American Journal Of Agriculture And Horticulture Innovations
(ISSN – 2771-2559)
VOLUME 03 ISSUE 12 Pages: 33-39
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 7. 471)
OCLC – 1290679216

Publisher: Oscar Publishing Services

Research Article

Journal Website: https://theusajournals.com/index.php/ajahi

CHANGES OF SALT CONTENT IN HALOPHYTES AND SOIL IN THE CONDITIONS OF THE SOUTHERN ARAL SEA REGION

Submission Date: December 17, 2023, Accepted Date: December 22, 2023,
Published Date: December 27, 2023
Crossref doi: https://doi.org/10.37547/ajahi/Volume03Issue12-07

Sultanova Zulfiya
Karakalpak Agrarian And Agricultural Technology Institute, Professor ((Dsc), Uzbekistan

ABSTRACT

The article presents data from research conducted under high temperature conditions with various salt-tolerant plants. The possibility of using them for various purposes, as well as for improving saline soils, is being considered.

KEYWORDS

Soil salinization, halophytes, mineral fertilizers, plant growth in height, accumulation of dry matter.

INTRODUCTION

Halophytes are widespread plants in the Republic of Karakalpakstan and the study of their features as soil salt accumulators for practical use represent scientific interest.

Among the facultative halophytes there are plants used in the preparation of foodstuffs, medicines, the production of vegetable and industrial oils, and the production of fodder for livestock. The world gene pool of halophytes includes 2,500 species, including 900 species in Central Asia.

The use of halophytes is possible for the sustainable development of viable agriculture in arid regions of the world for the restoration of degraded lands, including saline ones, and for the production of high-protein energy-rich fodder, grain forage, medicinal and oil raw materials [1; 7-11 p].

In the region, in many fields there are places of salt accumulation, so-called "bald patches", which have a very high salt content up to 24 mg% and the seeds of sown cultivated plants do not germinate on them. Special salt-tolerant vegetation develops on saline soils [5; 160-163 p].

Yensen N.P., Bedell J.L., Yensen S.B. in experiments in 1995 and Toderich, K.N., Popova, B.B., Aralova, D.B., Gismatullina, L.G., Rekik, M. & Rabbimov, A.R. experiments in Karakalpakstan in 2016, propose the

American Journal Of Agriculture And Horticulture Innovations
(ISSN – 2771-2559)
VOLUME 03 ISSUE 12 Pages: 33-39
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 7. 471)
OCLC – 1290679216
Publisher: Oscar Publishing Services

use of halophytes as valuable livestock feed. In the plants that have special adaptations for normal completion of ontogenesis in conditions of high salinity. In nature, saline soils have quite rich and various vegetation.

Due to lack of water, the cultivation of traditional plants becomes a problematic issue. As cotton, wheat and rice consume almost two, two and a half times more water. Therefore, the diversification of non-traditional crops, which are characterized by low water consumption, have a lower transpiration coefficient, improve soil structure, and create favorable conditions for the growth of subsequent plants, is an urgent task.

Shamsutdinov Z.Sh., Shamsutdinov N.Z. experiments in 2000-2002, that in connection with the salinization of majority of soils in the region plants adapting in the process of their ontogenesis to existence on saline soils , i.e. halophyte plants are of great interest. Here they are found in wild form, and some of them have practical use in livestock farming. Halophytes are characterized by high osmotic pressure of cell sap in cells and tissues, which allows them to absorb water from concentrated solutions.

Salt-accumulating halophytes, or euhalophytes (from the Greek her - good, real), have the greatest resistance to salts. They grow and develop well on the most saline soils. These plants absorb a large amount of salts from the soil. This group includes mainly the so-called saltworts (Chenopodiaceae stirpes - Chepodiaceae), saltwort, seaweed, sarcazan, some species of tamarix, etc. [3; 22-28 p]. Some saltworts accumulate up to 7% of salts from the mass of cell sap.

As a result, the water potential of the cells is greatly reduced, and water enters them even from saline soil; salt accumulates in the vacuoles. Taking into account this feature of plants, we were faced with the task of selecting plant species that remove salts from the soil, reducing their initial content, and that have beneficial properties for use in animal husbandry or for technical purposes [4; 75 p].

Akinshina, N., Toderich, K., Azizov, A., Saito, L. & Ismail, S. in experiments in 2014, suggest use halophyte biomass as a promising source of renewable energy.

For this purpose, the possibility of using high-quality facultative and halophytes themselves for land improvement was substantiated. In 2021-2022, field experiments were launched on the fields of the Scientific-Production Association Grain and Rice in the Nukus region. Soils of the site are meadow-alluvial, medium loamy, moderately and in some places highly saline.

