efficiently and provide livestock with nutritious fodder.

The 3.3part of the Decree of the President of the Republic of Uzbekistan dated February 7, 2017 No PF-4947 “On the Action Strategy for further development of the Republic of Uzbekistan”, in the section “Modernization and accelerated development of agriculture” addresses issues such as further strengthening the country's food security, expanding the production of environmentally friendly products, creating a fodder base for livestock, expanding the area under forage crops, increasing fodder production, providing livestock with quality feed [1].In carrying out the work outlined in this strategy, the Order of the Agency for Science and Technology No. 43 of July 10, 2017 on "Cultivation of plants resistant to saline soils in Syrdarya region" pays special attention to the selection of saline plants and increasing soil fertility in Sidarya region.

To perform these tasks, it is firstly necessary to study the salt resistance and salt accumulation properties of food crops under certain soil-climatic conditions. This is because more than 60% of irrigated lands in the country and more than 90% in the Syrdarya region are saline to varying degrees.

The study of these issues will increase the productivity and efficient use of saline soils using plant resources, increase agricultural production and improve the quality of animal feed.

It is known that there are two ways to increase the productivity of agricultural crops and the volume of high-quality products: to increase the yield of traditional plants under the influence of combined factors and to adapt new species and varieties of plants to local soil-climatic conditions. At present, in order to create a fodder base for livestock, a number of non-traditional crops with high yields are being introduced into the arable lands of the republic. These plants may play an important role in the future in the national economy of our country, including beekeeping and the strengthening of the fodder base of livestock, as well as in the implementation of phytomelioration works on uncultivated and infertile lands.

Based on the above considerations, it is expedient to select promising salt-tolerant forage plants from introducers and natural flora in Syrdarya region, to study their eco-biological and salt accumulation properties in different saline soils, as well as to determine their chemical composition.

In the second half of the last century, researchers of the Institute of Botany of the Academy of Sciences of Uzbekistan were engaged in biomelioration of saline soils of the Syrdarya region. Their research is mainly focused on studying the biology of the licorice plant. In recent years, B. Tukhtaev (2009) was engaged in the introduction of medicinal plants in the Syrdarya region. B. Adilov (2010) studied the morphology and halo accumulation of some dominant species.

The role of legumes in the phytomelioration of saline soils is great. The reason is that legumes are not only fodder plants with high nutritional value, but also have practical importance in improving soil structure with the presence of nitrogen-fixing bacteria in their roots.

Numerous studies on the study of plant halo accumulation have been devoted to the study of the salt accumulation properties of plants and species in plant communities under different environmental conditions. In particular, preliminary data on the amount and composition of salts in plants were obtained from M.M. Shukevich [26;pp 39-80],this can be seen in the research. The author was one of the first to highlight the comparative differences in the halo accumulation of plants in saline, sandy, barren soils and to determine the localization of HCO^{-3}, Cl^{-}, SO_4^{-2}, Ca^{+2}, Mg^{+2}, Na^{+}, K^{+} ions in the upper and lower parts of plants. The scientist's conclusions about the adaptation of plants to saline environments are noteworthy. He argues that plant cells that are adapted to a saline environment must have a high salt-accumulating volume or, if not, the ability to somehow release salts from their bodies into the external environment in order to adapt. In addition, the scientist's work contains information about the accumulation of different amounts of salts in different organs of plants, the structural differences of salts in their surface and bottom, and the amount of salts in plants depends on their selectivity. Subsequent studies such as B.A. Keller [14; 190-p 215], N.I. Akjigitova [3; p 189], T.A. Glagoleva [8; pp1080-1088], X.K. Matjanova [20; p18], and others.

B.A. Keller [14; 190-215 b] by studying the salt accumulation properties of plant communities, emphasizes that plant groups in a given environment selectively select salt ions and that their accumulation varies. For example, the ratio of Cl - SO-24 ions in the dry mass of Atriplex (Atriplex verruciferum), algae (Alhagi camelorum) and statis (Statice tametilla) in the Atriplex verruciferum community varies. In particular, while the chlorine ion (11.57%) in the dry mass of the atriplex in this community is superior to the sulfate ions (3.21%), in the statistic this is the opposite, i.e. sulfate ions (4.36%) are more abundant than chlorine ions (1.64%), on the other hand, the Cl - SO-24 ratio was almost equal (0.88-0.71%). This indicates that plants have an evolutionarily well-established system that homeostatically maintains the ionic potential of the cell.

N.I. Akjigitova [3; p189], in a study of the salt accumulation properties of halophilic plants in Central Asia, concludes that the degree of accumulation of plant groups varies. According to her, hypergalophytes have the ability to accumulate large amounts of salt (38.9% - Halostachys caspica), eugalophytes in moderate amounts (25.6% - Suaeda paradoxa) and crinohalophytes in small amounts (18.05% - Limonium gemelini).

