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Methods of Increasing The Productivity of Phytomeliorants for The Growth of Saline Lands

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ABSTRACT: Plants are valuable species of the earth. The methods of optimal artificial regulation of plant genesis are still unknown, which can lead to their maximum productivity without pathogenic consequences. Methods for the productivity of plants and soil are necessary and regulate photosynthesis, periodicity and dynamics of growth and nitrogen exchange. The reason for the vegetation crisis is the diversity and different orientations of the pathological phenomena. Pathological phenomena are combined into three categories: pathological reactions, pathological processes and diseases. The most dangerous cases are violations that lead to the complete or partial disappearance of some plant species. Destruction of plants can be related not only to human anthropogenic activities, but also to some natural disasters. The most important of them is physical destruction for agriculture and forestry purposes. Plant breeding is measures to improve the state of the environment through the production or maintenance of plant communities.

Keywords: Phyto-amelioration, Productivity, Soil, Fertilizers.

INTRODUCTION

Herbs are one of the most important food safety capacities for raising the society securities according to health records which would be published every year and make guaranty for better situations (Alinia-Ahandani et al., 2019; Alinia-Ahandani et al., 2022; Mohammed et al., 2022). Phyto-amelioration is a set of activities that improve the environment with the help of the cultivation of natural plant communities and showing services (Mohammed et al., 2023; Hosseinipour et al., 2024). Phyto-amelioration is divided into humanitarian, engineering, bioproductive, interior, and environment-protective (Akgul et al., 2020; Mohammed et al., 2021). As a result of a wide range of intraspecific selection, plant phyto-ameliorants, fodder that is the source of energy, and 15 perspective types and ecotypes of suitable plants for the production of medicinal plants on medium saline soils watered by saline water have been found. According to the data given, the strong saline clay layers of desert soils contain 48 t/ha of salt. The ground phytomass of 18-20 t/ha of halophyte plants removes 8-10 tons of salts from 1 hectare of soil per year. As a result of evaporation, halophyte plants hinder the increase of salts on the surface of the earth. The green pavement effect consists of 2.5 t/ha salt. As a result, the amount of salt in the soil area where the halophytes are planted comprises 10-12.5 tons per year. Many scientists have carried out reclamation work for desalting soils for 4-5 years in medium saline soils and 6-7 years in strong saline soils. Plant breeding is superior to physical and chemical methods because plant waste is biodegradable and sometimes can be converted into other products and is also called green breeding (Serebryakova, 1972; Akbasoya et al., 2005). As we know, some main recent majors like nanotechnology can support some items which guide to better ways with some new products and their applications in future (Naeem et al., 2023). Heavy metals also will play the role in many cases which are related to these kinds of headings and they would be so remarked in food safety issue at final analysis (Alinia-Ahandani et al., 2023). Some similar reasons will drive this subjects with multi checking lists which would be shown by some particular methods for heavy metals measurements (Bigaliev et al., 2004; Alinia-Ahandani et al., 2019; Alinia-Ahandani et al., 2021). In our case, we conducted experiments on the soil of the resalted rice field of Karatobe village of the Zhanakorgan region and the non-arable land of Nurtas village of the Turkistan region. Perennial legume plants were chosen as perspective bio-ameliorants for gray-irrigated saline soils. They are conventional alfalfa (*Medicago sativa*), white clover (*Trifolium repens*), and conventional camel alfalfa (*Melilotus officinalis*).

The aim of this study is to improve saline land by green process of improvement by plants and it is assumed that plants can improve the improvement process through root and stem and leaf systems.

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MATERIALS AND METHODS

The determination of ecological and agrochemical indicators of soils and plants is carried out according to specially approved state standards and approaches adopted in organizations of the agrochemical service in Kazakhstan and the CIS countries.

Total nitrogen content was determined by the titrimetric method, nitrite nitrogen was determined by the Lunge-Griss reagent (disulfophenol method), nitrate nitrogen by the SOEKS ecotester, and humus by the Tyurin method.

The analysis works were carried out according to the following characteristics: (1) a concentration of sulfate, hydrocarbonate and carbonates, chloride, calcium, and magnesium; (2) a concentration of nitrogen ions according to the photocolorimetry method ("KFK-03-1- ZOMZ"); (3) the amount of humus in the soil; (4) the general degree of salinity; (5) moisture; (6) the pH environment.