METHOD OF RESEARCH

Field experiments phenological observations, diagnostics of salt content in soil and plants using the express method and laboratory tests.

Phenological monitoring and recording of plant growth and development phases. The starting point of the phase was taken as the date when 10% of plants entered this phase, and 75% of plants entered the full phase at the onset of this phase.

Monitoring of salt content change in soil and plants; for this purpose, the salt content in the soil was determined at the beginning and at the end of the plant growing season using the conductometric method.

Biometric analysis of plants from sample plots measuring 0.25 m2, chemical analysis of plants according to generally accepted methods.

American Journal Of Agriculture And Horticulture Innovations
(ISSN – 2771-2559)
VOLUME 03 ISSUE 12 Pages: 33-39
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 7. 471)
OCLC – 1290679216
Crossref doi Google Scholar WorldCat MENDELEY
Publisher: Oscar Publishing Services

Determination of humus content in the soil according to the method of I.V. Tyurin, $N-NO_3$ – by the method of Granwald-Lyazhu, P_2O_5 - by the method of Machigin, exchangeable potassium on the fire photocolorimeter according to the method of V.P. Protasov.

Humus content, 0.8-1.1%; nitrogen content 0.26 mg%, content of mobile P_2O_5 -30 mg/kg; The content of mobile K_2O is 156 mg/kg. The soils of field plots of phosphorus content belong to the low-supply group and vary from 12 to 27 mg/kg. By the content of mobile potassium, all investigated soils belong to the group of low-supply of these elements; in the arable horizon, the potassium content ranges from 110 to 200 mg/kg.

RESULTS AND DISCUSSION

According to A. Rabbimov, B. Bekchanov, T. Mukimov experiments in 2011, are given systems for growing salt-tolerant crops and halophytes. To develop technology for cultivating salt-tolerant crops in the conditions of the Southern Aral Sea region, we carried out phenological observations of the growth and development of halophytes.

Shprouts of cultivated facultative halophytes appeared on the 5-7th days after sowing (Table 1). Later and sparse sprouts were observed in Klimakoptera on the 10th day after sowing. Flowering under conditions of lack of moisture was observed in quinoa on the 38th day after germination. The beginning of amaranth flowering was noted on August 5-10. Maturation of these two plants is noted at the end of September: quinoa 17-19, amaranth 22-25 September.

Table 1

Phenological observations

Name of plants	Date of sowing	Beginning of germination seeds (%)	Full seed germination	Bloom	Plant ripening
Quinoa Q5	15.05.21	22.05.21	71	30.06	17-19.09
Amaranthus white	15.05.21	21-22.05.21	98	05-10.08	22-25.09
Pennisetum glaucum	18.04.21	24.04.21	97	01.07	05-08.09
Sorghum vulgare	18.04.21	23.04.21	92	28.06	20-22.09
Climacoptera crassa	17.04.21	27.04.21	37	25-29.06	26-28.10
Kochia scoparia	17.04.21	24.04.21	71	1-5.07	18-20.10
Atriplex patula	17.04.21	24.04.21	57	01-03.07	25-27.10
Karelinia caspia				30.07	28-30.11
Mung bean	16.04.21	23-24.21	90	01.07	05.07-30.07.

Flowering of Klimakoptera is noted on June 25-29, and seed ripening on October 28. Kochia is characterized by the accumulation of large green biomass, especially when watered and fertilized. Flowering of plants is noted on July 1-5, ripening on October 18-20. Quinoa plants flower at approximately the same time, but ripening is more extended and begins on October 25-27 and continues until frost.

American Journal Of Agriculture And Horticulture Innovations
(ISSN – 2771-2559)
VOLUME 03 ISSUE 12 Pages: 33-39
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 7. 471)
OCLC – 1290679216
Crossref doi Google Scholar WorldCat MENDELEY
Publisher: Oscar Publishing Services

Mung bean is a plant with a short growing season and rapid grain ripening; the bean harvest was extended from the beginning to the end of July.

The height of plants in all variants varied depending on the rate of fertilizer application. With an increase in the rate of fertilizers, plant growth in height increased and by the end of the growing season was on average 185.2 cm for white amaranth, and 180.6 cm for red amaranth (table 2). With the application option N150P100K100, plant height is higher than the norm N80P60K40 by 43.7 cm; compared to red Amaranth by 59 cm, Soybean by 27 cm, Atriplex by 21.4 cm. Such changes and a positive reaction to fertilization are observed in all types of plants. The role of fertilizers is that they not only increase growth, but also increase biomass, productivity, and at the same time, by shading the soil, they save moisture from evaporation. Halophytes with large biomass also remove more salt ions from the soil.