T.A. Glagoleva and others [8;pp 1080-1088] studied differences in the salinity properties of eugalophytes among species belonging to the NADF-ME-S4, NAD-ME-S4, and S3 groups. According to their data, halophytes belonging to the succulent type and growing in very saline soils belong to the NAD-ME-S4 and S3-groups, their osmotic pressure is high and Na + in leaf tissue (0.28-0.97 mg.eq / 100 g by mass) ions predominate over K + ions

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(0.05-0.08 mg.eq / 100 g of mass). In the NADF-ME-S4 group of plants, on the other hand, the osmotic pressure is relatively low, with K + (0.16-0.20 mg.eq / 100 g by mass) ions Na + (0.02-0.04 mg. eq/100 g relative to the mass) ions.

T.A. Glagoleva and others [8; pp 1080-1088] show that even among the halophytes belonging to the same group (eugalophytes) there are mutual differences in the distribution of ions.

X.K. Matjanova [20; p18], taking into account the low and high levels of salt accumulation of plants, classified them into 3 groups according to their halo accumulative properties: 1) low salt accumulators - salt accumulates up to 5% of the dry mass; 2) moderate salt collectors - collect salt up to 5-15% of the dry mass; 3) large salt collectors - those who accumulate more than 16% of salt in their tissues. The author again divides the salts in plants into groups such as carbonatophilic, sulfatophilic, chloridophilic according to their structural properties.

Although the research conducted by M.M. Shukevich, B.A. Keller, N.I. Akjigitova, T.A. Glagoleva, X.K. Matjanova is a classic work in the study of salt accumulation properties of plants, their research does not fully show the halo-accumulative properties of plants growing in saline environments.

For example, M.M. Shukevich [26; pp39-80], although he drew noteworthy conclusions in his work, the scientist analyzed the amount and composition of salts in halophytes not in the roots, stems and leaves of plants, but in the vegetative organs in two parts - the surface and the bottom. This does not fully reflect the localization of harmful ions in plant organs. B.A. Keller [14; pp190-215] in his works shows that the salt accumulation of plants is relative only to salt anions, N.I. Akjigitova [3; p189], T.A. Glagoleva and others [8; pp 1080-1088], X.K. Matjanova [20; p18] in theirs show the analysis of the quantitative and compositional salts of salts in plant groups relative to their leaves prevents them from drawing definite conclusions about the salt accumulation properties of halophyte plants.

Differences in the accumulation and localization of salt ions between salt-tolerant and non-salt-tolerant plant groups were observed in L.P. Lapina, Edith L Teleisnic, A. Wallase, M.A. Harivandi is reflected in the Matoh Torular data.

For example, L.P. Lapina et al [20;p 18], there are mutual differences in the accumulation of chloride ions in salt-tolerant and non-salt-tolerant plant organs. In particular, chlorine ions accumulate in the body of the salt-resistant bean plant (Phaseolus vulgaris L.) in the form of root> leaf> stem>. In a moderately salt-tolerant sunflower (Helianthus annuus L.), chlorine ions accumulated in the form of leaf> root> stem in weak salinity, while in a strong background, the plant accumulated chlorine ion in its body in the form of stem> root> leaf. In annual hawthorn (Salicornia europae L.) and perennial cochlea (Kochia amiricana Wats.), chloride ions accumulate mainly in their leaves and young twigs, and the amount of chloride ion in their stems and roots is much lower.

Edith L Telesnic [34; p221-228],according to her research, under saline conditions, both groups accumulated less sodium sodium than the halophyte species at the base of the glycophyte species, with no difference in the absorption and transport of Na + ions to the plant. The author explains this situation by the fact that the recirculation in glycophytes is faster than in halophytes.

A. Wallase [35; pp 65-68] The Galenia pubescens plant was planted and propagated at a concentration of 400 m-eq / l of NaCl and Na_2SO_4, and Na^+ ions in its leaves, stems and roots increased by 4.86%, 3.80%, 0.83%, respectively. - 3.70%, 4.32%, 1.09%.

M.A. Harivandi and others [31; pp 507-517] Puccinella distans, P. Lemon plants were irrigated in seawater on sandy and swampy soils. According to them, as the amount of salts in the soil increases and the plant grows, the amount of Na +, Cl- ions in their surface organs also increases.

Matoh Toru et al [33; pp 451-459] crinogalophyte Atriplex gmelin plant was grown at different concentrations of NaCl, Na_2SO_4, KCl, K_2SO_4 salts and found that although sodium and potassium are both monovalent alkaline ions, their accumulation in halophytes is always different. Although the research of these scientists is devoted to the accumulation and localization of harmful ions in the halophyte organs in different saline environments, they first draw conclusions about the absorption and distribution properties of certain harmful salt ions (Cl^-, Na^+) in plant organs. However, in addition to harmful Cl^-, Na^+ salt ions, there are Ca^{+2}, Mg^{+2}, SO_4^{-2} ions, it is important to study the localization of these ions in plant organs.

Recent research requires the study of the absorption properties of salts harmful to plants at the cellular and molecular level. Such work can be seen in research conducted by many scientists.

In particular, E.B. Kurkova and others [15; pp 32-39], studied the accumulation of Na^+, Cl^- ions in the leaf of the salt-tolerant species Petrosimonia triandra, proving that these ions accumulate in the cell vacuole by "free-floating" pinocytosis intussusception and multivezicle formation.