To determine soil moisture, 25 g of soil are placed in a borosilicate glass chemical dish with a lid set at a constant weight. When opening the lid of borosilicate glass chemical dishes, soil samples are dried in a drying cabinet at a temperature of 105^{0}C for 7-8 hours. In a calcium chloride-containing desiccator, the samples are cooled by weighing them every 3-3.5 hours. The weight determination is repeated twice, and the drying is considered complete only if the difference in weight after each weighing does not exceed 0.02 g (Meshkov et al., 2012).

The formula for calculating soil moisture (W, in %) is: $W = \frac{(m_1 - m_0) \times 100}{(m_1 - m_0)}$

where: m_1 and m_0 are the mass of dry soil dried in a chemical dish made of borosilicate glass, g; m is the mass of empty chemical dishes made of borosilicate glass with a lid, g.

Determination of the pH of the studied plants. 10 g of air–dried plant samples are placed in a glass (50 cm^3) and filled with distilled water in a volume of 20 cm^3. The samples are thoroughly mixed, and the pH values are determined using a pH meter.

RESULTS AND DISCUSSION

The perennial legume plants chosen for the study are saturated with soil nitrogen. Their root system has developed very well as a result of which they serve for many years and influence the emergence of humus and are characterized by a strong phyto-amelioration impact. In addition, the cover and strongly developed root system of perennial legume plants protect them from soil removal and flying. Therefore, they are considered soil formers (Strogonov, 1973).

Before planting the plants, an analysis was performed on the water extract of the soil types that are to be studied (Table 1).

Table 1. *The results of the laboratory analysis conducted on the water extract of soil types*

Salt ions mg/dm^3	Nurtas village of Turkistan region	Karatobe village of Zhanakorgan region	According to the amount in water extract, mg/dm^3
Cl^-	244.71	75.3	350
SO_4^-	0.629	2.602	500
NO_2^-	0.18	0.248	0.1
NO_3^-	169	30.93	45
NH_4^+	6.081	5.034	2.5
CO_3^-	-	-	100
HCO_3^-	305	305	1000
Ca^{2+}	572.6	157	200
Mg^+	300	123	100

According to the results of the analysis, a high exponent of salt elements was identified in the soil of the Nurtas village. The amount of chloride, nitrate, ammonium, and calcium ions in the soil of the Nurtas village showed slightly higher results compared to the soil of the Karatobe village. Nitrates are 169 mg/dm^3, ammonium - 6.081 mg/dm^3, calcium 572.6 mg/dm^3, magnesium is 300 mg/dm^3 in the soil of Nurtas village, while in the soil of Karatobe village magnesium is 123 mg/dm^3, ammonium 5.034mg/dm^3 and nitrite 0.248 mg/dm^3. The amount of these ions in the soil is higher than that of the standard. As the analysis results have shown, carbonate ions were not observed in the composition of the soil.

A higher number of cations and anions was observed in normal saline gray soils in the South Kazakhstan region. All micro and macro elements in the soil composition are necessary for plant nutrition. The shortage and increase in the required elements in the soil harm plants. There is a considerable difference between the soil compositions of the Nurtas and Karatobe villages. While studying the soil of Nurtas village, phyto-amelioration works were conducted on the soil of Karatobe village. Therefore, it is important to improve the chemical and physical structure of the saline areas in the soil of the Nurtas village.

The degree of salinity of the soil taken for the study was defined before planting the plants (Figure 1).

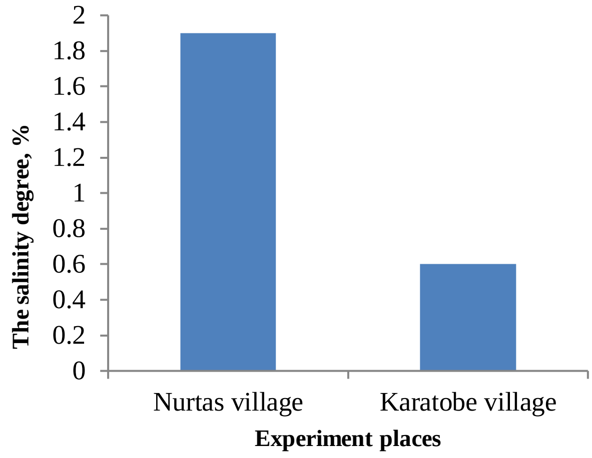

Figure 1. *The degree of salinity of soil types was taken as the study object..*

In essence, saline soils are the amount of mineral salts in which is 0.25% and more that are harmful to agricultural plants. The amount of salt in the soils in the study objects is higher than 0.25%. According to Table 1 in the second part: the soil of Nurtas village is defined as a strongly saline soil comprising a salinity degree of 1.9%, while the soil of Karatobe village referred to a medium saline soil of 0.6 % salinity degree. The plants under control were grown in the laboratory and field (Figures 2, 3).

