Studying the activity of microorganisms (laboratory conditions) in moderately and highly saline meadow alluvial soils based on cotton

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Abstract. In the article, an experiment was carried out on the irrigated soil of the "Central Asia" farm, Bukhara region, Bukhara district, with moderate salinity, and some places with strong salinity. The composition of the biofertilizer used in the experiment consisted of micro and macro-green algae and high plant residues. Including organic substances 50-60%, humus 22-27%, nitrogen 10-12%, phosphorus 5-7%, potassium 1.8-2.1%, albumen 35-40%, 17 amino acids and copper, zinc and other from trace elements are available. Experiments have been carried out in three options when the macerated microalgae suspension is planted and mineral fertilizer (NPK No.) is added and the number of ammonifiers is increased from 1,900,000 to 1,200,000, fungi from the first 8 thousand to 12 thousand; it was found that the number of green microorganisms increased from 200,000 to 950,000.

1 Introduction

Soil fertility directly depends on its physic-chemical properties, organic mineral substances contained in the humus layer, and especially on the collection, quantity and biological activity of various useful microorganisms in its components. One of the most important tasks is to create methods of studying and managing the cultivated areas of our country, the quality of the soil composition, the chemical and biological, especially microbiological processes occurring in them, improving the structure of the soil, and increasing its productivity.

Bukhara region, Bukhara district, irrigated soil of farm "Central Asia" is moderately saline, and some places are strongly saline. The mechanical composition of the soil is medium and light sandy soil, suitable for cotton cultivation. Along with cotton, alfalfa, corn and wheat are grown in these agricultural fields. However, the main crop of agriculture is cotton. It is known that the types and activities of microorganisms in the soil are very diverse. To determine this condition, preliminary experiments were conducted in laboratory conditions on a highly saline soil sample of this farm.

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2 Results and analysis

The composition of the biofertilizer used in the experiment consisted of micro and macro-green algae and high plant residues which included organic substance 50-60%, humus 22-27%, nitrogen 10-12%, phosphorus 5-7%, potassium 1.8-2.1%, protein 35-40%, 17 amino acids and copper, zinc and other from trace elements are available. The salts in the composition are as follows: (in % of dry residue) sulphates 2.0-3.0; - chlorides- 0.1-0.2. First, a quantitative index of microorganisms living in highly saline meadow alluvial soil was determined. For this, the amount of microorganisms, that is, ammonifiers, in 1 g of soil during 20 days is 1 million. It was found that 600 thousand cells, oligonitrophils consist of 2 million 900 thousand cells, fungi - 8000 thousand cells. The presence of green microalgae cells was not observed (Table 1).

To determine the amount of microorganisms, Bukhara-6 seed was thawed in a suspension of cotton green microorganisms containing 10-15 million cells in a volume of 1 ml and planted in the highly saline soil that mentioned above. Within 8-9 days, the amount of ammonifiers in the soil will increase from the initial 1 million 600 thousand to 3 million 100 thousand; the amount of oligonitrophils is from the first 2 million 900 thousand to 4 million 100 thousand; It was found that fungi increased from 8 thousand to 12 thousand, microalgae increased from 210 thousand to 400 thousand. Experiments have been carried out in three options when the macerated microalgae suspension is planted and mineral fertilizer (NPK No.) is added and the number of ammonifiers is increased from 1,900,000 to 1,200,000, fungi from the first 8 thousand to 12 thousand; it was found that the number of green microorganisms increased from 200,000 to 950,000. (Table 1)

Table 1. Development of microorganisms and green microalgae in highly saline soil under laboratory conditions.