L.Ya. Pagis and others [22;pp 334-340], T.G. Leonova and others [17; pp 876-881], P.V. Ershov and others [11; pp 867-875], R.V. Lunkov and others [19; p52] highlighted the importance of H^+ -ATPase, Na^+/H^+, K^+/H^+ ion carriers in halophyte plants in the tonoplasty and plasmalemma of salt-resistant and resistant plant leaf and root cells.

Yu.V. Balnokin and others [4; pp 905-912], described in detail the mechanisms of root K^+, Na^+, Cl^- ions in plants in different groups of halophyte plants, the near and long transport of saline ions in the plant, the importance of ion carriers in halophyte plants.

Also, the following studies by a number of scientists provide partial information on the seasonal variation in the amount and composition of salts in plant organs.

For example, A. Wallase and others [35; pp 65-68] by studying the exchange of Na +, Cl-, Ca + 2, Mg + 2, SO-24 ions in Atriplex polycarpa, Atriplex canescens plants in strongly saline gray soils. +2 indicate that it causes a decrease in the amount of Mg + 2.

A.J. Joshi, H.S. Bhoite [32;pp 191-196] Aeluropus logopoides determined the seasonal dynamics of mineral elements - Na +, K +, Ca + 2, Mg + 2, Cl - in the leaves, stems and roots of the plant and in the soil. According to the researchers, during the season, the amount of Na +, Cl- ions predominated (Na + <Cl-) in the soil and thus in the plant leaf, and the distribution of the remaining ions was as follows Mg + 2> Ca + 2> K +. In other vegetative organs (stem and root) the amount of mineral elements remained unchanged.

S. Kabulov, V.B. Davletmuratova [13; pp 41-43] determined the dynamics of the amount of salts in the leaves of halophytes (Halostachys caspica, Salicornia europaea, Suaeda prostrata) during their growth and development phases, and the flowering phase of halophytes determined the decrease in the amount of salts in the leaf and their adaptive properties.

V.B. Davletmuratova [9; p 22], the halophyte group studied the dynamics of salt ions in their leaves during the ontogeny of plants. According to the authors, the halophyte group of plants occurs in the form of a sequence of glycophytes → haloglycophytes → hemigalophytes → euglophytes → hypergalophytes in terms of the amount of salt accumulation.

D. Yusupova, L.F. Streltsova [27;pp 209-211], [28; p 256] determined the salt accumulation properties of the representatives of the Suaeda family (5 species), which are annual halophytes, in different soil salinities. According to the researchers, although the members of the Suaeda family belong to the same ecological group, the accumulation of salt ions in their organs (leaves) is constantly changing depending on the level and type of soil salinity.

Method and object of the experiment. Scientific research was conducted in 2012-2014 in the experimental field of Gulistan State University in the framework of the scientific-practical project "Study of phytomelioration of saline soils of Mirzachul oasis in the process of desertification." The soil of the experimental area is an old irrigated meadow, weakly saline; the mechanical composition consists of light sands.

According to the analysis of soil samples taken in early spring, the amount of salt ions in the average 0-60 cm layers of soil is 0.4-0.6%. Salinity fluctuates in all layers of the soil in the chloride-sulfate type. Salinity by cations is of the sodium-calcium type. The high content of calcium ions in the soil may be due to the richness of the experimental area to the pre-natural vegetation cover.

The amount of humus in the soil averages 0.48-1.05% in all cases. The amount of total nitrogen fluctuates around 0.029-0.98% in all layers of the soil horizon, and phosphorus fluctuates around 0.035-0.120%. Most of the nutrients belong to potassium, its content is 0.42-1.30% and this is typical for Central Asian soils.

The purpose of the study was to select salt-tolerant, productive and promising forage species and cultivars from the local flora and introducers and to recommend them for soil and climatic conditions of Syrdarya region.

In the experiment, the object quality was represented by members of the family Fabaceae: control-Medicago sativa (native alfalfa), Onobrychis transcaucasica (espartset), Crotallaria alata, Vicia angistifolia (vica), Galega officinalis, Melilotus albor (white кашкарбеда) and Guizotia abissinica species from the Asreraceae family were studied by planting.

Medicago sativa (control) was planted in the experimental field in the spring at the rate of 600 seeds per 1 m2, and the remaining plants at the rate of 50 seeds per 1 m2. In the experiment, the number of variants was 8 and was performed in 4 repetitions. The number of stakes is 32. The total area of each option is 20 m2, ie 10 meters in length and 2 meters in width, of which the calculated area is 10 m2. The total experimental area is 640 m2.

Medicago sativa (control), Onobrychis transcaucasica (espartset) and Vicia angistifolia (vica), which had positive results in the first and second years of the experiment, were planted in the third experimental year at the Hotambek Palvon farm in Mirzaabad district.

The study of the rhythm of seasonal development of plants were conducted according to works of I.N. Beydeman [6;p 153] and I.V. Borisova [5; pp 5-94].