The plants were grown in the soil in two ratios: in the initial soil and the manure-added soil in a 1:1 ratio. The plants were grown in bottomless wooden boxes of 100x50x100 sm in the field, while in the nature case, they were planted in saline gray soil from the study objects. The repeatability of the experiment is three times. Analysis works were carried out to define the humus of the soils of the study objects as a result of which the soil humus of Nurtas village was 0.6%, while the soil humus of Karatobe village was defined as 1.04%.

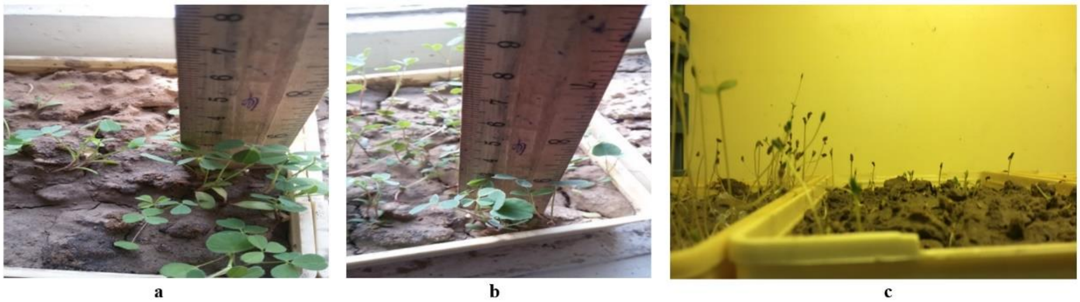

Figure 2. *The plants grown in the laboratory: a, b – plants grown in the soil type taken from Karatobe village; c – plants grown in the soil type taken from Nurtas village.*

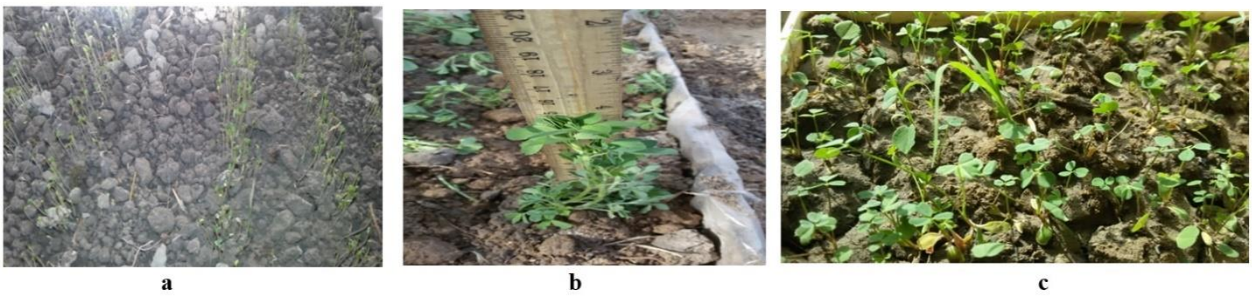

Figure 3. *The plants grown in the field case: a – the plants grown in the soil of Karatobe village; b, c - the plants grown in the soil of Nurtas village.*

Mutagenic energy and productivity of plants grown in the laboratory were observed (Table 2).

Analyzing the suitability of herbaceous plant seeds, that is, their mutagenic energy and productivity, is of great importance, as it is the proof of a qualitative product.

Table 2. *Mutagenic energy and productivity of herbaceous plants under control*

Crops names	Productivity %	Mutagenic energy
Melilotus	95.5	4
Trifolium repens	94.85	4
Medicago sativa	96.1	3

A higher mutagenic exponent was observed in conventional camel alfalfa, among the plant seeds. Its mutagenicity showed 96,1 % in comparison with conventional alfalfa and white clover.