table 2

Dynamics of plant growth and development in variants, sm

Plants	09.06.	10.07.	10.08.	10.09.	15.10.
Quinoa (Q5var.)	22,7	62,8	69,5	68,2	-
Amaranthus white	24,8	140,4	173,1	184,0	185,2
Amaranthus red	23,6	137,1	168,5	179,4	180,6
Setaria italica	25,2	69,6	82,3	89,6	91,9
Carthamnus	39,4	76,2	96,5	105,4	108,2
Sorghum vulgare	28,3	75,7	89,6	98,3	102,0
Mung been	15,5	42,7	59,2	60,7	58,1
Suaeda physophora	20,4	58,3	92,8	98,5	104,3
Climacoptera crassa	18,8	51,8	96,3	103,9	107,6
Kochia scoparia	31,8	98,4	151,4	157,5	158,2
Atriplex patula	33,4	96,7	160,7	163,2	164,8

The highest plant height was observed in sweda, climacoptera, kochia and atriplex plants; further, as determined by the analyses, these plants also accumulated the greatest dry plant biomass (table 3).

The growth of plants and their accumulation of organic biomass are the final results of interaction with environmental factors, the result of complex processes occurring in cells, tissues and organs. The study of the dynamics of growth and accumulation of dry matter depending on specific growing conditions

American Journal Of Agriculture And Horticulture Innovations
(ISSN – 2771-2559)
VOLUME 03 ISSUE 12 Pages: 33-39
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 7. 471)
OCLC – 1290679216
Publisher: Oscar Publishing Services

and varietal characteristics of the plant is of significant scientific and practical interest. The duration of each phase, as well as the entire life cycle, depends on the varietal characteristics and nutritional conditions.

The accumulation of dry biomass by plants was determined mainly by the same features as growth dynamics [6; 161-163 p]. The accumulation of above-ground mass proceeded more vigorously in variants with the application of mineral fertilizers by irrigation. In the phases of emergence and flowering, the indicators are high; the plants were formed using options with the introduction of optimal doses of fertilizers.

table 3

Accumulation of dry matter by plants

Plants	Determination dates							
	09.06.	29.06.	10.07.	30.07.	10.08.	22.08.	30.08.	10.09.
Quinoa (Q5var.)	25	32	46,2	55,8	58,3	59,5	63,4	-
Amaranthus white	14,7	42,7	73	86	113,7	135,2	142,6	144,2
Amaranthus red	20	39,8	61,6	84	104	130,6	133,8	134,6
Carthamnus	27	30	40	53	63	67	67	70
Soybeans	25	39	59	92	95	96	96	
Setaria italica	26	62	89	108	106	108	107	
Sorghum vulgare	45,8	72	111,4	198,6	202,2	205,4	206,8	206,9
Mash	12,9	26,7	36,1	47,7	65,1	68,5	68,2	68,3
Suaeda physophora	40,8	65	76,3	97,8	128,4	130,1	132,6	132,7
Climacoptera crassa	19,2	41,4	52,2	60,25	71	74,3	76,1	76,1
Kochia scoparia	31,8	92,3	116,9	178,8	208,7	232,1	234,4	234,6
Atriplex patula	20,8	62,8	98,8	113,6	130,8	132,5	134,1	134,4

The most intense average daily increases in dry biomass were observed in white amaranth, atriplex and kochia, then climacoptera was observed until August 10, then the accumulation of biomass decreased.

American Journal Of Agriculture And Horticulture Innovations
(ISSN – 2771-2559)
VOLUME 03 ISSUE 12 Pages: 33-39
SJIF IMPACT FACTOR (2021: 5.705) (2022: 5.705) (2023: 7.471)
OCLC – 1290679216
Crossref doi Google Scholar WorldCat MENDELEY
Publisher: Oscar Publishing Services

Dry matter accumulation was higher in the variants with fertilizer application. Some increase in dry matter in variants without fertilizers is apparently associated with the uneven distribution of nutrients in the soil and the ability of compounds to migrate.

Shamsutdinov Z.Sh., Shamsutdinov N.Z. in 2003, consider it appropriate use of halophytes for sustainable development of viable agriculture in arid regions of Russia and Central Asia. Plants characterized by general resistance to a complex of abiotic stresses and relatively high productivity under arid climate conditions and low soil fertility are recommended for ecological restoration of arid pastures.

Under drought conditions, irrigation plays a positive role in the accumulation of dry mass by plants and their removal of salts from the soil (Table 4). Here is data on the plants Karelinia caspia, Atriplex, Kochia. In areas with Karelinia caspia and Kochia plants, the salt content in plants is higher at the end of the growing season (October) compared to the middle of the growing season (July).