Biomorphological properties of plants T.A. Rabotnov [23; pp 7-204], while in their study of the root system M.S. Shalyt [25;pp 381-383] methods were used.

The quality of plant samples for chemical analysis and the amount of bound and free forms of plant salts were determined by the method of qualitative and quantitative chemical titration of mineral salts in plants on the basis of the methods of the Uzbek Cotton Research Institute "Methods of agrochemical analysis of plants" [21].

Analysis of soil samples in the experiment developed by the State Research Institute of Soil Science and Agrochemistry "Guidelines for chemical and agrophysical analysis of soil analysis" [24], the volume of soil using a metal cylinder, mechanical and microaggregate composition N.A. Kachinsky, humus in the soil I.V. Tyurin, total nitrogen Keldal, total phosphorus I.M. Maltseva, L.P. According to Gritsenko, total potassium Simmit, mobile phosphorus and potassium in one percent carbon-ammonium absorption, nitrate form of nitrogen in Grandvald-Lyaju method, specific mass in pycnometer method 0-30; detected in layers of 30-50 cm.

Hygroscopic moisture, ash content and nitrogen-free extractives (NFEs) in plants were determined by generally accepted methods, crude protein by the Keldal method, crude fat by Soxhlet apparatus by the "residual method", crude fiber by the method proposed by Genneberg and Shtoman (modification) (Zootechnical fodder analysis, 1981) [12].

II. RESULTS AND DISCUSSIONS

The study of ways of adaptation of plants to salinity serves to provide both theoretical and practical conclusions for phytomelioration measures. A study of the literature suggests that all the ways in which plants adapt to salinity are processes that occur depending on the quantity and quality of the salts they contain. The resistance properties of plants to saline environments are directly related to their halo accumulation, which is one of the main factors determining how and to what extent they adapt to saline environments. At this point, the study of the adaptive properties of plants to salinity requires, first of all, the study of their salt accumulation capacity.

Accordingly, in our study, the halo-accumulative - salt accumulation properties of some plants were studied.

The results obtained when determining the salt resistance of plants studied in the 2012-2013 experimental years showed that these plants have a specific salt accumulation capacity (Table 1).

Table 1. The total amount of mineral salts in the surface of some of the studied plants (in% / mg.eq relative to 100 g of absolute dry mass)

Plants	General amount, %	HCO-3	Cl-	SO-24	Ca+2	Mg+2	Na++K+	SO-2 / Cl-	Na++K+ / Ca+2
Melilotus officinalis	6,73	1,896	0,342	2,789	1,12	0,455	0,127	6,0	10,1
		31,08	9,63	58,10	55,89	37,42	5,51		
Melilotus albus	7,55	1,556	0,642	3,223	0,848	0,324	0,961	3,7	1,0
		25,51	18,08	67,15	42,32	26,64	41,78		

Medicago sativa (махаллий)	9,12	2,162	0,587	3,789	1,984	0,155	0,441	4,8	5,2
		35,44	16,54	78,94	99,00	12,75	19,17		
Crotallaria alata	6,13	1,438	0,102	2,862	0,999	0,114	0,617	20,8	1,9
		23,57	2,87	59,63	49,85	9,38	26,85		
Guizotia abissinica	4,75	0,845	0,255	2,296	1,225	0,057	0,070	6,7	20,0
		13,85	7,18	47,83	61,13	4,69	3,05		
Onobrychis transcaucasica	7,24	2,189	0,389	2,656	1,116	0,201	0,689	5,0	1,9
		35,89	10,96	55,33	55,69	16,53	29,96		
Vicia angistifolia	8,49	2,587	0,816	2,803	1,531	0,378	0,375	2,5	4,7
		42,41	22,99	58,40	76,40	31,09	16,31		
Galega officinalis	7,93	1,847	0,545	3,301	1,464	0,205	0,563	4,5	3,0
		30,28	15,35	68,77	73,05	16,86	24,49		

Note: The average values of the three indicators are shown

If the increase in halloaccumulative capacity of plants is compared, it looks like this: Guizotia abissinica <Crotallaria alata <Melilotus officinalis <Onobrychis transcaucasica <Melilotus albus <Galega officinalis <Vicia angistifolia <Medicago sativa (control).(Fig.1)

Study of new literature sources [10; 19 b], [pp29; 25] indicates a lack of data on the salt accumulation properties of the above plants. Only in the cited literature are the amounts of certain micro and macronutrients (calcium, potassium, manganese, phosphorus, nitrogen) related to their nutrition. However, these indicators do not provide information on what salt plants can accumulate in a saline ecological space or, if not, their salinity adaptation properties.