The saturation of plants in the soil with organic substances depends on their longevity. The main function of plants in their growth development is due to their rooting in the soil and their penetration into the soil structure. Therefore, paying much attention to the peculiarities, usage, and planting technologies of plants grown in agrosystems is of paramount importance as it allows one to get qualitative products in the agricultural field.

When choosing the study plants as phyto-ameliorant, first, the structure of the root system and its importance in agricultural systems and second, growth dynamics in all types of soil were taken into account. As is well known, the root system of plants freely penetrates all layers of the soil structure with their grid-like items and affects the soil directly and indirectly. At the same time, an analysis was carried out on the role of plants in the formation of soil structures.

Soil formation depends on climate, relief, and geological structure and is affected by many ecological factors. The soil connects a biogeocenotic system with the ecosystem and becomes the main joint component between them. This kind of ecosystem is an organizing plant. As an initiative for trophic relations, plants are considered as producers of the first yields and the unique energy sources of soil formation. Plants absorb one part of the solar energy and distribute it to the biosphere throughout their existence, while the rest of living organisms absorb the solar energy collected by them (Sunakbaeva, 2019).

In natural ecosystems, plants provide the normal balance of organic substances. The structural conditions of the soils used for arable fields are much worse than those of forests, pastures, and green pastures due to the growth of cultural plants, which leads to the disruption of the balance disruption of organic substances in them. Farming does not affect soil structure and richness in the same way and therefore all soils cannot be phyto-ameliorants (Mazhaysky et al., 2003).

Cultural works in arable fields, such as the use of different types of heavy machinery, irregular watering, and the use of different fertilizers, have potential negative consequences on the physical properties of the soil and the conditions of organic substances. For this reason, perennial herbaceous plants have a strong phyto-ameliorating effect and are considered a former soil structure (Suyundukov et al., 2007).

Agrarian salinity-tolerant plants were used in assessing gray saline soils. Agrarian salinity tolerance is the proper development of living organisms in saline soil and the ability to give yields that meet the needs of agriculture in such a condition. Agrarian salinity-tolerant plants are camel alfalfa, sunflower, sorghum, cotton, canola, wheat, and beets. The average salinity-tolerant plants: wheat, soy, corn, carrots, tomatoes, peppers, cloves. Plants tolerant to low salinity: clover, celery, radishes, peas, and foxtail (Poluektov, 2004).

For this purpose, the meliorative properties of conventional camel alfalfa, conventional alfalfa, white clover, and legume herbaceous plants that were taken as the study object according to their salinity-tolerant exponents were considered.

Camel alfalfa (*Melilotus*) is used as food for animals in agriculture. Conventional camel alfalfa provides more food biomass and has the property of improving the structure of the soil (Bykov, 1983).

Camel alfalfa is used as a phyto-ameliorant to return saline land requiring recultivation in agricultural farms in West Siberia, Kazakhstan, and other regions. *Camel alfalfa* is also used to decrease the degree of salinity of saline soils in agricultural fields and farming. In most cases, the use of camel alfalfa in regions that grow rice is of great importance. Furthermore, camel alfalfa is used to cultivate land used for industrial purposes (Blinov et al., 1990).

Conventional camel alfalfa is the best saline-tolerant plant. Its roots are capable of withstand different concentrations of soluble saline in the soil. Due to this property, its roots and green mass can develop in saline soil. Simple plant roots cannot spread in the dense layers of saline soils and nature's strongly variable dry climate cannot provide them with water. For this reason, most plants dry before reaching a vegetative period. However, the roots of camel alfalfa penetrate all layers of the deep soils, 40 sm in the first year and 100 sm in the following year, and use the spread of water throughout the soil layer. In this way, the roots of camel alfalfa loosen all the layers of the natural structure of the saline soil very well. Live and dead roots, parts composed of soil, affect the salt in the saline layer that is washed away to the deep soil layers. They considerably decrease the mineralized groundwater level in the process of desalting saline soils or biological melioration. This possibility is created by a large amount of organic mass gathered along with camel alfalfa in and on the soil (approximately 200 kg/ha of wet weight). Furthermore, camel alfalfa reduces the temperature of the earth by forming meadow grass, resulting in physical evaporation on the surface of the earth and a salt concentration in the upper layer (Adekenov, 1996).