Experience options	Microscopic organisms	Days									
		Day1	Day3	Day5	Day7	Day9	Day11	Day13	Day15	Day17	Day19
		Total number of microorganisms in 1 kg of dry soil (in thousand cells)									
soil (control)	Ammonifiers	1600 ±32	1683 ±36	1720 ±42	1700 ±40	1540 ±30	1500±28	800± 12	820± 14	730± 10	660± 8
	Oligonitrophils	2900 ±60	3170 ±71	3300 ±72	3450 ±75	3400 ±75	3210±78	2900 ±70	2800 ±73	2520± 69	2000± 67
	Fungi	8± 0,3	8± 0,031	9± 0,35	9± 0,36	8±028	8± 0,32	7± 0,28	7± 026	6± 0,24	6± 0,21
	Green microalgae	–	–	–	–	–	–	–	–	–	–
Soil green microalgae	Ammonifiers	1600 ±30	2100 ±40	2500 ±41	3100 ±50	3000 ±55	2800±52	2500 ±61	2450 ± 64	2350± 060	2000± 58
	Oligonitrophils	2900 ±61	3400 ±74	3650 ±78	3870 ±72	4100 ±70	4000±71	3800 ±71	3750 ±69	3000± 67	2800± 61
	Fungi	8± 0,31	9± 0,4	9± 0,39	10± 0,44	12± 0,45	10± 0,4	9± 0,34	8± 0,32	8± 0,28	7±0,26
	Green microalgae	210± 6	380± 7	490± 8,1	400± 8,1	260± 6,2	80± 1,4	50± 1,1	20± 0,4	20± 0,41	10± 0,2
Soil green microalgae NPK(50%)	Ammonifiers	1600 ±30	2200 ±40	2650 ±44	2800 ±41	3800 ±71	3500±68	2900 ±47	2850 ±44	2120± 38	1400± 28
	Oligonitrophils	2900 ±63	5100 ±80	9300 ±92	1020 0±94	1010 0±98	10200± 92	1000 0±93	850± 12	800±10	820± 13
	Fungi	8± 0,32	11± 0,4	14± 0,4	16± 0,54	20± 0,7	14± 0,55	12± 0,5	11± 0,45	10± 0,42	10± 0,4
	Soil green microalgae	200± 5,4	400± 7,1	900± 12	950± 11	400± 6,8	150± 2,8	30± 1,1	12± 0,42	9± 0,35	6± 0,28

Green microalgae are given in 1 ml suspension in 1000 cells.

Note: Underlined values are significantly different from the value of the control option (soil) at $R<0.05$.

Based on the conducted experiments, it was found that the growth and development of microorganisms and the activity of soil enzymes are low due to the high amount of sulphate and chloride ions in highly saline soil. In order to study the effect of green microalgae on the growth, development and yield of Bukhara-6 cotton, as well as the composition and enzymatic activity of microorganisms, further experiments were carried out in moderately saline irrigated meadow soil. It was determined that the salt content of moderately saline soil is as follows (in % of dry residue): sulphate 1.0-2.0, chloride-sulphate 0.03-0.1 (Maqsudov et al., 2005). The growth of microorganisms and green microalgae (chlorella) in the irrigated soil was checked for 20 days (Table 2). Experimental option 1g of soil contains 3 million 800 thousand ammonifiers and 6 million oligonitrophils. It was found that there are 700,000 cells, fungi - 20,000, and green microalgae - 5,000 cells. When green microalgae were added to the soil, it was observed that the number of organisms of cells that mentioned above increased by 1.6-1.9 times. It was found the amount of ammonifiers increased from 3 million 800 thousand to 5 million 800 thousand, oligonitrophils increased from 6 million 700 thousand to 8 million 420 thousand, fungi - from 20 thousand to 175 thousand, green microalgae increased from 457 thousand to 589 thousand. Later, it was observed that the number of organisms of cells above decreased [1-11].

When mineral fertilizers and green microalgae were applied to the soil, it was observed that the growth and development of bacteria increased compared to option I and II (Table 2). A decrease in the number of cells was observed during the remaining days of the experiment. Studies have shown that during 6-8 days, the amount of ammonifiers increased to 7 million 160 thousand, the amount of oligonitrophils increased to 15 million 570 thousand, fungi increased from 20 thousand to 275 thousand, and slime microalgae increased from 400 thousand to 573 thousand.