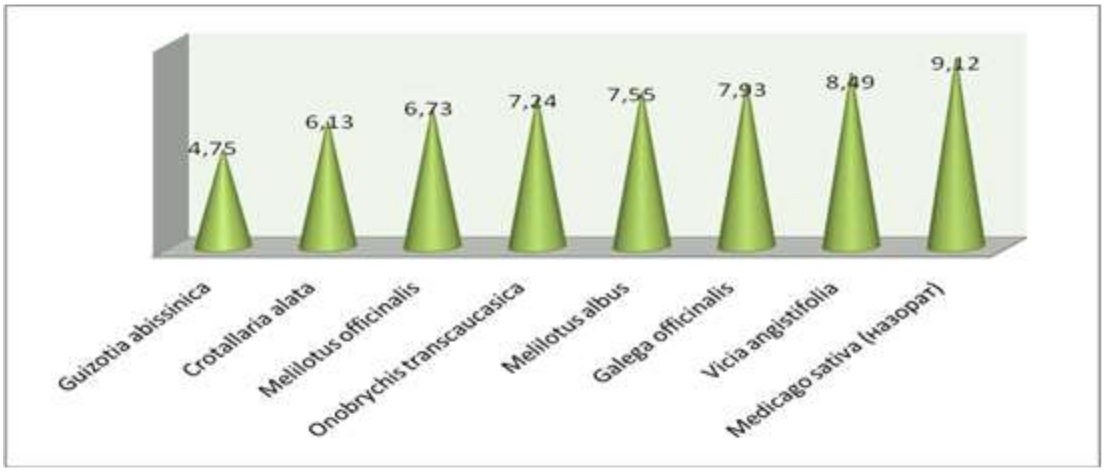

Figure 1. The order of increasing the halo accumulative capacity of the studied plants

Our scientific studies have shown that when the results of chemical analysis are analyzed, plants have different salt accumulation capabilities and salt resistance.

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Medicago sativa- (control) has the highest salt accumulation capacity, with more than 9% of harmful salts accumulating in its surface. This indicates that it is rich in ash elements. In all the plants studied, this figure was below control, and we can see Vicia angistifolia (8.48%) in the post-control row.

Guizotia abissinica has the lowest halloaccumulative capacity, with 4.75% water-soluble salts accumulating in its surface.

The possibilities of salt accumulation between the two species of melilot are also different. In particular, the medicinal melilot - Melilotus officinalis (6.7%) accumulates less harmful salt ions than the white melilot - Melilotus albus (7.6%). The high amount of salts in Melilotus albus may be due to its adaptation to a typical habitat. The amount of alkaline and calcium ions from cations in the plant is close to each other (0.961-0.848%, respectively), and we can say that magnesium (0.324%) is the least common cation.

Melilotus albus (white melilot) is widespread in the saline-plain part of Mirzachul and is mainly a species adapted to growing in abandoned areas, on roadsides, around ditches in fields. Melilotus officinalis (medicinal melilot) is mainly distributed in the mountainous region of Mirzachul, which contributes to less accumulation of salts in its composition.

The amount of total salt ions in the plant Onobrychis transcaucasica is 7.2%. Most of the total salt ions fall from anions to sulfate (2.7%) and bicarbonates (2.2%). Plant ash contains higher amounts of calcium (1.1%) than cations, followed by alkaline ions (sodium + potassium) (0.7%). Chlorine and magnesium are among the least common ions in plants.

The Galega officinalisa plant ranks third after Medicago sativa (control) and Vicia angistifolia in terms of total ash content. Unlike other plants, it has a much higher content of sulfate ions (3.3%) and is closer to Medicago sativa (control) (3.79%), indicating that it is a sulfatophilic plant. In terms of calcium ions (1.46%), it is close to vica. It has a low content of magnesium and alkaline ions (0.2-0.6%), as in other plants.

In assessing the salt resistance of plants can be assessed not only by the total amount of salts they contain, but also by the quantitative distribution of some harmful ions in them.

Such ions include chlorine ion, which is considered to be the most harmful of salinity ions, and its content in the plant serves to assess the salt resistance of the plant [20; p18].

The results of the chemical analysis obtained explained the non-distribution of chlorine ions in the studied plants.

The amount of chloride ion (0.816%) in Vicia angistifoli was higher than in all plants studied. This figure was 0.055% higher in Melilotus albus than in Medicago sativa (control) and 0.042-0.485% lower in the remaining plants. In Medicago sativa (control) and Galega officinalis, the amount of chlorine ion accumulated was almost equal.

In addition, the analyzes showed that the amount of chloride ion in the plants had a correlative unit with their halo accumulative capacity.

According to the distribution of chloride ions in the studied plants and their decrease in salinity, they can be placed in the following order: Vicia angistifolia> Melilotus albus> Medicago sativa (control)> Galega officinalis> Onobrychis transcaucasica> Melilotus officinalis> Guizotia abissinica> Crotallari.

As can be seen from the series, plants with high halo accumulative potential are also at the forefront in terms of chlorine ion accumulation.

B.A. Keller [14; pp193-215] by studying the salt accumulation properties of plants, emphasizes that plant groups growing in the same environment selectively select salt ions and that their accumulation varies. It has been shown that in salt-resistant plants, the chloride ion from the anions accumulates more than the sulfate ion.

Also, in our experiment, when we studied the mutual ratios of SO-24 / Cl- ions and the salt resistance of plants according to it, it became clear that the greatest value of the ratios belonged to the Crotallaria alata. The content of sulfate ions in the plant is 2.9%, and chlorine ion - 0.1%. This means that the chlorine ion is twenty-one times less than the sulfate ion. The lack of chloride ions in the Crotallaria alata indicates that the plant is more resistant to salt than other species. Therefore, it is recommended to plant this species only in weakly saline soils.