Camel alfalfa is cold and drought tolerant and can live combined with other cultural plants in simple and complex agrophytocenoses (Figure 4). As a phyto-ameliorant, camel alfalfa is distinguished by its stability (Arystangaliev, 1995).

a **b**

Figure 4. *a – conventional camel alfalfa; b – three-year root system.*

Conventional alfalfa (*Medicago sativa*) is a perennial legume plant and is used as a green fertilizer and feed in agriculture. It has also been used as pet food for agricultural purposes for a long time and is grown in almost all parts of the country today. There are more than fifty varieties of conventional alfalfa. However, only some varieties are used in agriculture. They are very similar in terms of morphology and are characterized by their tolerance to cold, alkaline environments, disease, and drought (Abdulina, 1989).

It gives a high yield as a green fertilizer. In the case of irrigation, they give 8–10 to 80–120 tons of grass. Living in an environment compatible with nitrogen stabilizer bacteria, alfalfa collects nitrogen from the atmosphere in the collection vessels. Nitrogen lives in harmony with stabilizer bacteria; alfalfa accumulates nitrogen from the atmosphere in its roots and meadow residues. Within 2 to 3 years, alfalfa accumulates as much nitrogen in the soil as 40-50 tons of manure (approximately 300 kg of nitrogen accumulates in 1 ha of soil). When the biomass of alfalfa collapses, it becomes a light humus and has the property of reducing the acidity of the with absorbable substances and improving the structure of the soil. Alfalfa can be a good initiative for the growth of cotton, wheat, and other cultural crops. The alfalfa effect is maintained for several years (Abdulina, 1989; Alinia-Ahandani, 2018).

The deeply settled and strongly developed root system of conventional alfalfa improves the structure of the soil, increases its water and air conductive ability, and affects the accumulation of humus. In a thick meadow, it cleans the valleys of weeds. Being used as a phytosanitary, it is stable against different diseases damaged by nematodes and healed soils (Riaz et al., 2023; Mohammadi Deylamani et al., 2023). They use rainworms, and collapsed types of soil microorganisms after improving their life function state as food. In turn, it results in a decrease in the number of plant illnesses and an increase in productivity (Mukhitdinov, 1997; Ahandani et al., 2022).

Conventional alfalfa is also grown in valleys and improves meadows and pastures. It is kept in grasslands for 10 years. It can grow rapidly after being cut. It tends to grow in medium saline soils; alfalfa grows in the same place for 4-6 years and is drought tolerant. Its roots can penetrate deep soil layers and can provide alfalfa with water. Increase soil fertility and nitrogen supply. Alfalfa withstands erosion processes (Basibekov, 1983).

It improves soil moisture, incentively white clover *(Trifolium repens)* is a perennial legume herbaceous plant. Its root system is fringed and penetrates the soil up to 50 sm depth, but the separate roots are located at a depth of 1 m. It can grow in different types of soil, but only a strongly acidic environment complicates its growth. Although it is a moist environment, white clover is drought tolerant. It can grow in winter and is resistant to compaction; therefore it often grows in pastures. Compacted soils do not affect its growth. It is useful as pasture food for wild and domestic animals. In particular, proteins are mostly accumulated (Burkovskaya and Artemenova, 1986; Sheydaei et al., 2020; Hajipour et al., 2023).

As mentioned above, all types of perennial herbaceous plants are used to improve soil moisture. In most cases, they have a much better impact on the accumulation of organic substances and improvement of soil structure than other plants. After these plants are grown, other cultural plants can also be planted. At the same time, perennial herbaceous plants improve not only the structure of the humus but also the composition of the soil aggregation and increase their ability to withstand erosion (Mazhaysky et al., 2003; Dubinina and Dultseva, 2003; Hajipour et al., 2023).

It has been experimentally established that the soils of the studied regions have very low humidity. Total soil moisture ranged from 43-48%. The presence of such a low level of humidity increases the density of the soil, which leads to deterioration in the growth and development of plants.

Herbaceous legume plants are well known to be nitrogen formers. In this regard, an increase in the amount of nitrogen ions was observed when performing analysis on the soil in which the plants were grown (Gaisina and Khaybullina, 2007).