In general, it was observed that the number of microorganisms and the growth and development of cotton is at a high level in moderately saline soil.

Table 2. Development of microorganisms and green microalgae in highly saline soil under laboratory conditions.

Experience options	Microscopic organisms	Days									
		Day1	Day3	Day5	Day7	Day9	Day11	Day13	Day15	Day17	Day19
		Total number of microorganisms in 1 kg of dry soil (in thousand cells)									
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	Fungi	8± 0,3	8± 0,031	9± 0,35	9± 0,36	8±028	8± 0,32	7± 0,28	7± 026	6± 0,24	6± 0,21
	Green microalgae	–	–	–	–	–	–	–	–	–	–
Soil green microalgae	Ammonifiers	1600±30	2100±40	2500±41	3100±50	3000±55	2800±52	2500±61	2450±64	2350±060	2000±58
	Oligonitrophils	2900±61	3400±74	3650±78	3870±72	4100±70	4000±71	3800±71	3750±69	3000±67	2800±61
	Fungi	8± 0,31	9± 0,4	9± 0,39	10± 0,44	12± 0,45	10± 0,4	9± 0,34	8± 0,32	8± 0,28	7±0,26
	Green microalgae	210± 6	380± 7	490± 8,1	400± 8,1	260± 6,2	80± 1,4	50± 1,1	20± 0,4	20± 0,41	10± 0,2
Soil green microalgae +NPK(50%)	Ammonifiers	1600±30	2200±40	2650±44	2800±41	3800±71	3500±68	2900±47	2850±44	2120±38	1400±28
	Oligonitrophils	2900±63	5100±80	9300±92	10200 ±94	10100± 98	10200± 92	10000± 93	850± 12	800±10	820± 13
	Fungi	8± 0,32	11± 0,4	14± 0,4	16± 0,54	20± 0,7	14± 0,55	12± 0,5	11± 0,45	10± 0,42	10± 0,4
	Green microalgae	200± 5,4	400± 7,1	900± 12	950± 11	400± 6,8	150± 2,8	30± 1,1	12± 0,42	9± 0,35	6± 0,28

Green microalgae are given in 1 ml of suspension in 1000 cells.

Note: Underlined values are significantly different from the value of the control option (soil) at R<0.05. We used a glass container to grow green microalgae in laboratory conditions.

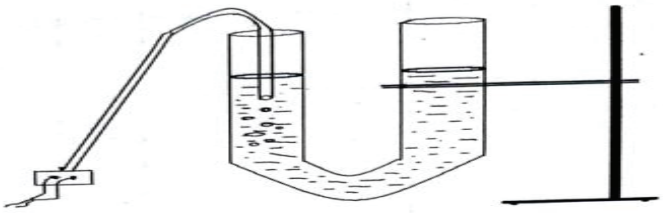

Fig. 1. Device for preparation of a preliminary suspension of green microalgae in laboratory conditions.

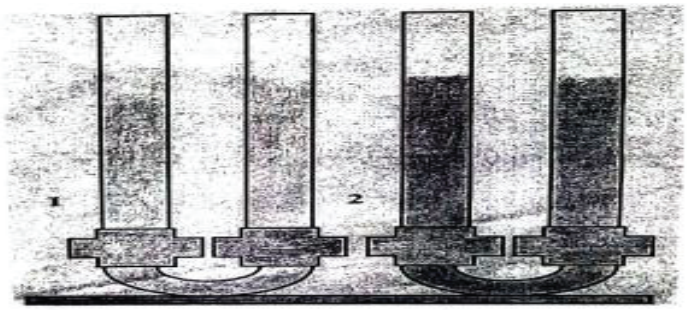

Fig. 2. Breeding of green microalgae in laboratory conditions 1) 3-day growth of chlorella; 2) 7-day growth of chlorella.

We implemented the method of growing laboratory microalgae (chlorella) suspension based on the method proposed by candidate of biological sciences E T Tokhtamurodov and doctor of agricultural sciences I D Djumaniyazov. The First and second pictures (fig. 1 and 2) show the shape of the device. Further experiments were carried out to apply a suspension of (chlorella) cultured on the basis of small biotechnology to an irrigated meadow alluvial soil.