Vicia angistifolia (vica) is the plant with the lowest ratio of SO-24 / Cl- ions, the highest content of chloride ions. It is also rich in sulfate and bicarbonate ions, and their content in the plant is 2.8-2.6%, respectively. Among the plants with the lowest rates of harmful ions were observed in Vicia angistifolia and Melilotus albus (2.5–3.7) (Fig. 2).

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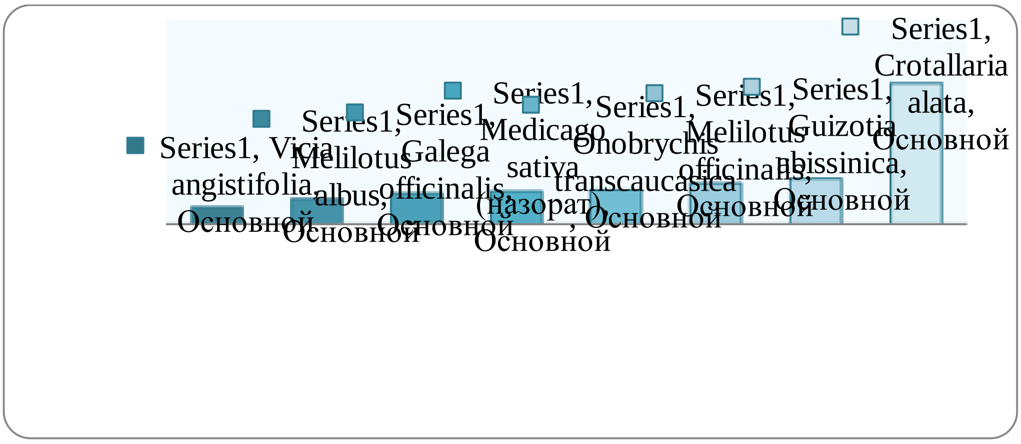

Figure 2. Decreases in salt resistance properties of plants as the ratio of SO-24 / Cl- ions increases

Numerous publications have shown that calcium ions play an important role in regulating the response of plants to saline environments and in maintaining the water-salt balance of the cell, and that calcium ions play an important role in their salt resistance [2; p183], [7;p 119], [30;pp 207-211], [36; pp52-53], [37; pp12-17], [18; pp575-581]. In addition, alkaline ions in glycophyte or glycohalophyte plants under saline conditions, unlike calcium ions, disrupt the permeability of their intercellular membranes and reduce the resistance of plants to saline conditions.

The high content of calcium ions in glycophyte or glycohalophyte plants ensures their resistance to saline conditions [2; p183]. Accordingly, based on the results of chemical analysis, the total ratios of calcium and alkaline ions in plants were determined (Fig. 3).