Analysis work was performed in the initially controlled soils in which herbaceous plants had been grown and soils with manure to define their chemical composition; as a result, their salinity degrees were identified (Figures 5 and 6)

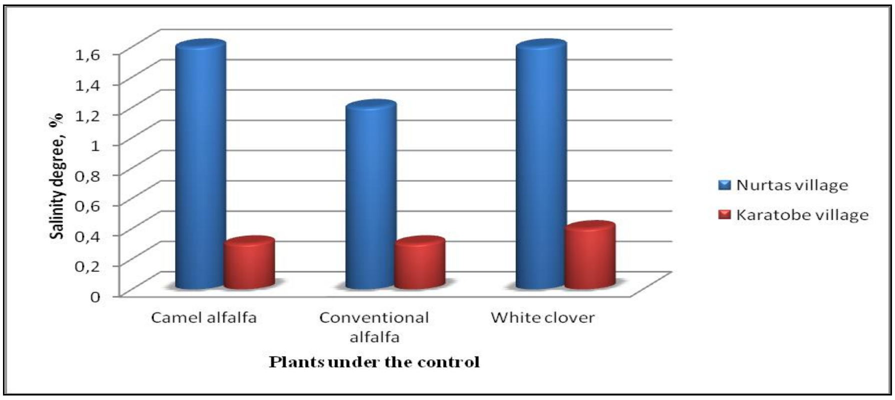

Figure 5. *A change in the level of salinity degree of the soil types under control after growing plants without adding manure.*

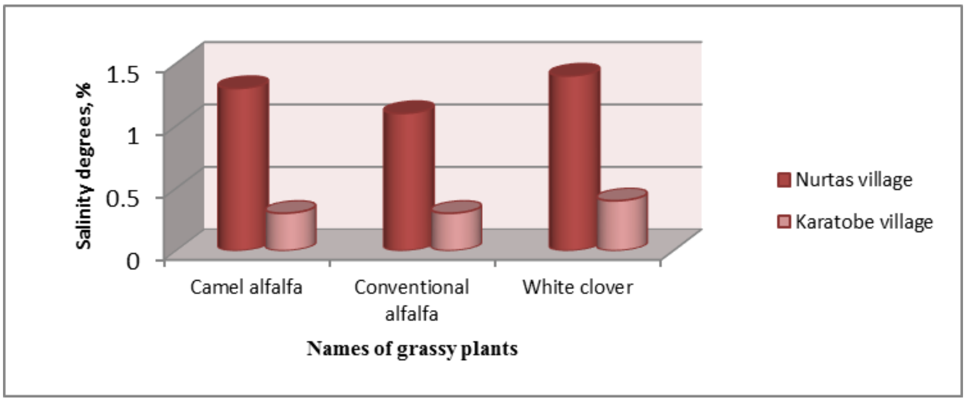

Figure 6. *A change in the level of salinity degree of the soil types under control after growing plants with the addition of manure.*

The degrees of soil salinity in the study objects have decreased after growing the plants. The degrees of salinity in the two versions of the soil types have decreased more than the initial soil types (before growing plants). The degree of salinity of soil types without adding manure: the degree of salinity of the soil added to manure in Nurtas village decreased by up to 1.6%, the soil grown with conventional alfalfa – 1.2%, the white clover – 1.6%, while the degree of salinity of the soil of Karatobe village in which camel alfalfa, conventional alfalfa and white clover had grown was reduced by up to 0.4%. The degrees of salinity of the control soils were the same in all types of soil on which the plants had been grown. The degree of salinity of the manure-added soils: the degree of salinity of the camel alfalfa soil grown in Nurtas village decreased to 1.3%, the conventional alfalfa grown– 1.1%, the white clover grown – 1.4%, the degree of salinity of the camel alfalfa and the conventional alfalfa soil grown in Karatobe village reduced to 0.3% and the white clover grown to 0.4%. The duration of the experiment carried out on the soil types chosen to grow the plants under control is 2 months. Manure is one of the most important fertilizers for plants and a source of food necessary for their growth. It is not only plant food but also affects the soil structure. Manure impacts the pH environment of the soil. Regular penetration of manure reduces soil acidity and saturates the soil with calcium, magnesium, and other microelements (Galiulin, 2008). The degree of salinity of the soil types added to manure was considerably reduced compared to the soil without manure.