Table 4

Change in salt content in soil and plants in the middle and end of the growing season, g/l

Crops	July 19, 2021		July 19, 2022		October 17, 2021		October 21 ,2021	
	Salinity (Ec)							
	in soil	in plant	in soil	in plant	in soil	in plant	in soil	in plant
	Karelinia caspia							
1. Without fertilizers and without irrigation	8,7	3,00	7,1	3,36	15,9	1,27	9,1	3,9
2. fertilizers without irrigation	8,3	2,08	9,3	3,12	11,57	2,5	5,27	3,58
3. Irrigation without fertilizers	7,62	2,00	4,51	2,25	7,88	1,56	8,3	3,24
4. fertilizers +irrigation	7,8	2,1	6,24	2,41	9,24	1,72	10,8	3,7
	Atriplex							
1. Without fertilizers and without Irrigation	2,4	3,05	2,45	3,88	4,83	2,15	2,4	1,9
2. Fertilizers without irrigation	2,46	2,70	0,94	2,65	2,92	2,15	2,2	2,4
3. Irrigation without fertilizers	2,1	2,50	3,04	4,96	2,94	2,17	2,9	2,5
4. Fertilizers +irrigation	1,75	3,2	1,61	2,94	1,89	1,22	1,57	1,88
	Kochia							
1. Without fertilizers and without irrigation	4,32	1,74	2,94	0,79	3,66	11,17	7,1	2,15
2. Fertilizers and without irrigation	0,8	1,33	1,33	0,7	2,37	1,28	3,2	1,4
3. Irrigation without fertilizers	1,32	1,27	1,12	1,08	2,17	1,71	2,4	2,5
4. Fertilizers+irrigation	1,84	1,24	2,1	1,7	3,18	1,46	3,1	1,8

These characteristics are determined by such bioecological mechanisms as a developed and deeply penetrating root system, productive use of soil moisture reserves, the ability to carry out photosynthesis with a positive balance at ultra-high air temperatures (+40-+45 oC and above), belonging to the C4 type and other useful characteristics.

CONCLUSION

under normal moisture conditions, plant seeds germinate in 6-10 days and have good germination. The yield of above-ground mass, useful parts and removal of salts by halophytes largely depend on the intensity of plant growth in height. The growth and accumulation of dry matter of the studied plant varieties of non-traditional crops and halophytes were more strongly influenced by the application of increased doses of mineral fertilizers, which should be taken into account when cultivating to obtain plant biomass. Of the 3 plants studied, only Karelinia caspia and Kochia scoparia accumulate salts at the end of the growing season higher than Atriplex patula.

REFERENCES

1. Akjigitova N.I. Halophilic vegetation of Central Asia and its indicator properties. - Tashkent: Fan, 1982. - 192 p.
2. Akinshina, N., Toderich, K., Azizov, A., Saito, L. & Ismail, S. 2014. Halophyte Biomass: A Promising Source of Renewable Energy. Journal of Arid Land Studies, 24(1): 231-235.
3. Kosulina L. G., Lutsenko E. K., Aksenova V. A. Physiology of plant resistance to unfavorable environmental factors. - Rostov-on-Don: From the Russian State University, 1993. - 240 p.
4. Myachina Olga, Toderich Kristina, Hidenari YASUI, Akinshina Natalya, Sultanova Zulfiya, Rimma Kim Agrochemistry and microbial activities under halophytes grown under different salt affected soils. Journal of Arid Land Studies Vol. 32, Issue 3, Pages 75// The Japanese Association for Arid Land Studies
5. Rabbimov A., Bekchanov B., Mukimov T. Chemical composition and palatability of some halophyte species. Arid ecosystems -2011, volume 17. -№. 2(47). -p.47-54.
6. Sultanova Z.S. Abdieva G.M., Karimullaeva M.U. Accumulation of biomass by halophytes in applying mineral fertilizers// Bulletin of Karakalpak State University.-Nukus 2023. Special issue (62). -P.160-163.
7. Toderich, K.N., Popova, B.B., Aralova, D.B., Gismatullina, L.G., Rekik, M. & Rabbimov, A.R. 2016. Halophytes and salt tolerant forages as animal feed at farm level in Karakalpakstan [online]. Dubai. [Cited 30 January 2016]. https://hdl.handle.net/20.500.11766/3490
8. Shamsutdinov Z.Sh., Shamsutdinov N.Z. Use of halophytes for sustainable development of viable agriculture in arid regions of Russia and Central Asia // Arid ecosystems. 2003. No. 19-20. v.9. pp. 22-37.
9. Yensen N.P., Bedell J.L., Yensen S.B. Domestication of Distichlis as a grain and forage. In: Biology of salt tolerant plants /Eds. M.A Khan, I.A. Ungar. Ohio Univ., Athens, 1995: 388-392.