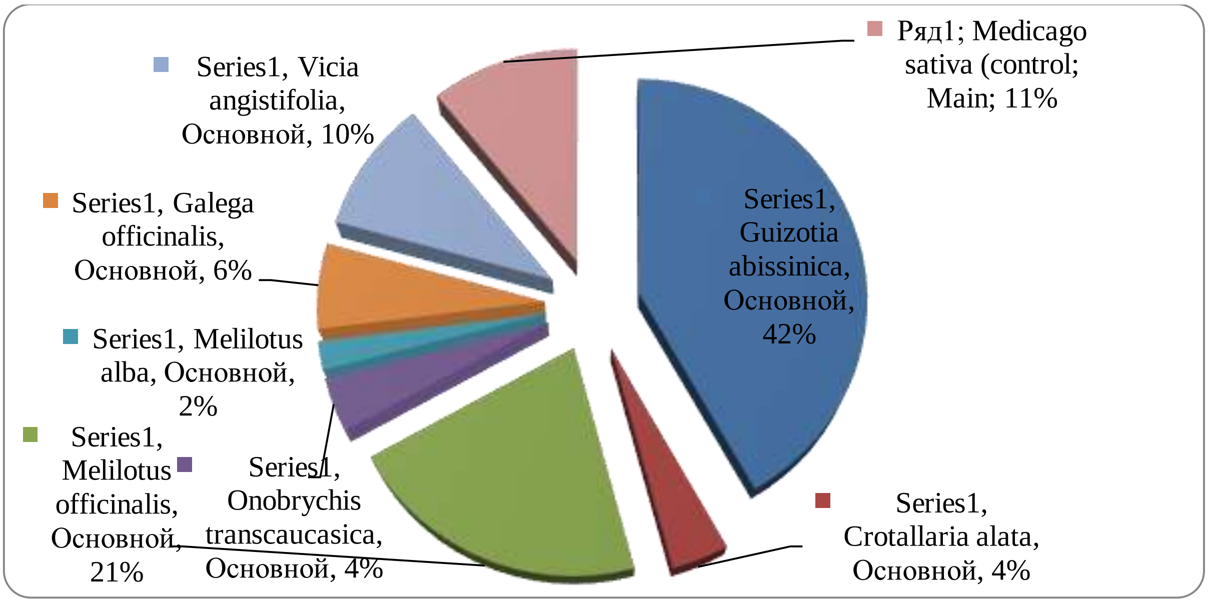

Figure 3. Na ++ K + / Ca + 2 ions in plants distribution ratios

As can be seen from Figure 3, the highest value of Na ++ K + / Ca + 2 belongs to Guizotia abissinica. If the amount of Ca + 2 ions in it is 1.2%, then the amount of alkaline ions is 0.07%, ie the amount of calcium ions is about twenty times more than the amount of alkaline ions. The next largest Na ++ K + / Ca + 2 ratio belongs to Melilotus officinalis. The ratio of ions in it is 10.1. The lowest value of the ratios was observed in Melilotus albus (1.0), where the content of calcium ions was 0.85% and that of alkaline ions was 0.96%, respectively. Based on the halloaccumulative properties of plants, we can say that Vicia angistifolia, Medicago sativa (control) and Melilotus albus are resistant species to saline soils. The high content of chlorine and calcium ions in the composition of these plants indicates that the plant tissue is resistant to the toxic effects of salts and adapted to saline conditions.

The results of the obtained chemical analysis can be recommended for phytomelioration works of Vicia angistifolia (vica), Melilotus albus (white melilot) and Medicago sativa (control), depending on the halo accumulative capacity of plants and the amount of chloride ions in them.

In 2012-2013, Vicia angistifolia, Onobrychis transcaucasicas, which showed positive results not only in terms of halo accumulation and salt resistance, but also in terms of growth and development, yield, multiple harvests and nutrients, were planted in 2014 in the field of Mirzaabad district "Hotambek polvon" farm, and their properties were studied. In Medicago sativa (control), this figure was determined for a three-year-old local alfalfa variety planted in the GulSU experimental field (Table 2).

Farm soils consist of irrigated gray-grass soils. The amount of humus was 0.64% at a thickness of 0-50 cm, and its content in the lower layers was reduced by 50%. The amount of nutrients in the mobile form in the soil also decreases as the soil layer thickens. The amount of mobile phosphorus in the soil in the upper layers (0-50 cm) is 16.17 mg / kg in the lower layer, this figure is reduced by almost 2 times. This indicates that the plant has very few nutrients that it uses during the growing season.

When analyzed on the basis of exchangeable potassium, the experimental field belongs to the group of poor soils. The amount of exchangeable potassium in the soil is 171 mg / kg in the upper layer, while in the lower layer it is 130 mg / kg.

The soil is moderately saline, moderately compacted. The dry residue is 1.580%, Cl-0.098%, SO_4 -0.860%. The groundwater is 1.60 cm deep and the gypsum layer is 72 cm deep.

It can be seen that the amount of salt ions in these plants planted on the farm in 2014 differs from the results of the analysis of the first years (2012-2013). As the amount of salt ions in plants changes, we can see that their salt resistance indicators - the ratios between sulfate / chloride ions and alkaline ions / calcium ions - have been preserved. In particular, in 2014, the amount of salt ions in Onobrychis transcaucasia increased compared to 2012-2013, and decreased in Vicia angistifolia, but it was found that the ratios between sulfate / chloride ions remained the same (Table 2).

This was also observed in the control-Medicago sativa. This condition means that the salt resistance of plants is an evolutionarily assimilated trait.

Table 2. The total amount of salt ions in the surface of plants studied in 2014 (in% / mg per 100 g of dry mass) *

Ўсимликлар	Умумий микдори, %	HCO_3^-	Cl^-	SO_4^{2-}	Ca^{+2}	Mg^{+2}	$Na^+ + K^+$	Тузлар суммаси	SO_4^{2-} / Cl^-	$Na^+ + K^+$ / Ca^{+2}
Onobrychis** transcaucasica	7,39	2,241	0,35	2,789	1,214	0,256	0,548	7,39	8,0	0,5
		36,74	10,0	58,10	59,54	21,02	24,28			
Vicia** angistifolia	8,15	1,756	0,79	3,314	1,731	0,289	0,270	7,90	4,2	0,2
		28,79	22,6	69,04	84,89	23,77	11,74			
Medicago sativa***	9,71	2,211	0,65	4,114	2,147	0,227	0,359	8,93	6,3	0,2
		36,24	18,6	85,71	105,30	18,67	15,61			

Note - ** Crops planted on the farm area

*** Three-year alfalfa in the experimental field of GulSU

As the salt resistance of the plants decreases, we can place them in the following order: Vicia angistifolia → Medicago sativa → Onobrychis transcaucasica (Fig. 4).