Table 3. *The results of the analysis work carried out on the chemical composition of soil types that do not contain manure in which the plants under control had grown (water extract, mg/dm3)*

The study objects	Plants name	Salt ions mg/dm^3							
		Cl^-	SO_4^{2-}	NO_2^-	NO_3^-	NH_4^+	HCO_3^-	Ca^{2+}	Mg^{2+}
Nurtas village	Camel alfalfa	150.7	0.599	0.092	590	1.242	168	264.9	193
	Conventional alfalfa	166.5	0.596	0.91	600	1.089	165	259.8	139
	White clover	188.9	0.602	0.528	602	2.905	305	150.2	250
	The controlled soil type	244.71	0.629	0.18	169	5.034	305	574.6	300
Karatobe village	Camel alfalfa	62	1.91	0.324	222	1,784	72	60.1	34
	Conventional alfalfa	53	1.8	0.675	196	1.416	73	65.3	46
	White clover	58.92	1.6	0.231	200	1.375	201	85.2	22
	The controlled soil type	75.3	2.602	0.248	30.93	5.034	305	157	123

Table 4. *The results of the analysis work carried out on the chemical composition of the types of soil-added manure in which the plants under control had grown (water extract, mg/dm^3)*

The study objects	Plants name	Salt ions mg/dm^3							
		Cl^-	SO_4^{2-}	NO_2^-	NO_3^-	NH_4^+	HCO_3^-	Ca^{2+}	Mg^{2+}
Nurtas village	Camel alfalfa	131.7	0.569	0.074	1008	2.242	122	220.4	180
	Conventional alfalfa	150.5	0.496	0.304	1060	2.089	122	200.4	120
	White clover	181.9	0.602	0.447	556	3.905	305	163.2	228
	The controlled soil type	244.71	0.629	0.18	169	5.034	305	574.6	300
Karatobe village	Camel alfalfa	56	1.72	0.334	342	1.694	61	50.2	24
	Conventional alfalfa	43.9	1.632	0.825	216	1.306	61	60.3	36
	White clover	59.02	1.53	0.301	269	1.285	183	80.12	12
	The controlled soil type	75.3	2.602	0.248	30.93	5.034	305	157	123

a

b

Figure 7. *a – conventional alfalfa; b – one-year root system*

Figure 8. *White clover*

During the analysis work on the soil added to manure, it was observed that the amount of nitrogen component ions in the soils that did not contain manure increased by 5 times. The amount of nitrate of conventional alfalfa in the manure-added soil of the Nurtas village increased from 169 mg/dm^3 to 1060 mg/dm^3 in comparison with other herbaceous plants. A high amount of nitrate defined in Karatobe village was identified in the alfalfa-grown version of camel and it increased from 30.93 mg/dm^3 to 342 mg/dm^3. The nitrogen-accumulating properties of conventional alfalfa and the amount of nitrogen in the manure composition were taken into account.

Due to the abundance of organic substances in its composition, manure has a positive effect on the physical, chemical, mechanical, and biological properties of the soil. Regular manure increases the humus and nitrogen composition in the soil and saturates it with basic substances. The version of the soil added to manure loosens easily and improves the passage of water and air (Selamoglu et al., 2022, Selamoglu et al., 2023).

The difference between the given ions was observed in all cations and anions (Tables 3, 4; Figures 5 and 6). The calcium and magnesium cations were absorbed by the plants in both versions. It is known that cations are well absorbed by plants; in this sense, nitrogen ammonia cations in the initial soil form in Nurtas village decreased to 6.081mg/dm^3, in the camel alfalfa grown to 2.242mg/dm^3, in the conventional alfalfa grown- 2.089 mg/dm^3, white clover grown– 3.905 mg/dm^3. In the gray saline soil of Karatobe village, ammonia nitrogen was reduced to 5.034 mg/dm^3, camel alfalfa grown to 1.694 mg/dm^3, conventional alfalfa grown **-** 1.306 mg/dm^3, white clover grown to 1.258 mg/dm^3.

The amount of chlorides and hydrocarbonates in the soil composition has been considerably reduced. However, chlorides and hydrocarbonates were not defined during the analysis work on the composition of the plant. Half of the anion was washed away during the watering of the plants. It is necessary to identify the absorption and biological translocation coefficient of grey soil (Pestrikov et al., 2006).

Table 5. *pH exponents of study plants grown in soil*

Crops name	The study object name	
	Nurtas village	Karatobe village
	pH - environment	
Initial soil form	5	5
Camel alfalfa	7.342	7.365
Conventional alfalfa	7.409	7.076
White clover	7.798	6.930

The pH environment of the soil has a positive effect on plant growth (Table 5). A favorable pH soil environment condition for the cultivation of cultural plants cultivated in agriculture is shown in Table 6.