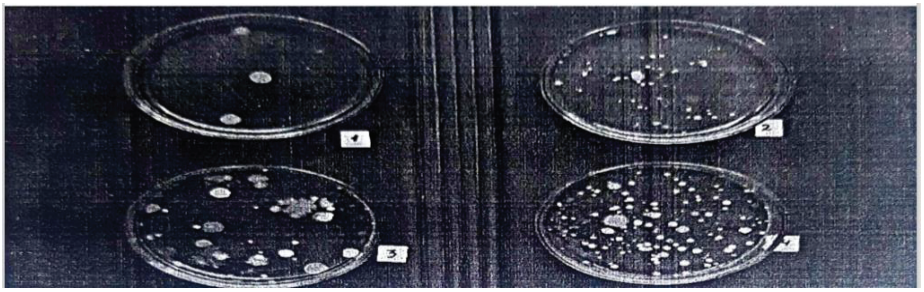

Fig. 3. Soil colonies of bacteria. 1) the seeds are soaked in water and the bacteria in the planted soil are given +NPK. 2) bacteria in the 2nd soil, where seed seedlings are re-warmed in a suspension of microalgae. 3) the growth of bacteria, which were planted in a suspension of green microalgae, and the suspension was fed through the leaves of cotton once during the growth period; 4) the colonies of bacteria in the soil where biofertilizer was added to the soil planted in the suspension of green microalgae.

3 Conclusion

It can be seen that one of the achievements of microalgae, biotechnology and agricultural microbiology, in particular, the field of plant science, is the preparation of seeds before planting, in plants during the growing season, for the storage of agricultural products, which can be used for tillage before planting. As a result, the vegetation period of plants accelerates and creates healthy soil agrocenosis conditions. At the same time, it prevents contamination of the soil with residual amounts of fungicides, herbicides, insecticides, phytopathogenic micromycetes and their metabolic products.

References

1. B.B. Tokhirov, X. Mustafoyev, M.B. Tagayeva*, Production of microscopic always, their use in livestock and poultry,* Economics and society **4-1,** 426-427 (2021)
2. N.R. Khodzhimurodova, et.al., Guliston (2020)
3. M.B. Togaeva, et.al., *Main sources of increasing the productivity of alluvial soils of medium salt grazing of Bukhara region,* JournalNX- A Multidisciplinary Peer Reviewed (2020)
4. N. Khodzhimurodova, N. Khakimova, M. Tagaeva, Biological activity of soils of the Bukhara oasis depending on the degree, p. 1061-1064 (Tashkent, 2020)
5. N.N. Balyshev, Algae and their role in soil formation (MGU, 1968)
6. V.V. Berezhnova, et.al., Influence of phosphorus mobilizing bacteria from green microalgae on the content of soil mobile phosphates and potato productivity (2020)
7. B.B. Tokhirov, et.al., *Dynamics of enzyme activity in salted soils,* DYNAMICS **6,** 10 (2020)
8. B.K. Khusenov, B.B. Tokhirov, M.M. Turaev, *Biotechnology of biological and chemical treatment of water from the factory of Bukhara oil refinery*, Center for Scientific Publications **1,** 1 (2020)
9. E.Kh. Baimisheva, G.I. Kazakov, *Soil moisture and pea yield depending on fertilizer systems and methods of basic tillage*, Proceedings of the 46th scientific and practical conference of faculty, staff and graduate students, p. 26-27 (Samara, 1999)
10. B.B. Tokhirov, D.R. Teshaeva, *Characteristics of plants that enrich the phytosanitary state of the Jailau Kyzylkum*, Voprosy nauki i obrazovaniya **10(22)** (2018)
11. B.B. Tokhirov, N.N. Tolibova, B.F. Aripov, *Determination of zooplanktons in dengizkol lake and their use in fishing*, Center for Scientific Publications **1,** 1 (2020)