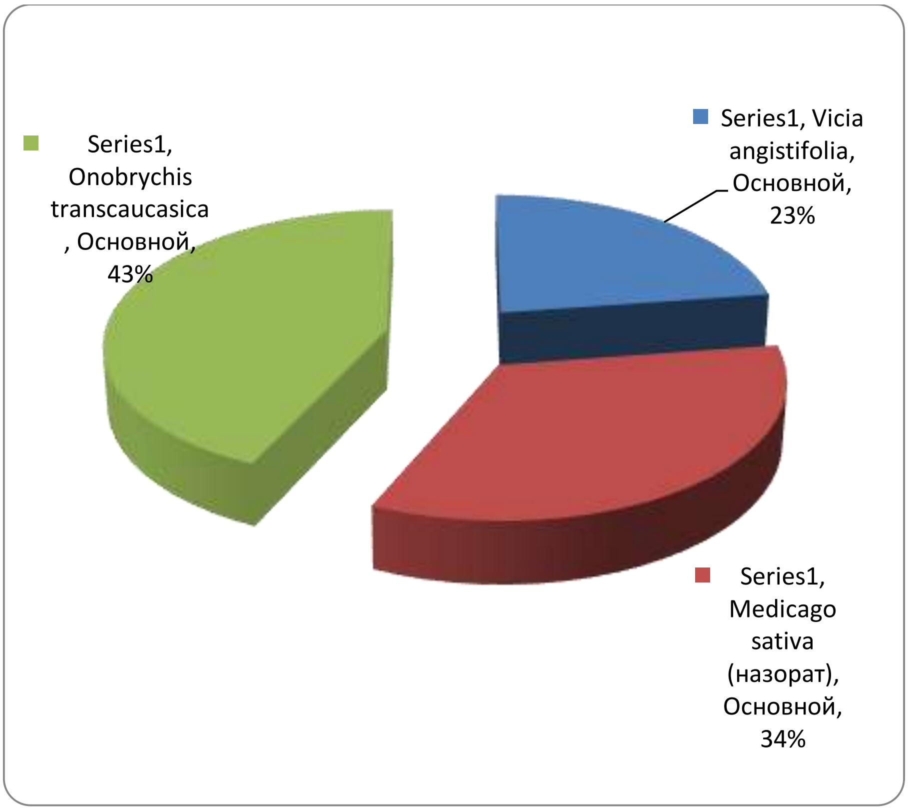

Figure 4. SO_4^{-2} / Cl^- ions in plants distribution ratios

As can be seen from Figure 4, the smallest of the ratios belongs to Vicia angistifolia and the largest to Onobrychis transcaucasica. The lack of chloride ions in Onobrychis transcaucasia indicates that the plant is relatively resistant to salinity compared to other species.In conclusion, we can say that the selected forage plants have the ability to retain their salt-resistant properties in other soil conditions. This indicates that their resistance to salt is a stable-genetic trait.

III. CONCLUSIONS

Among the legumes tested in Mirzachul soil-climatic conditions Medicago sativa, Vicia angistifolia, Melilotus albus, M. officinalis, Onobrychis transcaucasica, Galega officinalis, Crotalaria alata and Guizotia abyssinica perspective species are chosen. It has been noted that the remaining species die in the early stages of ontogeny, unable to withstand salinity.Comparative analysis of the growth of two species of Melilotus in Mirzachul conditions showed that Melilotus albus is better adapted to soil salinity than Melilotus officinalis. The green mass of the first round was found to be about 1.5 times higher than that of the second round. At the end of the first year of vegetation, the survival rate of M. albus seedlings was 83.4%, while that of M. officinalis seedlings did not exceed 67.0%.The increase in the halo-accumulative capacity of plants is reflected as follows: Guizotia abissinica <Crotallaria alata <Melilotus officinalis <Onobrychis transcaucasica <Melilotus albus <Galega officinalis <Vicia angistifolia <Medicago sativa (control)

According to the distribution of chlorine ions in the studied plants and their decrease in salinity, they can be placed in the following order: Vicia angistifolia> Melilotus albus> Medicago satica (control)>Galega officinalis > Onobrychis transcaucasica > Melilotus officinalis > Guizotia abissinica > Crotallaria alata.The high content of chlorine and calcium ions in Vicia angistifolia compared to other types of plants indicates that the plant tissue is resistant to the toxic effects of salts and adapted to saline conditions. It can also be grown on moderately saline soils.Lack of chlorine ions in Crotallaria alata indicates that the plant is more resistant to salinity than other species. Therefore, it is recommended to sow this species only on weakly saline soilsVicia angustifolia, Onobrychis transcaucasica, Melilotus albus species were found to be able to produce two crops in the first year of vegetation. These plants are more resistant to soil salinity and are fully preserved until the end of the growing season. The viability of Galega officinalis at the end of the growing season was 40.0%. Given the reduced productivity of Guizotia abissinica due to the destruction of the lower leaves of the stem at the beginning of the fruiting phase, it is advisable to carry out the harvest during the flowering period or at the beginning of fruiting.

Selected fodder plants have the ability to retain their salt-tolerant properties in other soil conditions. This indicates that their salt tolerance is a stable-genetic trait.Depending on the results of chemical analysis, haloaccumulative potential of plants and the amount of chlorine ions in them, it is possible to recommend Vicia angustifolia, Onobrychis transcaucasica, Melilotus albus and Medicago sativa for phytomelioration.

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