Table 6. *A favorable condition of the pH soil exponent for the main types of plants.*

Cultural plants	pH optimal exponent
Wheat	6.0-7.6
Tea	4.8-6.2
Tomato	6.3-6.7
Carrot	5.5-7.0
Peas	6.0-7.0
Potato	5.0-5.5
Cabbage	6.7-7.4
Turnip	5.5 and more
Cucumber	6.0-7.0

That is, they have a positive effect on soil structure following the descriptions of the herbaceous plants chosen for the study. During planting, the pH of the soil showed an acidic environment but changed to a neutral and slightly alkaline environment after the plants had grown. This case showed that herbaceous legume plants affected not only the physical and chemical composition of soils but also their pH and environment. Among other plant seeds, the sprouting exponent of conventional camel alfalfa was high. Its sprouting was 96.1 % compared to conventional alfalfa and white clover. The degree of salinity of the soils of the study objects was reduced after planting. The degree of salinity of the soil types without adding manure: the salinity degree of the camel alfalfa soil grown in Nurtas village decreased to 1.6 %, the conventional alfalfa grown– 1.2%, the white clover grown– 1.6%, while the degree of salinity of the soil of Karatobe village in which camel alfalfa, conventional alfalfa and white clover had grown was reduced to 0.4%. The degrees of salinity of the soils under control were the same in all types of plants. The degree of salinity of the manure-added soils: the degree of salinity of the camel alfalfa soil in Nurtas village decreased to 1.3%, the conventional alfalfa soil – 1.1%, the white clover– 1.4%, while the degree of salinity of the camel alfalfa and conventional alfalfa soils in Karatobe village decreased to 0.3%, and the soil grown with white clover to 0.4%. The amount of nitrates from conventional alfalfa in the manure-added soil of Nurtas village increased from 169 mg/dm^3 to 1060 mg/dm^3 in comparison to other herbaceous plants. A high amount of nitrate defined in Karatobe village was identified in the alfalfa-grown version of camel and it increased from 30.93 mg/dm^3 to 342 mg/dm^3. The nitrogen-accumulating properties of conventional alfalfa and the amount of nitrogen in the manure composition were taken into account. The cations were well absorbed by the plants; in this sense, the ammonia nitrogen cations in the initial soil form in Nurtas village decreased to 6.081mg/dm^3, in the camel alfalfa grown– 2.242mg/dm^3, in conventional alfalfa grown - 2.089 mg/dm^3, white clover grown– 3.905 mg/dm^3. The nitrogen of ammonia in the soil of Karatobe village reduced to 5.034 mg/dm^3, while in the plants it decreased to 1.694 mg/dm^3, 1.306 mg/dm^{3,} and 1.258 mg/dm^3. Improving the resalinity of the irrigated lands that were degraded in the condition of the South Kazakhstan region by the phyto-amelioration method was ecologically and economically efficient.

CONCLUSION

Plants, with their special potential, can change the physical and chemical properties of the soil, which is known as green amendment. In this paper, we have tried to analyze the data to guide better conception. The productivity of phytomeliorants plays a crucial role in enhancing the fertility and sustainability of saline lands. By implementing effective methods to regulate plant growth, photosynthesis, and nitrogen exchange, it is possible to optimize plant productivity while minimizing pathogenic risks (Isabaeva, 1984; Alinia-Ahandani et al., 2023). Addressing the challenges posed by pathological phenomena—such as diseases, environmental stressors, and human-induced degradation—requires a comprehensive approach that integrates soil management, selective breeding, and ecological restoration techniques. Furthermore, understanding the interaction between phytomeliorants and their environment is essential for mitigating the adverse effects of soil salinity and improving agricultural and forestry outcomes. The success of phytomelioration efforts depends on the strategic application of fertilizers, soil amendments, and adaptive plant breeding techniques that enhance resilience and sustainability. Continued research and innovation in this field will contribute to the development of more effective solutions for restoring degraded lands and promoting ecological balance. By prioritizing sustainable phytomelioration strategies, we can ensure long-term agricultural productivity, support biodiversity, and foster environmental resilience against both natural and anthropogenic threats.

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CONFLICT OF INTEREST

No conflict of interest was declared by the authors.

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